

**INFORMATION AND UNCERTAINTY IN REGULATORY PROCESSES:
EVIDENCE FROM PESTICIDE REGULATION**

Andrew B. Whitford

Professor
Department of Public Administration and Policy
School of Public & International Affairs
The University of Georgia
204 Baldwin Hall
Athens, GA 30602-1615
Voice: 706.542.2898
Fax: 706.583.0610
Email: aw@uga.edu

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Abstract

Agencies must simultaneously weigh technical information against the political and distributive consequences of their decisions. In a study of the U.S. Environmental Protection Agency's implementation of federal pesticide policy, I show that the EPA accounts for both risk and constituency factors. I model the sequence of steps in the decision process to show the effects of both uncertainty and information on the EPA's decisions. This is accomplished by estimating a competing risks model of the timing of the agency's decisions.

INTRODUCTION

Studies are ambiguous about how agencies reconcile political demands regarding the policies they make with the boundaries of their knowledge. For instance, writers are often ambivalent about the exact or proper role for scientific information in setting government policy. Technical experts often fail to agree on how to use rules to manage actual health risks (Rushefsky 1982); technical information often takes a backseat to other, more political concerns even in econometric modeling (Kraemer 1987). Some who observe this limited role of objective technical assessment in policy call for more public discourse in policymaking (Majone 1989). Others claim that bureaus that can make decisions based on technical information are better able to protect their reputations as guarantors of safety (e.g., Carpenter 2001, 2002, 2004; see also Jackson 1970 and Quirk 1980).

Specifically, we often criticize regulators for not making decisions based on technical merits, even if they do so for political or distributive reasons beyond their control. For example, studies often condemn the U.S. Environmental Protection Agency (EPA) for failing to educate the public since the agency holds more information than does the public (e.g., Landy, Roberts, and Thomas 1994). Some studies on human health risks try to assess how this kind of scientific information should be used in regulation: that decision-makers should grade different levels of health risk (Travis, et al. 1987) and balance known risk and proposed benefits (Cropper, et al. 1992), even though risk perceptions probably depend on psychological frames (Viscusi 1995). Regulators may balance risks and the costs of mitigating those risks (even if prohibited from doing that) (Van Houtven and Cropper 1996), with consequences for efficient health risk management (Viscusi and Hamilton 1999). More recently, Carpenter (2002) shows that the FDA considers the incidence of a disease in a population, itself a kind of technical information.

A bureaucrat cannot perfectly foresee the effects of her decisions (Duval and Groeneveld 1987), but her organization's reputation depends on how she manages organizational risk, and that risk depends on avoiding bad decisions (such as adverse health events after product approval) (Carpenter 2002, 2004). Put a different way, a bureau's reputation is a consequence of the management of organizational risk, and organizational risk is managed when an agency makes decisions on the basis of scientific and technical information (objective risk). Of course, we often try to separate "risk" (as when one can calculate probabilities based on an objective classification of circumstances) and "uncertainty" (as when no such classification is possible), but actually all probability statements are subjective and based on a degree of belief (Knight 1921, Savage 1954, Hirshliefer and Riley 1992). Risk is perceived.

These two types of risk both matter – both the risk of an adverse event occurring (or not occurring) and the organizational risk of making (or not making) a decision. Carpenter shows how the U.S. Food and Drug Administration manages risk when it approves new pharmaceuticals. Likewise, Heimann (1993, 1995, 1997) discusses "acceptable risk" in the case of the Challenger accident. Organizational risk threatened the National Aeronautics and Space Administration's reputation; it had to avoid both the risk of making a decision that proves to be dangerous and the risk of failing to make a decision when action is needed.

The problem is that our knowledge of the agency's knowledge associated with a choice is usually incomplete. The purpose of this paper is to estimate the impact of both uncertainty and information on an agency's decision. I focus on the relative weight applied by policymakers to scientific information and other distributive or political factors when they hold discretionary authority about important policy choices. Here I assess the weight given to (1) the presence or

absence of knowledge about objective risk, and (2) the understood degree of objective risk when EPA officials process states' petitions for waivers from national environmental rules.

The discretionary actions of regulators can depend on scientific information in two ways. First, for regulatory choices scientific information is or is not available; not holding information means that the regulator faces significant uncertainty about the technical merits of the case. Second, when information is available, regulators may incorporate that information in their decision calculus. In both cases, regulators face specific tradeoffs and are forced to apply weights to the technical merits of the situation and other political or distributive factors.

The case under study involves the conditions under which states may petition for waivers, which are set out in national legislation as a way of balancing the goals of national uniformity and local flexibility. These procedural protections define an interaction sequence between the petitioning state and the bureaucrat representing the interests of the national government. In the case I present here, Section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) authorizes the EPA to waive national rules and permit the use of a pesticide product when a state claims the existence of emergency conditions. This official appeal process defines the structured way in which the EPA and the state negotiate over the waiver. The parties make independent choices including the state's decision either to make an emergency or a crisis appeal (the two procedural devices allowed), the state's decision to withdraw the waiver request at some point, and the EPA's decision to approve or deny the state's request. How bureaucrats weigh scientific information (the technical merits of the case, or objective risk) and other political and distributive factors depends on and influences this procedural setting.

