Conditional Forbearance as an Alternative to Capture: Evidence from Coal Mine Safety Regulation[1]

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[1]Forthcoming in Daniel Carpenter and David Moss, eds., *Preventing Capture: Special Interest Influence in Regulation, and How to Limit It.* Cambridge and New York: Cambridge University Press.

1 Introduction

Regulatory agencies are often accused of offering forbearance to powerful actors within the industries they are charged with overseeing, possibly in violation of their statutory mandates and to the potential detriment of the broader public. The term "bureaucratic capture" is often employed as a shorthand for this phenomenon. Any attempt to construct a coherent analytical framework for understanding it, and to assess its empirical referents, however, must confront the interaction between two broad forces shaping the context in which regulators act: efforts by firms within the industry to protect and promote their economic interests, and the actions of the regulators' political superordinates.

Regulatory agencies are fundamentally complex hierarchies – chains of principal-agent relationships (Moe 1984)– consisting of many tiers of civil servants overseen by a leadership appointed by, and ultimately (more or less, depending on the extent of agency independence) responsive to, elected public officials (and, by extension, the public). At all levels of an agency's hierarchy, occupants are, to some extent, responsive to the incentives created for them by their administrative or political superordinates. To the extent that the goals of those superordinates may change, whether because the superordinates themselves have been replaced or because they have revised their regulatory goals, one may expect commensurate changes in the behavior of regulators.

On the other hand, regulated interests have a variety of means at their disposal to influence regulators, and may be expected to use them to protect their own profitability. These means fall under the broad rubric of agency "capture." Some accounts stress an implicit exchange in which leniency is exchanged for political or financial support or the promise of future employment; while others stress that regulators drawn from industry will prove inherently sympathetic to their former employers. In either case, the operative notion of capture presupposes a principal-agent relationship in which an agency's effective principal

is the industry itself.

The existence of these two influences on regulators naturally raises the question of how they interact. Capture in its purest form could correspond to a situation in which the agency's allegiance to the industry completely dominates its accountability to political principals (who may be relatively unsympathetic to industry interests, but powerless to act on their conception of the public interest). Alternatively, it could imply that the political principals are, themselves, captured by industry. In both situations, the preferences of the agency's personnel would be fundamentally and inalterably shaped by those of the industry.

Alternatively, consider a situation in which the the agency's allegiance to industry is not complete, but instead shifts according to the preferences of elected officials and/or their constituents. While we may still see responsiveness to industry interests in this circumstance, it would correspond to an altogether different account of industry-agency relations: one in which the degree of regulatory forbearance is *conditional* on the identity of the agency's political principals and/or the salience of the policy area falling in its jurisdiction.

In this chapter, we consider the possibility of conditional forbearance in the context of the regulation of coal mining by the U.S. Mine Safety and Health Administration (MSHA). Coal mining represents an interesting case for scholars of regulation: historically, the mining industry has enjoyed substantial political strength at the national (Ackerman and Hassler 1981) and, particularly, the state and local (Martin 1948; Gaventa 1980) levels. At the same time, the history of mining regulation suggests a pattern in which tragic accidents lead to mine safety legislation, often over the objections of industry. In fact, a familiar adage in mining communities holds that "safety laws are written in miners' blood." Moreover, Congress placed MSHA in the Department of Labor in large part because critics of its predecessor in the Department of Interior was seen as too beholden to industry interests.

At the same time, the case of coal mining departs in an important sense from canonical accounts of agency capture: according to those accounts, the interests of industry that

motivate it to shape agency behavior are arrayed against the interests of a diffuse and typically unorganized public. Much of the development of mine safety regulation in the United States, by contrast, has taken place against the backdrop of conflict between two organized interests: mining companies and labor unions, most prominently the United Mine Workers of America.

In his chapter on "Detecting and Measuring Capture," Professor Carpenter offers much-needed clarity with respect to some of the conceptual challenges associated with diagnosing bureaucratic capture. Most importantly, he argues that several evidentiary standards must be met to sustain such a finding. First and foremost is the ability to articulate some notion of the public interest as a counterfactual. Doing so is rather tricky in the field of mine safety regulation, given the conflict of interests that lies at its heart, and given the close association of mining companies and labor unions with, respectively, the Republican and Democratic parties in contemporary U.S. politics. Each of these groups of actors has a different – and often plausible – conception of the public interest in mind, which weighs the inherent tradeoffs associated with more and less stringent regulation of the industry differently. These tradeoffs involve, inter alia, miner safety, miner employment, regional development, energy independence, and environmental degradation.

Moreover, while even the most zealous advocate of the industry would surely agree that an accident that resulted in miners' deaths is not itself "in the public interest," this cannot be taken as evidence that the public interest is unfailingly synonymous with maximally stringent regulations to reduce the risk of accidents to negligible levels. Indeed, we would expect the miners themselves to chafe under such restrictions – particularly if they led to the miners' unemployment. By the same token, a radical environmentalist might take the mere *existence* of the mining industry to be a net public harm; if this is stipulated, then any government activity that permits the industry to continue functioning at all is synonymous with capture.

Carpenter suggests, further, that scholars often conflate capture and what he refers to as "electorally sanctioned pro-business governance." One may take our theory of conditional forbearance as fleshing out the details of this alternative mechanism, which we believe often provides a more compelling account of industry influence in government than that of pure "capture," and particularly so in the case of MSHA.[1]

Assessing conditional regulatory forbearance empirically faces two challenges. First, changes in agency incentives commensurate with changes in political principals or policy salience may induce behavioral change not only in the *agency*'s behavior, but also in the *industry's* behavior. Strategic adjustment by the industry, as we explain in greater detail below, can make evidence of variation in the degree of agency forbearance difficult to document. To address this issue, we examine the effects of mining accidents on subsequent agency behavior. In the short-run, we argue, MSHA can alter its enforcement of safety standards before strategic adjustment by the industry has a chance to occur. By focusing our attention on mining accidents occurring in different political climates, we can assess whether, in fact, agency deference to industry influence is mediated by deference to its political principals.

Second, it is possible that the changes in agency behavior following an accident are purely cosmetic and designed to squelch public outcry and prevent meaningful reform. Our empirical strategy for addressing this concern involves comparing MSHA's response across accidents receiving different levels of publicity within the same administration, and comparing similarly publicized accidents across administrations.[2] As we explain in greater detail below, the conditional forbearance account is supported if the first comparison suggests greater responsiveness in the more highly-publicized case, and the second implies changes in agency behavior imposing a direct, material cost to industry and more protests from industry.

[1]Of course, mining regulation is just one of many policies over which elected officials have responsibilities, a fact that may contribute to agency loss between the typical voter and the elected official. Thus, we do not take "electorally sanctioned" to imply "ideal from the perspective of the median voter."

[2]For a related treatment of the media's effects on agency behavior, see Carpenter 2002.

In fact, we observe precisely this pattern in the data. We document no significant change in agency behavior following a little-publicized disaster occurring shortly after September 11, 2001, but substantial changes following the highly visible Sago mine disaster in 2006. Increases in enforcement activity similar to those following the Sago tragedy followed the Upper Big Branch Disaster in 2010; however, following the latter accident, average penalties increased, and agency action was met with more resistance from industry.

The remainder of the chapter proceeds as follows. In the first section following this introduction, we provide a brief background on the evolution of federal mine safety laws in the United States, and describe the MSHA enforcement process. We then provide a simple heuristic model, outline our empirical strategy, and describe our empirical expectations. The next section describes data and measures used in our analysis. We then present our empirical results, and interpret them in the context of the conditional forbearance account. We conclude by discussing the implications of our findings for the empirical analysis of industry influence in regulatory policy more generally.

2 Background

2.1 The Coal Industry: Technology and Safety

Coal has long played a substantial role in the nation's profile of energy sources and thus its economy, fluctuating between 20 and 40% of total energy production in the last 60 years (U.S. Department of Energy 2010). As of June 2012, the industry employed about 84,000 workers (U.S. Bureau of Labor Statistics 2012), a steep decline from the industry's peak in the 1920s, when bituminous and anthracite coal mining employed over 860,000 workers nationwide (Carter et. al. 2006).

The historical development of coal mining in the past century has been characterized by remarkable changes in technology of extraction. In the nineteenth century, miners – drawn increasingly from the ranks of eastern European immigrants – would descend below ground

with kerosene lamps attached to their helmets, armed with pick axes, shovels, drills, and/or explosives. In the case of soft, bituminous coal, miners would manually cut the coal from the exposed face of a seam. In the case of harder, anthracite coal (a once-common domestic heating fuel), a carefully-placed explosive shot – first black powder, and later dynamite – would, upon detonation, release a significant quantity of coal from a seam onto the mine floor, whereupon the miner would shovel the coal either into a cart or onto a conveyor for removal and subsequent processing. Mules typically drew carts, but electric locomotives replaced these draught animals by the early twentieth century. These locomotives were initially powered by exposed high-voltage copper wires running the length of mine tunnels, posing a substantial electrocution risk to the miners (as well as the remaining mules). Later, battery-powered locomotives reduced that risk. Kerosene illumination gave way to carbide and then battery-powered lamps. Hand-cranked drills gave way to electrical ones and then (to reduce the risk of sparking) drills powered by compressed air.

Over the 20th century, the process of underground coal mining became increasingly mechanized, with teams of miners operating heavy machinery to remove ever-larger quantities of coal from a seam. Conventional mining, which employs techniques evolved from those described above, now accounts for less than three percent of all underground coal production in the United States (U.S. Department of Energy 2009). Like conventional mining, continuous mining employs a "room and pillar" approach in which a grid of tunnels is excavated, leaving sufficient quantities of the mined materials to support the millions of tons of "overburden" material overhead. However, continuous mining replaces manual techniques with a tungsten carbide-toothed cutting machine capable of a far more rapid rate of recovery. The most common modern technique in the United States is longwall mining, in which a coal shearing machine moves on a conveyor to dislodge coal from a single "panel" that may be over a mile long and 800 feet wide (U.S. Department of Energy 2005).

These developments have been accompanied by the development of surface mining tech-

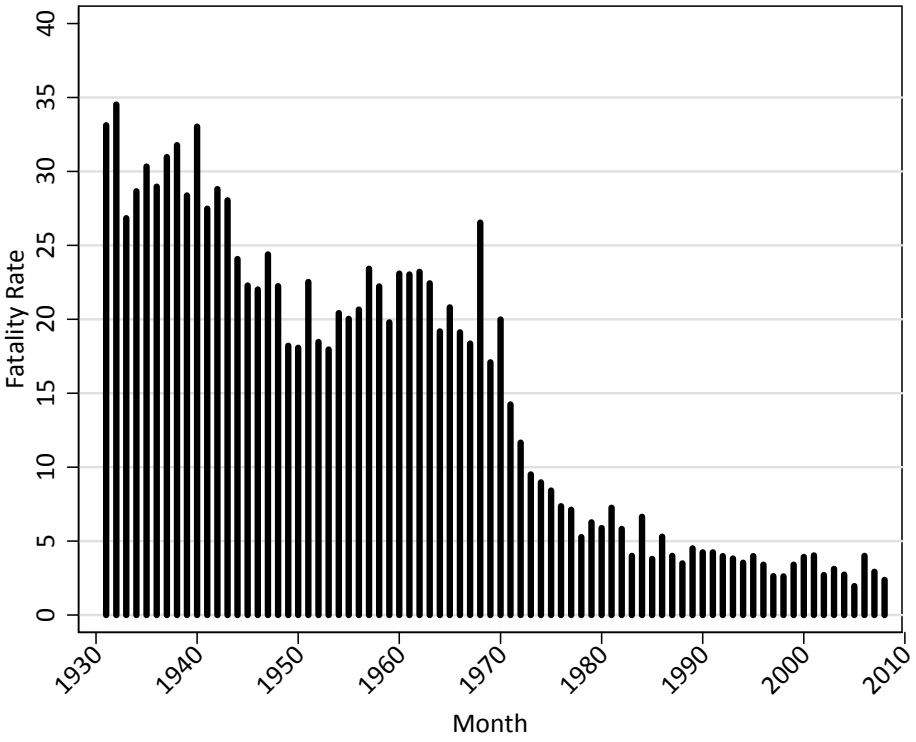
niques to harvest shallow coal deposits. In strip mining, overburden material - sand, rock, gravel, and dirt - is removed (e.g., by enormous excavators) and coal seams are accessed directly. Mountaintop removal mining is exactly that: explosives blast the overburden off of mountains, exposing the coal seams beneath.[3]

Mining is one of the most hazardous jobs in the United States (U.S. Bureau of Labor Statistics 2009). Added to the host of industrial accidents that may occur in any environment where heavy equipment is operated, a spark from the equipment can ignite accumulated flammable gases or coal dust if insufficient safeguards are employed or if the mine is insufficiently ventillated, causing a deadly explosion. Asphyxiation and drowning are threats in some mines. And cave-ins or collapses are also possible at any point in the mining process, but particularly in the case of "retreat" mining, where the pillar material in a room and pillar site is harvested in the final phases of a mine's operational lifetime.

Despite these risks, the 20th century witnessed a remarkable decline in the incidence of mining-related fatalities. Over 3,000 coal miners lost their lives in 1907; by 2010 – a year that experienced the worst single disaster since the 1970s – that number had fallen to fewer than 50. Figure 1 displays historical data on miner deaths per 10,000 full time equivalent workers. In 1931 (the first year in the time series), 1,463 miners lost their lives on the job; the figure displays that a massive reduction in fatalities has occurred even once one accounts for the roughly 70% reduction in total employee hours worked that occurred over the same period. While supporters of stringent mining regulation attribute this success to the evolution of the regulatory regime itself (e.g., Lewis-Beck and Alford 1980; Braithwaite 1985), critics suggest that regulation is not cost effective (e.g., Kniesner and Leeth 2004) and that technological change would have led to similar reductions even in the absence of regulation. Others have attributed improvements in safety to unionization (Graebner 1976,

[3]Note that these techniques are controversial primarily for their deleterious environmental effects, an important topic that is, unfortunately, beyond the scope of the current inquiry.

Figure 1: Miner Deaths Per 10,000 Full Time Equivalent Workers, 1931-2008.



Source: MSHA.

139), although the empirical evidence for this has been mixed (e.g., Appleton and Baker 1984; Fishback 1986; Morantz 2009, forthcoming).

2.2 Federal Mine Safety Regulation in the United States

The historical development of a federal presence in the arena of mine safety and health regulation has followed a remarkably consistent, if depressing, pattern since its rather meager beginnings in the late 19th century. Typically, a catastrophic mining accident or series of accidents revulses public sentiment and produces accusations, either from unions or progressive elites, that gross inadequacies in the existing landscape of state and federal laws and regulations led to the accident; and that regulatory agencies are captured by mining companies (whether through pro-industry appointments, intimidation, or outright bribery).

Congress subsequently responds accordingly with more stringent legislation - in some cases cosmetic, but in others dramatically increasing the scope of federal regulatory authority.

For example, in 1891, an explosion at the Mammoth Mine in Mount Pleasant Township, PA killed 107 miners.[4] Several months later, Congress responded with the first federal law governing coal mining. As its name suggested, "An Act for the Protection of the Lives of Miners in the Territories" only covered mines in U.S. territories, but it established the first federal safety standards for mines in U.S. history, and permitted the president to appoint a corps of territorial mine inspectors in the Department of Interior (Nichting, Beverage, and Johnston 2006).

In 1907, the largest mining disaster in U.S. history, an explosion in the Monongah Nos. 6 and 8 Coal Mines in Monongah, WV, took the lives of 362 miners. Two years later, 259 miners were killed in a fire at the Cherry Mine in Cherry, IL. In fact, the period 1909-1910 experienced more separate coal mine disasters than any other two year period in American History: 39 (USBM 1960). In response, Congress created the Bureau of Mines (USBM) in 1910. Located within the Department of Interior, the Bureau initially conducted research into mine safety, but had no regulatory authority. In 1940, an explosion in the Willow Grove Mine in St. Clairsvill, OH killed 72 miners; in 1941, Congress granted federal USBM inspectors the authority to enter mines. In 1947, a blast in the Centralia No. 5 Mine in Centralia, IL killed 111 miners; Congress responded by granting rulemaking authority to USBM. In 1951, an explosion at the Orient No. 2 Mine in West Frankfort, IL killed 119 miners; the following year, Congress granted limited penalty authority to the Bureau and annual inspections of some underground mines. The 1952 legislation was amended to cover all coal mines in 1966. That year, Congress also granted limited rulemaking and enforcement authority to the USBM for metal and non-metal mines.

[4]Much of the information contained in this summary, unless otherwise noted, is drawn from MSHA's own History of Mine Safety and Health Regulation and its list of fatal mining disasters, available on its website.

Following an explosion that killed 78 miners at Consol No. 9 in Farmington, WV the previous year, Congress passed the Federal Coal Mine Health and Safety Act of 1969 (popularly known as the Coal Act). The act mandated inspections at underground and surface coal operations, created a regime of civil and criminal monetary penalties, and contained agency-forcing language for the promulgation of health and safety standards. The Coal Act was in force in 1972 when a fire at the Sunshine Mine in Kellogg, ID killed 91 miners. The following year, Nixon Interior Secretary Rogers C.B. Morton split the enforcement and rule-making functions from the USBM into a new agency in Interior, the Mine Enforcement and Safety Administration (MESA).