I estimate the impact of information and uncertainty on the timing of the EPA's decisions: what determines the length of time, or duration, of the EPA's processing of the waiver

request? I examine the contribution of scientific information or other distributive or political factors on the length of time before one of four outcomes occurs. Decisions made too early or too late have substantial consequences both for meeting the emergency conditions described by the state and in terms of bending federal rules regarding the use of specific chemicals. Waiver petitions face four “competing risks” that can cause a request to end (Zorn and Van Winkle 2000, Gordon 2002).¹

This paper proceeds as follows. I first review the role of bureaucratic discretion in granting waivers in federal systems, and offer pesticide regulation as a test case for assessing the context-dependent role of scientific information and political factors in regulation. After specifying a basic model, I estimate a series of survival analysis models of this petition/response negotiation process. I find that the effects of uncertainty and scientific information, along with that of distributive and political factors, are truly context-dependent. Both uncertainty about scientific information and the scientific information itself influence the speed with which the EPA addresses waiver petitions, but their impacts are different for the four outcomes. The effects of distributive and political factors on the speed of the EPA’s policy making are also context dependent. Last, I offer conclusions about this theory, case, and test.

INFORMATION, FLEXIBILITY, AND THE PRACTICE OF DISCRETION

Bureaucrats must make discretionary decisions within systems of rules that define the relative powers of national agencies. In the United States, a key problem for the national

¹ This adds a third interpretation of “risk”: the statistical risk of a waiver being approved or denied in the days following its proposal by a state. This type of risk also applies to other agency decisions, such as FDA new drug approvals, requests for economic sanctions, or the decision to block proposed mergers.

formation and implementation of policy is to remain flexible to varying local needs and conditions (Brown-John 1988, Chubb 1985, Fesler 1949, Graves 1964, Hedge 1983, Osborne and Gaebler 1992). An attribute is that combinations of federal and state agencies often implement national rules (e.g., Clark 1936). Consequently, many have examined the success and failures of dual implementation (e.g., Garand 1988; Grodzins 1966; Hedge and Scicchitano 1994; Keiser and Soss 1998; Lowry 1992; Ringquist 1993a, 1993b; Scheberle 1997; Schneider 1988; Schneider and Ji 1990; Scholz and Wei 1986; Thomas 1979; Thompson 1987; Thompson and Scicchitano 1985; Wright 1988).

Essentially, federal bureaucrats have to determine whether and how to relinquish national power. Maybe it leads to cooperation and collaboration, or maybe actors simply respond to the same forces over time (Sanford 1967).² A simpler view is that this dual implementation is a system for representation (Beer 1978). Beer sees it as a problem of representing two kinds of pluralism: the territorial pluralism of the states, and the inherent social pluralism of the nation as a whole. The problem is solved in “public sector politics” when bureaucrats decide what government does and which pluralism to respond to. Of course, it is hard to equate representation and federalism (Lowi 1969, Thomas 1979), but the discretion national bureaucrats hold to tailor national laws to local circumstances, perhaps at the behest of state administrators, is a unique opportunity to rationalize territorial and social pluralism.³

² This is different from market preserving federalism (McKinnon and Nechyba 1997) because it centers on how states relate to a separate, supra-equal (first among equals) federal government.

³ This is different from either cooperative/dual federalism or federalism as a two-level hierarchical system (Chubb 1985). While states are not always responsive to national political

Federal officials have the discretion to arbitrate this representational divide, but they also want to minimize organizational risk and enhance their bureaus' reputations. As noted, in the example of new drug approval the FDA wants to reduce the likelihood of adverse reactions in new products, the National Aeronautics and Space Administration wants to reduce the likelihood of adverse events in the Space Shuttle program, and the EPA wants to limit adverse events from hazardous substances currently on the market.

In the United States this focus on the application and production of knowledge in policy decision-making (and thus also of the policy process) really dates to the policy sciences movement (Lasswell 1971). More broadly considered, it is part of the routinization of the organization of knowledge – of the storage, distribution, and application of information and knowledge (Dunn and Holzner 1988). It came to be aligned with the broad development and mustering of scientific knowledge in understanding social problems and their resolution (Dror 1971; Lasswell and Lerner 1951; Wildavsky 1979), to the point that we now live in an “age of assessment” in policy studies (Rayner 1995). More specifically, these developments lead to the rise of the “policy analyst” as a profession (Hughes 1963).

As discussed above, students of agencies now see the regulator's ability to make decisions based on facts and technical/scientific information as inherently linked to the agency's mitigation of organizational risk and construction of a reputation. Probably the most explored area in this regard in recent years has been the FDA's evaluation of new drug approvals. The FDA learns about the danger – the likelihood of adverse reactions – through the review of experimental evidence. For Carpenter (2002, 2004), this supports the conclusion that agencies

changes (Wood 1991), we often see cooperative relations and combinations of trust and involvement in federal-state relations (Scheberle 1997).

value waiting; they “buy certainty”, although there is a decreasing marginal return to information. In this tradeoff between protecting and providing, agencies value the benefits of providing by assessing the market for the good, and Carpenter (2002) provides compelling evidence that that market is a function of the organization of consumers and patients, the media, and the firms themselves.