1977 saw the creation of the current statutory structure for mine safety and health regulation: the Federal Mine Safety and Health Act (popularly known as the Mine Act). The Mine Act consolidated regulatory procedures for coal and metal/non-metal mines, detailed procedures for miners to report violations and accompany regulators on inspections, and implemented protections for those workers against retaliation from employers. Most importantly, the Mine Act transferred MESA to a new agency, called the Mine Safety and Health Administration (MSHA), in the Department of Labor. This transfer represented a major victory for labor: union representatives argued that the Department of Interior frequently sided with management against them and anticipated, based on their experience with OSHA, a more favorable agency in Labor. Management, for their part, argued vociferously against the transfer (U.S. House of Representatives 1977); however, several amendments offered by western members of Congress to block the move failed to garner a majority in either chamber (Wall Street Journal 1977). Management did win a concession in the form of a Mine Safety and Health Review Commission, staffed by presidential appointees and Administrative Law Judges, to hear appeals of citations and orders issued by MSHA.

Similar legislation had failed to garner the necessary support in the previous Congress (Washington Post 1976), but with comparable Democratic majorities in place and a Demo-

crat in the White House, the Mine Act passed easily in July of 1977. The structural changes represented by the Mine Act follow a familiar pattern to students of regulatory agency design (e.g., Moe 1989): a statute's enacting coalition, concerned that its majority status may be temporary, seeks to place statutory functions in a friendly executive department.[5] Its opponents, however, succeed in introducing appellate procedures that permit them to delay agency action or limit its effect.

While the Mine Act continues to be in force, it was strengthened in 2006 with the Mine Improvement and New Emergency Response Act, or MINER Act. This legislation had its origins in two mine disasters that same year: an explosion in the Sago Mine in Sago, WV killed 12 in January of that year, while an explosion in Darby Mine No. 1 in Darby, KY killed five. The MINER Act requires operators to establish emergency response plans specific to each mine, and increases civil and criminal penalties. Pursuant to the Act, a new penalty regime went into effect in April of 2007, yielding sharply higher penalties (and, at the outset, greater rates of contested penalties).

2.3 The MSHA Enforcement Process

MSHA is charged with regulating almost 15,000 coal, metal, and nonmetal (e.g., sand and gravel pit) mines and processing facilities in the United States. Inspection operations, the issuance of citations, and negotiations over remediation and penalties are largely conducted by the Administration's 11 district offices. MSHA inspectors visit surface operations at least twice-yearly, and underground operations at least four times a year. However, there is enormous variation in the intensity of individual inspections: the shortest inspections may involve one individual visiting a site for fifteen minutes. By contrast, the most intensive single inspection in the last decade involved 88 inspectors and over 16,000 inspector-hours over four months at Massey Energy's Upper Big Branch Mine in Montcoal, West Virginia

[5]See also the discussion of the Forest Reserve Transfer Act, which moved management responsibilities for U.S. Forests from the Department of Interior to Agriculture, in Kaufman 1960 and Carpenter 2001.

following an explosion on April 5, 2010 that killed 29 miners.

At a visit to a mine, inspectors document health and safety violations. The Mine Act mandates that management and labor representatives may accompany inspectors as they make their way around the mine. An MSHA inspector can issue a citation or order for detected violations; in consultation with the agency's Office of Assessments, these may be accompanied with civil penalties. While the penalty associated with an individual citation is typically small (currently $60 for a violation that does not constitute an immediate risk of injury), inspectors typically document numerous violations on a given visit: conditional on detecting any violations, the mean number of violations detected per visit was 13 over the course of the last decade. For more serious infractions (e.g., so called "S&S – significant and substantial – violations), civil penalties can be quite severe: under the agency's penalty policy promulgated under the 2006 MINER Act, penalties for flagrant violations can reach $220,000. The operating company then has 30 days to respond to the citation(s), and to inform the district office whether it intends to contest the findings. Depending on the nature of the citation, initial appeals may be heard by an Administrative Law Judge and then subsequently by the Mine Safety and Health Review Commission, and finally, in the federal courts.

2.4 Accusations of Agency "Capture"

While the history of federal mine safety regulation in the United States may be characterized as a steadily increasing array of regulatory requirements and a decreasing frequency of fatal mining accidents, critics of MSHA nonetheless complain that the mining industry exercises disproportionate and unwarranted influence over the agency's activities. Immediately following the Sago disaster in 2006, a *Washington Post* editorial opined that "the MSHA has in the past several years formed a series of "partnerships" with mining industry groups. In principle, such partnerships might help make mines safer. In practice, they might have al-

lowed the agency to become too friendly with the businesses it regulates" (Washington Post 2006). And following 2010's horrendous accident at the Upper Big Branch Mine, Representative George Miller (D-CA) argued that, following accidents, "everyone pledges to make it safer. But the mine owners, they just wait and let time work and let time erode emotion, and then they come to Washington. They tell members they can't do business [under more stringent regulation]." (Kindy 2011).

At the level of enforcement, the most frequent complaint concerning the undue influence of mining companies concerns the ability of companies to tie up agency resources by contesting MSHA inspectors' determinations of noncompliance. Because a case may take months or even years to pass through the agency's appellate procedure to the Mine Safety and Health Review Commission, MSHA officials face a strong incentive to settle for penalties smaller than those initially proposed.

In addition to reduced penalties, contesting citations may confer two additional benefits to mine operators: first, it may allow them to defer additional compliance expenditures associated with the cited violation. Second, it may prevent the official tally of S&S violations from reaching a critical threshold. Section 104(e) of the federal MSHAct affords MSHA discretion to confer a dreaded "Pattern of Violations" (POV) designation on a mine in the event of recurrent S&S violations. In theory, POV status can economically cripple a mine: it gives MSHA personnel the right to withdraw miners from the area of a mine affected by any subsequent S&S violation for 90 days. Until it did so for two mines in April 2011, however, MSHA had never conferred POV status on any mine.

Despite the apparent benefits to contestation, different mining companies have availed themselves of the opportunity to contest citations at substantially different rates. For example, in 2008 Murray Energy contested 1,806 of 3,091 cited violations at 13 mines, or 58%. By contrast, Alpha Natural Resources (which acquired Upper Big Branch operator Massey

Energy in 2011) contested 59 of 745 citations, or just over 9%.[6]

Critics have also raised the specter of a "revolving door" at MSHA, pointing specifically to the industry experience of George W. Bush's two MSHA heads: Dave Lauriski and Richard E. Stickler. And research by two reporters for the *Washington Post* revealed "nearly a dozen" district directors who recently took jobs at Massey or Murray Energy (Kindy and Eggen 2010). What is notable about the latter finding is that unlike the MSHA administrator, district directors are not appointed officials.

3 Empirical Strategy: Challenges to Identification and Interpretation

Consider the following simple heuristic model of the relationship between a regulatory agency and a mining firm. The agency chooses a level of monitoring m, lying between zero and one, while the firm chooses a level of compliance investment c, also lying between zero and one.

Investment at level c yields a fraction $(1-c)$ safety violations unremedied, while monitoring at level m yields a fraction $(1-m)$ unremedied violations undetected. The probability of a fatal accident, then, is increasing in the quantity $(1-m)(1-c)$; for simplicity, we will assume that the probability is equal to that quantity. Both the agency and the firm suffer a cost from a fatal accident, denoted by q_a for the agency and q_f for the firm. Additionally, the firm pays a sanction for detected violations, with the marginal sanction equal to s.[7] Finally, for simplicity, we give the agency and firm quadratic costs: in particular, the cost to the agency of monitoring at level m is given by $\mu m^2/2$, while the cost to the firm of investing at level c is $\kappa c^2/2$, where $\mu > 0$ and $\kappa > 0$ are parameters scaling the cost.

In a Nash equilibrium, each player will correctly anticipate the strategy of the other

[6]That year, Massey contested 2,379 violations, a third of its 7,179 total citations.

[7]The model could be extended by also permitting the agency to benefit from detecting violations as well as preventing accidents; this will not affect the intuition here.

player. The expected utility to the agency is given by

$$E[u_a(m, c; \mu, q_a)] = -(1-m)(1-c)q_a - \frac{\mu}{2}m^2,$$

while the expected utility to the firm is given by

$$E[u_f(c, m; \kappa, q_f, s)] = -m(1-c)s - (1-m)(1-c)q_f - \frac{\kappa}{2}c^2.$$

Label the agency's best response to firm investment $\hat{m}(c)$. It is straightforward to demonstrate that this is given by

$$\hat{m}(c; \mu, q_a) = \frac{(1-c)q_a}{\mu}. \tag{1}$$

Unsurprisingly, the agency's optimal level of monitoring is decreasing in the level of firm investment: firm compliance is a substitute for agency activity in the agency's objective function.

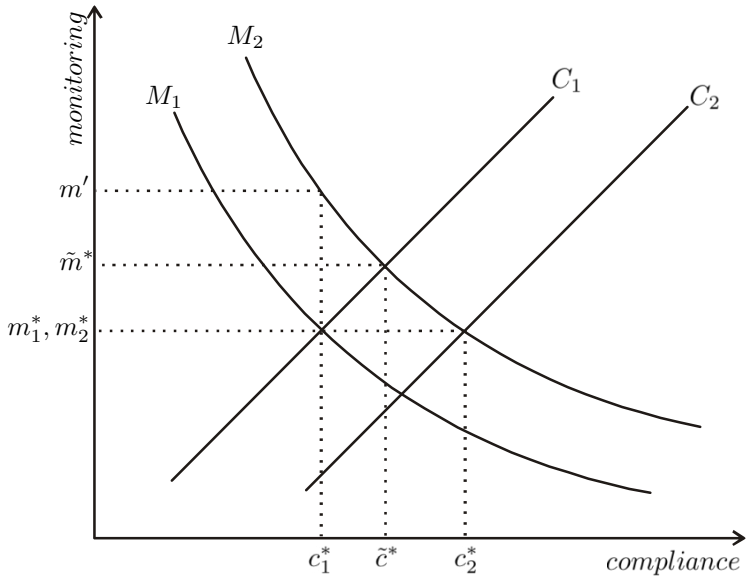
Next, label the firm's best response to agency monitoring $\hat{c}(m)$. This is given by

$$\hat{c}(m; \gamma, q_f, s) = \frac{q_f + (s - q_f)m}{\kappa} \tag{2}$$

Note that whether the firm's optimal level of investment is increasing or decreasing in the level of agency scrutiny depends on the sign of the quantity $s - q_f$. If sanctions are sufficiently high ($s > q_f$), then firm compliance is increasing in oversight; the actions of the firm and agency are complements in the firm's objective function. If, on the other hand, sanctions are low ($s < q_f$), then firm compliance is *decreasing* in oversight: agency and firm behavior in that instance are substitutes in the firm's objective.

Consider the case in which the firm's compliance is increasing in the degree of scrutiny. The logic of the equilibrium to the game is displayed graphically in Figure 2. The upward

Figure 2: Equilibrium in the Regulatory Enforcement Game and the Identification Problem



sloping curves labeled C_1 and C_2 correspond to the firm's best response correspondence for different parameter values, while the downward sloping curves labeled M_1 and M_2 correspond to hypothetical best response correspondences for the agency. Equilibrium levels of monitoring and compliance may be found at the intersections of the curves.

At first glance, a natural empirical strategy for adjudicating between a strong capture account, in which the industry effectively directs MSHA behavior irrespective of elected official, and our conditional forbearance account, in which the agency adjusts the intensity of oversight in response to changes in the political environment, would involve comparing agency behavior across administrations. To understand the challenges associated with this approach, consider a stable equilibrium at the intersection of C_1 and M_1, given by the strategy pair (c_1^*, m_1^*) . Now suppose the agency's incentives change – perhaps a new administration with fewer ties to the regulated interest group comes to power, resulting in a reduction in the cost parameter μ for the agency. This shifts the agency's best response correspondence from M_1 to M_2. In equilibrium, this shift produces a change not only in monitoring, but

also in compliance. The increase in compliance, in turn, induces the agency to invest less in monitoring than it would had the firm's behavior been completely unresponsive to changes in monitoring. In the figure, this implies the new equilibrium is at $(\tilde{c}^*, \tilde{m}^*)$ rather than at (c_1^*, m'). The net effect would be to obscure or weaken the observed effect of the change in the preferences of the political principal on the agency's behavior. In other words, compensating behavior by regulated parties exerts a downward bias on our ability to recover an estimate of the agency's response to the change in administration.

From the perspective of the analyst, matters are worse if the change in the environment affects the incentives of both the agency and the firm simultaneously. Suppose, for example, that the change in administration yields a reduction in monitoring costs to the agency (because of the change in the political environment) and a reduction in compliance costs for firms (for example, because the new administration facilitates a low interest loan program for compliance technology upgrades). This situation would corresponse to a shift both from M_1 to M_2 and from C_1 to C_2. In the example given in the figure, the effects are completely offsetting in the level of monitoring intensity – the new equilibrium monitoring level m_2^* is the same as the old. All of the action comes in the form of increased compliance – something that is much more difficult for the analyst to observe.

Our response to this challenge is to examine changes in MSHA's enforcement behavior immediately following mining accidents. Mining accidents, unlike changes of administrations, are highly stochastic, (unfortunately) recurrent incidents that may exogenously shock the preferences of the agency, as well as those of industry players.[8] In the aftermath of a lethal tragedy, MSHA can take steps to immediately increase the intensity of regulation: starting new spot inspections, employing a lower threshold for labeling violations "significant and serious," or issuing citations with accompanying penalties instead of warnings. It can also

[8]Examples of similar shocks in other regulated industries include foodborne pathogen scares, plane crashes, and periodic nuclear reactor shutdowns.

identify a "pattern of violations" at a mine and suspend operations until compliance problems are addressed.

Such incidents are likely to reveal information about aspects of the unlucky firm's regulatory compliance that are otherwise difficult for the agency to observe. Thus, while firms make calculated decisions about how much to invest into rectifying more easily observed violations as a function of the stringency of the regulatory regime, accidents are likely to expose vulnerabilities that are less affected by compensatory strategic behavior by the firm, at least in the short term. In the figure, this short-term adjustment by the agency corresponds to a shift from m_1^* to m'. We use the difference in agency behavior immediately before and immediately after such incidents as a measure of agency responsiveness, and compare this measure across administrations to assess the conditional forbearance account.

While the agency does have a "first mover" advantage over industry following an unanticipated tragedy, industry is likely to adjust to changes in regulatory zeal in the medium to long term. As we note above, this response may itself feed back into the behavior of regulators. The empirical implication of this dynamic is that momentary increases in observable metrics of regulatory enforcement intensity in response to unanticipated shocks are likely to be transient. Of course, it is also possible that that the agency's incentives return to pre-accident levels, which would also yield a gradual diminishment in the level of monitoring intensity. But a return to long-run steady-state levels of enforcement need *not* signify the "business as usual" of a captured agency, as it could be consistent with a new equilibrium reflecting a more stringent regulatory regime.

The second methodological challenge in distinguishing the conditional forbearance from strong capture stems from the possibility that a fully captured agency might behave strategically to *appear* responsive to accidents. Suppose, for example, a mining accident occurs and pressure mounts for new mine safety laws. Under such circumstances, industry (and a hypothetically captured agency in its thrall) might find it beneficial to stave off the legislation

by making a show of increased regulatory scrutiny under the existing statutory framework. In such circumstances, we would be unable to distinguish between conditional forbearance, in which a pro-industry president, in line with his pre-existing preferences, directs such a show; and a strong capture account, in which the industry calls the shots directly.

Our approach for addressing this issue is to compare agency responses to different disasters. First, we compare MSHA's response to two disasters that occurred *in the same administration*, but which invited different levels of public scrutiny. Specifically, we look at changes in MSHA behavior following three George W. Bush-era tragedies: the Jim Walter Resources No. 5 accident, which, because of its proximity to September 11, 2001, received very little press coverage; and the Sago and Crandall canyon disasters in 2006 and 2007, each of which received extensive publicity. Second, we compare MSHA's response to disasters occurring *in different administrations*, but which invited similar levels of public scrutiny. In particular, we compare MSHA's response to Sago and Crandall Canyon to its response to the Upper Big Branch disaster in 2010, during the presidency of Barack Obama. There are four possible conjunctions of findings to consider.

First, the agency may be equally responsive to high- and low-publicity events, and equally responsive across administrations. If we observe this, one cannot rule out either the possibility of agencies being fully insulated from political and industry pressures, or being fully captured by an industry that perceives no danger from greater public salience.

Second, the agency may be more responsive to high- than to low-publicity events in the same administration, but equally responsive across administrations. Such evidence would be consistent two accounts: The first is a strong capture account, in which, in the face of public outcry, the industry compels the agency to impose costs on it in the short run to prevent the imposition of still greater costs that would come about through legislative reform. The alternative interpretation is that the preferences of the two administrations are, with respect to the desirability of regulatory action and responsiveness to public scrutiny, so

similar *independent of industry influence* as to induce equality in responses.

Third, it may be equally responsive to high- and low-publicity events in the same administration, but more responsive in one administration than the other. This would be consistent with an account of conditional forbearance in which the agency is somewhat insulated from the public opinion pressures regarding the regulatory action driven by the accidents themselves, but is sensitive to changes in the preferences of its political principals.

Finally, MSHA may be both more responsive to high-publicity than low-publicity events in the same administration, and more responsive in one administration than the other. Such a conjunction of findings would be consistent with two accounts: The first is a relatively reassuring picture in which the elected official treats the public's attention to the event as an indicator of the public will, and influences the agency's behavior accordingly. A more disturbing possibility is that the official wishes to create a public impression of the administration's regulatory stance that is at odds with its true, effective position. In *either* case, though, the difference across administrations would be consistent with hierarchical political control, and thus conditional forbearance.

Moreover, we can make additional inferences about the extent to which the agency's response is real or symbolic by looking closely at the *kinds* of changes that occur in the wake of an accident. First, we distinguish between changes in agency behavior that impose specific, direct costs on the agency, and those that are as likely to be symbolic as to impose costs. If the agency is strongly captured but sensitive to public perceptions, we might expect to observe increases in the number of inspections or violations, but not in, for example, the penalties associated with a violation. Second, we look at the rate at which the industry challenges increases in scrutiny following a tragedy. If the agency is putting on a show for the public on behalf of the industry, it is less likely that the industry will seek to undermine the demonstration by challenging the agency's behavior. If, on the other hand, the agency is indeed cracking down contrary to the desires of industry executives, we should see evidence

of that dissatisfaction in greater rates of contestation.

To be sure, public salience may be both an antecedent and a consequence of agency behavior, and, consequently, one may worry that efforts to assess the effect of the former on the latter empirically may suffer from bias unless an exogenous source of variation in salience can be found. Our response to this concern is two-fold. First, our focus on the accidents–as we noted above, a plausible source of exogenous variation–significantly mitigates this concern. Such events are typically followed by media coverage and accusations of regulators "asleep at the switch." This coverage and the resulting scrutiny of agency behavior then gradually subsides until the next such event begins the cycle again. Second, our measures of low vs. high salience are themselves functions of exogenous events: the background news stories that had been the focus of media outlets. Thus, we consider a mining accident that took place in the wake of 9/11 and thus received very little media coverage, to an accident that took place at a "slow news" period and was, consequently, widely publicized.

4 Data

To examine the effect of unanticipated accidents on MSHA enforcement behavior, we assembled a dataset consisting of weekly indicators of regulatory performance from 2000 to 2010. The dataset was compiled from raw data from the Mine Data Retrieval System, which contains detailed information on over 240,000 inspections of active coal mines and almost 800,000 documented violations during this period. We look at six indicators of agency performance and how they react to accidents:

The first of these is the *number of new inspection starts* in a particular week. The second two concern the number of documented violations in active coal mines. Depending on the applicable portion of the Mine Act, MSHA inspectors can hand out citations, orders, or safeguards upon detecting regulatory violations. Safeguards do not carry penalties with them, but citations and orders may. We examine the number of *documented violations with*

Table 1: Summary Statistics for Measures Employed in the Analysis

Variable	Mean	Std. Dev.	Min	Max
New Inspection Starts	420.67	159.61	149	1180
Documented Violations With Penalties	1304.3	446.7	273	2695
Documented Violations with No Penalties	43.54	26.84	8	204
Averaged Proposed Penalty Per Violation				
- Before 2007 Policy Change	261.97	150.25	125.11	1665.81
- After 2007 Policy Change	1048.5	296.47	527.29	1833.89
Fraction of Penalties Ultimately Assessed	0.9	0.09	0.32	1
Contestation Rate (Dollar-weighted)	0.14	0.11	0	0.37

proposed penalties and the number of *documented violations with no proposed penalties*. We also look at the *average proposed penalty per violation* per violation, as well as the *fraction of penalties ultimately assessed* to determine whether MSHA is generous with its eventual settlements. We also look at the *contestation rate* - the fraction of proposed penalty dollars contested by mining companies - in order to ascertain whether they adjust dynamically to any changes in enforcement stringency.

Summary statistics for these measures appear in Table 1. Note that we report two figures for the average proposed penalty measure: before and after April 23, 2007, the date in which MSHA's new penalty policy went into effect (pursuant to the 2006 MINER Act). As the summary data indicate, the change in policy led to a near quadrupling of the average proposed penalty.

5 Results

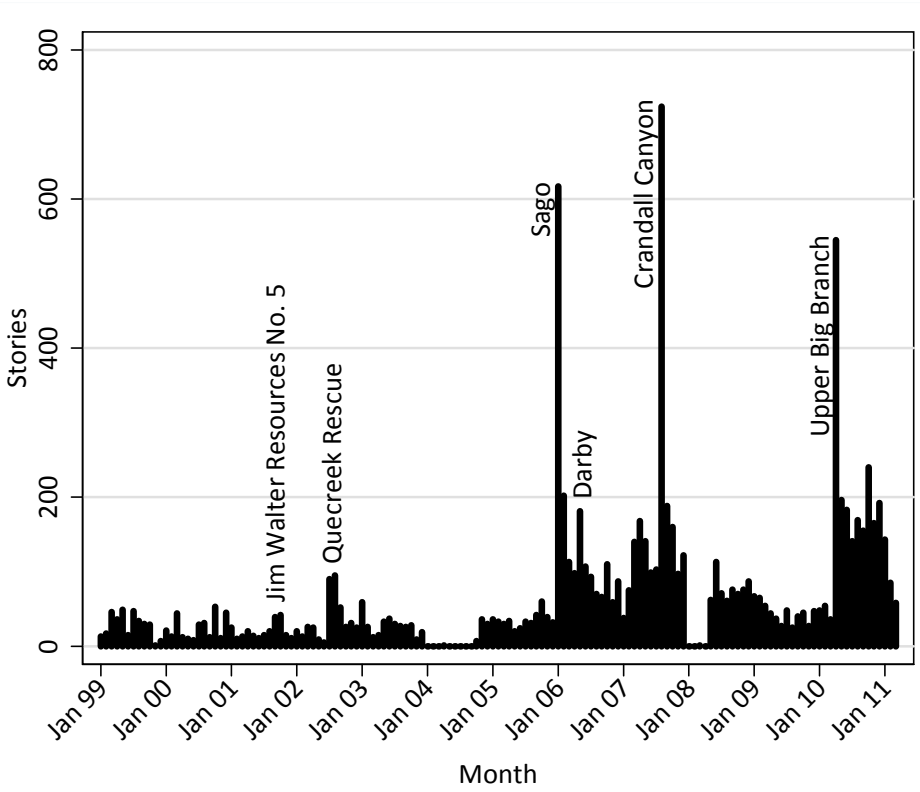
5.1 Preliminary Results: Public Awareness and Company Performance

Before proceeding with our main analysis, we examine the effect of mine disasters on media coverage of MSHA and on the stock performance of directly-affected mine companies. Figure 3, is the number of U.S. newspaper and wire stories mentioning the agency from 1999 through

2010 (source: compiled by authors from Lexis-Nexis). Six events are labeled in the graph: the Jim Walter Resources No. 5, Sago, Darby, Crandall Canyon, and Upper Big Branch disasters, and, for purposes of comparison, an accident with a happy outcome: the successful rescue of nine trapped miners from the Quecreek mine following the accidental breech of an adjacent flooded abandoned mine in July, 2002. As the chart indicates, mining tragedies typically generate a spike of news coverage for the agency, although the extent of that coverage varies considerably across accidents. For example, the worst mine disaster in the last two decades, at Upper Big Branch, actually generated less coverage for MSHA than the Sago and Crandall Canyon disasters. By contrast, the accident at the Jim Walter Resources No. 5 mine in Brookwood, AL generated almost no additional coverage for the agency, presumably because it took place less than two weeks after September 11, 2001. In the first nine months of 2004, a year with relatively few mining accidents and injuries, there was just one story mentioning MSHA.

To assess the impact of mine disasters on the mining companies themselves, we next consider changes in the stock prices of mining companies accompanying accidents. Because not all mining companies are publicly traded, we restrict attention to three cases: Walter Resources (the ultimate owner of the Jim Walter No. 5 Mine), International Coal Group (ultimate owner of Sago), and Massey Energy (ultimate owner of Upper Big Branch). Despite the occurrence of accidents in mines under their purview, neither Walter nor ICG experienced significant short-term changes in their companies' returns when compared against the S&P 500. By contrast, Massey experienced a more than 10% decline in share price immediately following the Upper Big Branch disaster, and abnormally low (though falling just short of statistical significance) returns relative to the S&P for the subsequent two-month period. Insofar as Upper Big Branch represented only about 1 percent of Massey's total coal output, it is reasonable to infer that the threat of regulatory response (as well as litigation) contributed to the drop.

Figure 3: U.S. Newspaper and Wire Stories Mentioning the Mine Safety and Health Administration, by Month, 1999-2010.



We also examined changes in the stock prices of Arch Coal, a large rival coal company that did not experience any major incidents during the period under consideration. An accident for producer A may have several different, potentially offsetting effects on producer B's prices. First, there may be a direct substitution effect, wherein coal buyers shift their purchases away from A and toward B, driving up B's returns. Second, there may be an indirect, regulatory substitution effect, in which MSHA reduces its regulatory burden on B to focus its resources on the less fortunate rival, to B's benefit. Finally, there may be a regulatory externality, wherein MSHA increases its regulatory burden at the mines of both producer A and producer B: this could drive down the share prices of producer B. We find that the Jim Walter Resources, Sago, and Upper Big Branch Mine disasters had no effect on the returns of Arch Coal relative to the S&P. The Crandall Canyon disaster, however, did increase relative returns by a bit less than one percentage point in the two months following that incident, although the effect just misses being statistically significant at conventional levels.

5.2 Main Results

Jim Walter Resources No. 5. The first disaster whose effect on MSHA enforcement we consider occurred on September 23, 2001 in Brookwood, AL, less than two weeks after the September 11 attacks on the World Trade Center and Pentagon. A cave-in at the mine led to the release of methane; the subsequent explosions killed thirteen miners. As noted above, the disaster generated negligible coverage in the press, and had no impact on Walter Resources' stock returns.

Figure 4 displays scatterplots of the measures of regulatory performance detailed above. Overlaid on each scatterplot are smoothed, local linear regression curves and their associated 95% confidence intervals. Two curves are fit for each plot: one corresponding to the subsample of data from before the accident, and one for the subsample occurring after. The

date of the accident is depicted by the vertical black line.[9]

An immediate effect on MSHA enforcement activities attributable to the accident would be indicated by a sharp break in the smoothed curves around the boundary. However, we observe no such effect in any of the figures. Nor do the data appear to indicate any substantial intermediate-term changes in agency behavior; the one possible exception being that a mild increase occurring in the number of violations assessed appears to reverse itself following the accident.

Sago. An explosion in the Sago Mine on January 2, 2006 trapped thirteen miners. The ensuing rescue attempt garnered major media attention and subsequent outrage when media outlets erroneously reported that all of the miners had been rescued when in fact only one had been. Ultimately, only one of the trapped miners was saved. Our analysis uses a breakpoint of January 4, the day on which the full scope of the tragedy was recognized. Figure 5 reports the interrupted time series results for the Sago event.

A different pattern from the one observed around the Brookwood tragedy emerges: in particular, following the Sago event MSHA almost doubled the number of new inspection starts from the preceding weeks, from around 200 to 400. We also observe a statistically significant immediate increase in the number of violations issued with penalties, as well as a slightly delayed bump in the number of violations issued without penalties. However, if one looks at the average proposed penalty, there is no significant immediate effect, although a slight rise does occur over the period in question.

As in the Walter Resources disaster, there appears to be no significant effect of the disaster on the fraction of penalties remitted or the rate at which the industry contested penalties.

Crandall Canyon. The Crandall Canyon disaster occurred on August 6, 2007 in Emery County Utah. A collapse trapped and killed six miners; three rescue workers were also killed.

[9]Bandwidths are calculated using the procedure described in Imbens and Kalyanaraman 2009.

Figure 4: The Effect of the Jim Walter Resources No. 5 Mine Disaster on MSHA Enforcement: Interrupted Time Series Analysis

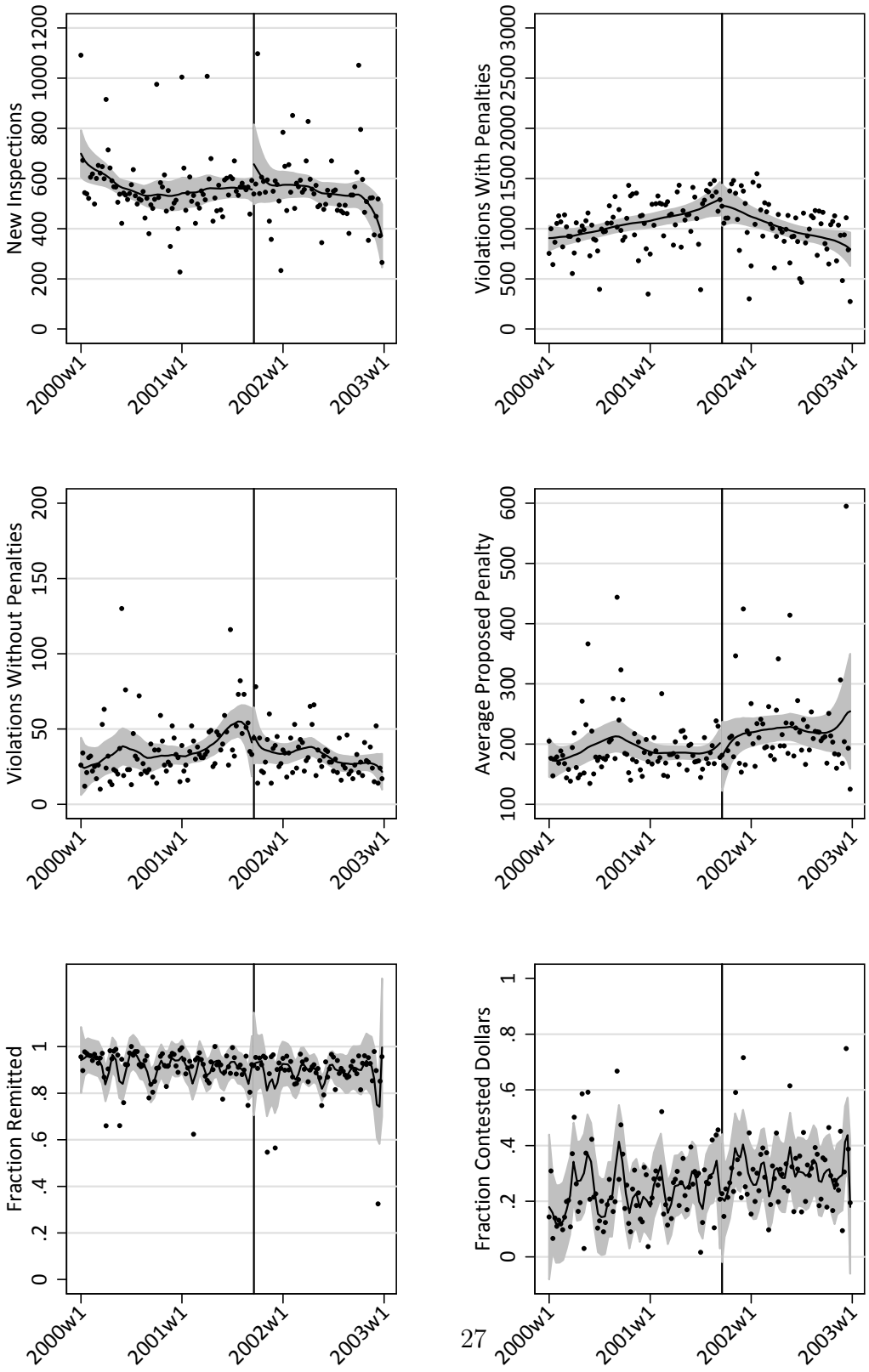
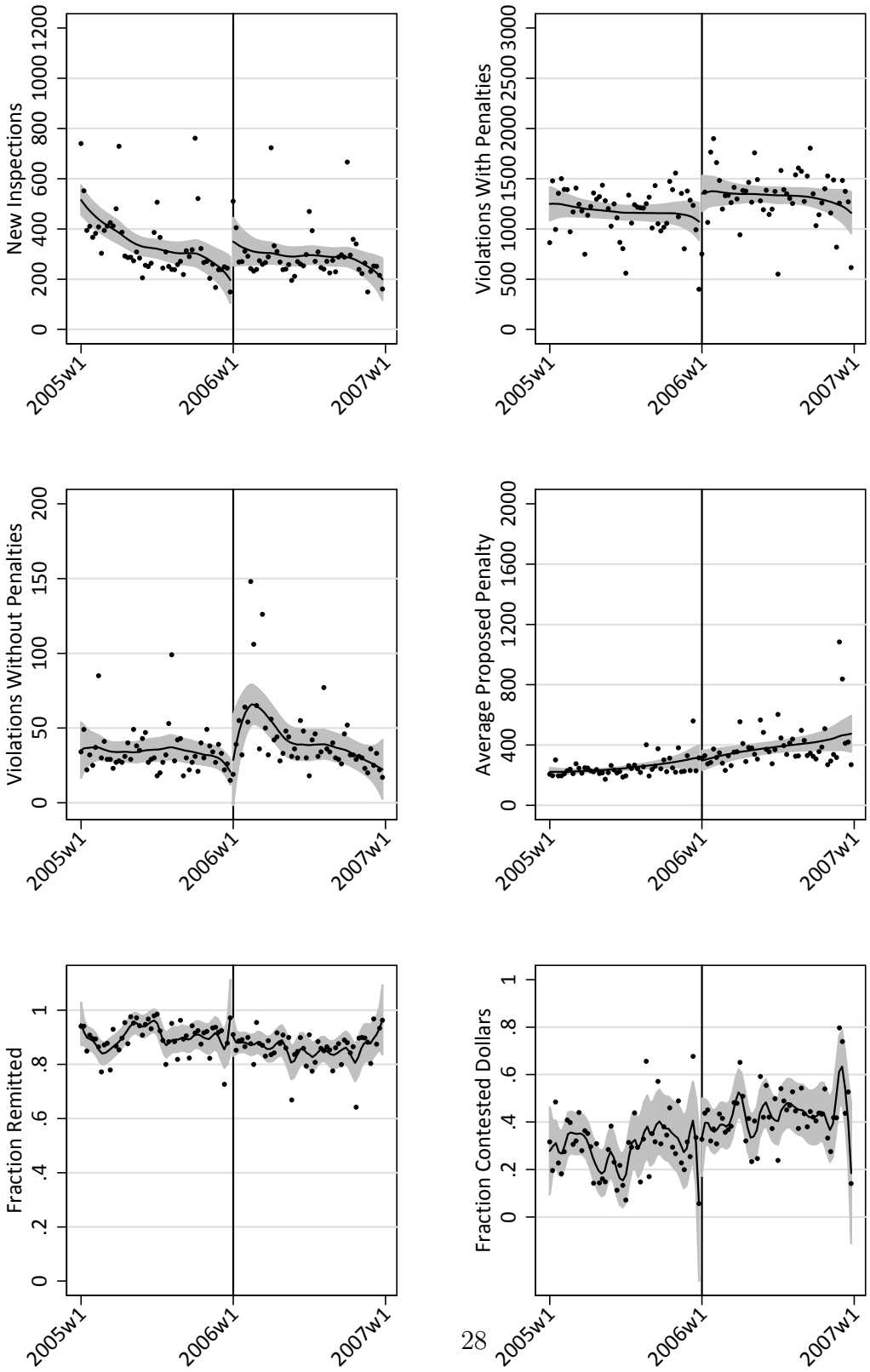


Figure 5: The Effect of the Sago Mine Disaster on MSHA Enforcement: Interrupted Time Series Analysis



Results for the analysis of the Crandall Canyon disaster appear in Figure 6. In addition to the black vertical line corresponding to the occurrence of the accident, the figure also displays a dashed line corresponding to the date on which MSHA's new penalty policy went into effect.

The most striking feature of the figure comes in the form of the sharp increase in average proposed penalties preceding the disaster; closer inspection, however, reveals that this is entirely attributable to the change in MSHA's penalty policy occurring in late April, 2007. Interestingly, the data document a *decline* in average proposed penalty per violation in the months following the disaster.

The only significantly different observable in the data is an increase in the number of violations issued with no penalties. A similar increase in violations with associated penalties is not statistically significant. Unlike Sago, the Crandall Canyon disaster did not lead to any discernible increase in the rate of inspection starts.

Upper Big Branch. The third disaster whose effect we consider is the recent tragedy at the Upper Big Branch Mine at Montcoal, West Virginia. A methane explosion killed 29 miners in the worst mining accident in decades. Results for the Upper Big Branch analysis appear in Figure 7.

Patterns in the data indicate that Upper Big Branch had a significant effect on MSHA's pattern of enforcement. The data indicate a highly significant increase in the number of violations issued, both with and without penalties. Unlike Sago, the average proposed penalty per violation jumped almost 50%, or over $400. Regulatory intransigence, as indicated by the fraction of penalties eventually remitted, appears to have increased as well, increasing to almost 100% in the months following the tragedy. Not surprisingly, the fraction of penalties contested by the industry increased in response to the large jump in the size of penalties. The graph indicates, however, that this fraction declines following the initial bump, such that by the end of 2010 it was lower than it had been previous to the accident.

The most intriguing result for this part of our analysis concerns the number of new

Figure 6: The Effect of the Crandall Canyon Mine Disaster on MSHA Enforcement: Interrupted Time Series Analysis

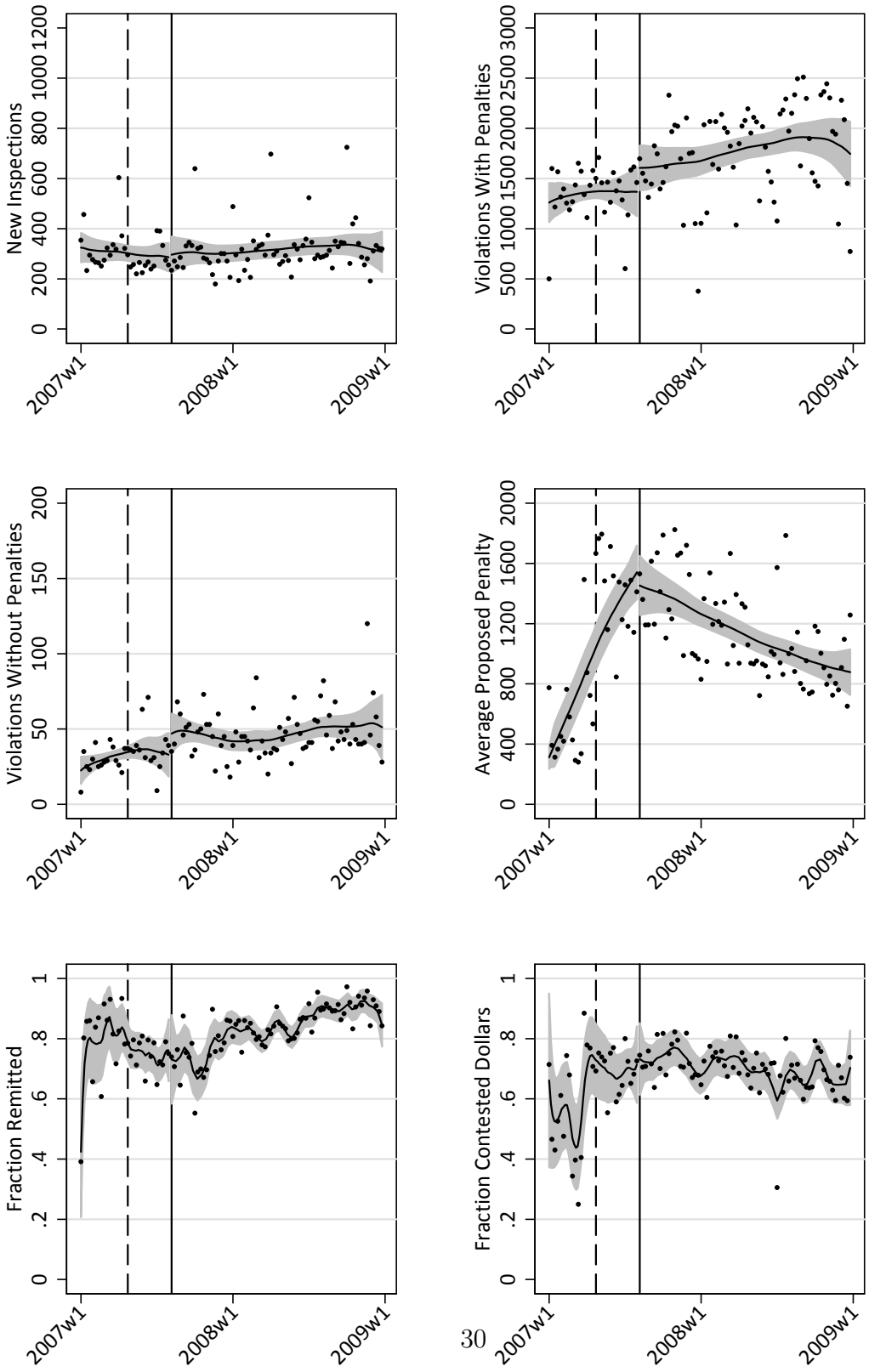
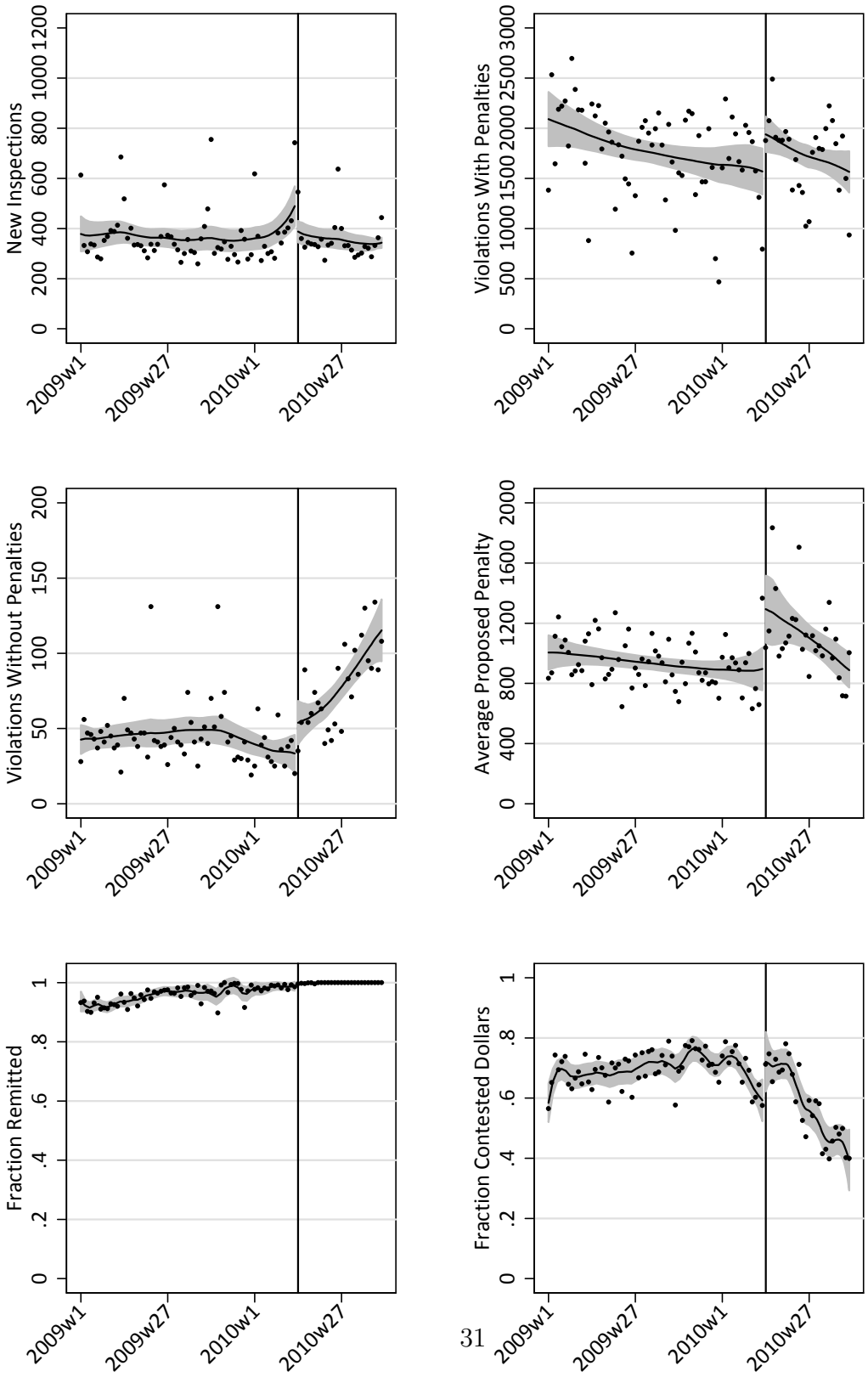


Figure 7: The Effect of the Upper Big Branch Mine Disaster on MSHA Enforcement: Interrupted Time Series Analysis



inspection starts. Contrary to expectation, the data indicate an immediate *decline* in that number. Closer examination of the data, however, reveals that the shift is attributable to an unusually high number of inspections taking place in the week prior to the tragedy, and to the deployment of a large fraction of MSHA's inspection force to Upper Big Branch immediately following the explosion.

6 Discussion

A suggestive picture emerges from comparing MSHA's response across the different disasters. First, after the Upper Big Branch Mine Disaster, which occurred during the Obama administration, the agency substantially increased both the number of violations with penalties and the average proposed penalty per violation. Coupled with a higher fraction remitted (approaching 1 after the disaster), this suggests that the agency responded to the disaster in a manner that directly imposed costs on the industry. This interpretation is borne out by the sharp increase in the rate at which mining companies contested violations following the accident.

Contrast this with Sago, a highly-publicized disaster that took place during the Bush administration. After Sago, the agency increased the number of violations issued with penalties and very substantially increased new inspection starts. However, the average penalty per violation remained unchanged in the period following the disaster; moreover, the remittance rate remained unaffected, as did the rate at which mining companies contested violations. A comparison of MSHA's enforcement response to Upper Big Branch and Sago, then, suggests a more vigorous response by the Obama-era MSHA than the Bush-era MSHA. This interpretation is further borne out by a comparison with the Crandall Canyon disaster, in which the only observed statistically significant change in agency behavior is the increase in the number of violations issued without any penalties attached. Together, these findings suggest the importance of hierarchical political control, and thus conditional forbearance, at

odds with a strong capture account. Note, however, that this assessment cannot be said to be definitive. Because Upper Big Branch took more lives (29 fatalities, compared to 13 at Sago and nine at Crandall Canyon), we cannot dismiss the possibility that an accident of comparable magnitude occurring under the Bush administration would have fueled public appetite for a similar agency response.

The comparison between MSHA's response to Sago and to the comparatively little-publicized Jim Walter Resources No. 5 in Brookwood, AL is instructive with respect to the effect of media coverage: while the change in agency behavior following Sago may have been less substantial than following Upper Big Branch, it was inarguably far greater than the response to the much less-publicized Brookwood tragedy, after which we observe effectively no change in agency behavior.

Respecting the effect of publicity on agency action, Crandall Canyon stands out as something of an anomaly: As indicated in Figure 3, this disaster had the most media coverage of all of the four disasters whose effects we examine.[10] However, the agency response to Crandall Canyon was considerably less pronounced than its response to the similarly-publicized Sago disaster a year earlier. There are two plausible explanations for this. First, the Crandall Canyon disaster occurred shortly after MSHA's new penalty policy went into effect. As Figure 6 indicates, the new policy had a substantial effect on agency enforcement practices, and this may have muffled the subsequent effect of the Crandall disaster. Second, the agency may have faced stronger incentives to appear effective and adversarial toward the industry at the time of the Sago disaster because MSHA faced a legislative challenge in the form of the MINER Act. By the time the Crandall Canyon disaster occurred, the new law was already on the books, as was the new penalty policy.

[10]We did not examine the Darby disaster owing to its proximity to a potentially confounding event: the passage of the MINER Act.

7 Conclusion

Regulators face multiple, overlapping sets of incentives and constraints brought about by their strategic interaction with regulated interests and their positions as agents in political hierarchies. Too blunt an account of the influence of regulated interests on agency behavior risks neglecting the different mechanisms by which those regulated interests might exercise influence in regulatory decision making, as well as the extent to which placement in a political hierarchy can mediate the extent of influence.

In this chapter, we describe a more subtle account of industry influence, in which the broader political context of regulatory action determines the extent to which regulators offer forbearance to regulated industries. The pure capture and conditional forbearance accounts yield distinct predictions about regulatory enforcement, which we examine in the empirical context of mine safety and health regulation. To overcome an empirical challenge associated with strategic behavior by regulated parties, we examined the the effect of exogenous shocks to the political environment of the Mine Safety and Health Administration on subsequent agency behavior. Our examination of MSHA's response to different disasters, each of which occurred in a different political climate, bolsters support for the conditional forbearance account.

In particular, the data indicate that the Bush administration responded forcefully to the highly-publicized Sago mine disaster, relative to the Jim Walter Resources disaster, which occurred shortly after September 11, 2001; and to the Crandall Canyon disaster, which, though highly publicized, occurred just after a new mine safety legislation and pursuant regulations had gone into effect. The data also indicate a more aggressive regulatory response by the Obama administration following a major disaster that occurred on its watch. Taken together, these findings suggest that MSHA's political principals do succeed in exercising influence on agency affairs separate from that exercised by the industry. Moreover, while

the fact of a stronger response under Obama than under Bush may seem consistent with a common understanding of the ideological leanings of both administrations, it is important to note that *any* increase in regulatory scrutiny under Obama following the accident would imply, ipso facto, that the administration did not completely disregard management concerns *before* the accident.

We conclude by noting that posing broader questions about the determinants of regulatory behavior, rather than focusing more narrowly on regulatory capture, may illuminate our understanding of the mechanisms by which regulated interests influence implemented policy. With a more complete picture of the avenues through which interests influence policy, we will be better able to assess the legitimacy of particular outcomes. While MSHA represents a particularly interesting case for scholars of interest group influence in regulatory behavior, our approach can be applied in a host of policy areas, such as food and drug, nuclear power, and airline safety regulation. In all cases, regulators face complex incentives in strategic interactions with political superordinates and regulated interests. And while the particulars of the political environment may differ in each case, the basic principle of using exogenous shocks to agency preferences represents a promising avenue for fleshing out a more textured account of regulatory politics.

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