Generally, the greater the risk, the more damage to the agency’s reputation (Carpenter 2002, 492). For new drug approvals, the rate of harming consumers (the danger of the drug) is what the FDA seeks to uncover through the drug approval process. Only this risk is subject to uncertainty (not the benefits of drug approval); danger is independent of the drug’s curative power. One difficulty with the FDA case, though, limits our understanding of how uncertainty management, based in part on the assessment of scientific and technical information, supports bureaucratic reputation. Specifically, it is exceptionally difficult first to measure and second to obtain that measure of the pharmaceutical’s risk. For this and other reasons, our discussion of how agencies react to risk in these kinds of situations has moved to the other side of time sequence: to trying to understand how agencies mitigate regulatory errors (or specifically, how the FDA reacts when a drug like Vioxx is discovered to carry significant risk) (Carpenter and Ting 2005).

This paper returns to the question of the independent effects of uncertainty and information on the decisions of a regulator by examining cases where the regulatory choice is made in one of two informational states. In the first state, the regulator does not have information about the risk associated with the approval of a market practice (and thus is uncertain about the organizational risk associated with that approval). In the second informational state, the regulator has scientific/technical information that characterizes the objective risk associated with their

approval of that market practice; in this case, the regulator can knowingly increase organizational risk by approving a product's use that carries higher risks to the user. Likewise, the regulator can reduce his organizational risk by not approving that use (but perhaps increases a second type of organizational risk if he does not bend national rules in a way that reflects greater local needs and demands). These two informational states help us test the argument that uncertainty and information flow through into the discretionary choices of regulators faced with guaranteeing the public's safety while meeting the need to be flexible in their application of the laws.

Pesticide Regulation as Representational Federalism

This is exactly the problem faced by the EPA in its implementation of national pesticide regulations. The Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA) governs pesticide registration, labeling, use, and sale, and marked an important and striking change in American policy (Bosso 1987). Between 1947 and 1972, FIFRA evolved from a system for insuring pesticide product quality to become the central means for regulating harmful effects of chemicals in the human environment. The EPA and environmental interests helped engineer the 1972 Amendments, an evolution marked by controversy, growing openness, and increased oversight; regulation rapidly fragmented. Later, the 1996 Food Quality Protection Act (FQPA) amended FIFRA and brought greater regulation of potentially hazardous pesticide agents. Along with other initiatives, the FQPA required EPA to assess the potential risks from aggregate and cumulative exposures to pesticides (see Schierow 1996).

In this paper a federal agency issues or denies state petitions for waivers or exemptions from national rules and regulations. Surprisingly little work has been done on this question, which is especially surprising given the many examples of such waivers in practice. In social welfare policy, prior to the Personal Responsibility and Work Opportunities Act of 1996, states

could claim control of the AFDC program when the Department of Health and Human Services granted special exemptions; federal Medicaid policy has similar aspects. In environmental policy, the Clean Water Act allows states to petition for variances in water quality permits awarded to regulated entities. The Clean Air Act expressly requires states to petition the EPA for approval of their state air quality implementation plans. Generally, states can take control over the implementation of parts or entire pieces of federal legislation within their boundaries under the process of primacy or partial preemption.

Federal agencies may distrust state attempts to control an area of policy where legislation sets federal control. The federal agency may fear relinquishing control too quickly, or retribution (from above or below) for not allowing state-level flexibility. Congress could fully devolve power. The bureaucrat's problem, given this endowment of authority, is to reconcile the dilemma of balancing national uniformity and territorial diversity in needs, conditions, and tastes.

Moreover, pesticide regulation is important for environmental policy generally and the EPA specifically. Information and perceptions about DDT in the environment, largely fueled by Rachel Carson's *Silent Spring*, helped the passage of the 1972 Amendments to FIFRA and the entire U.S. environmental movement. Farmers often see the EPA as an antagonist and productivity threat with limited understanding of (or interest in) the value of chemical pesticides. The EPA trades off environmental risk and economic reward, but many see the social cost of regulation as extremely high (Cropper, et al. 1992).

FIFRA Section 18 reveals these tradeoffs between risk and reward and between local and national pressures. The EPA is authorized to enable state agricultural agencies to allow the use of a pesticide product in a nonregistered way if emergency conditions exist in the state, and also to

set how long the product may be so used.⁴ To be specific, Section 18 is used when a pest is located on a crop and no currently recommended practices provide adequate control. More importantly, Section 18 is intensely local. A grower association or group first petitions the state department of agriculture, and the request is submitted to the EPA if the state agrees the minimum criteria have been met.⁵ Growers follow through newsletters the timelines and dispensation of requests made to the EPA.

There are five “states of the world” for requests: *science review pending* (SRP), *crisis*, *denial*, *withdrawal*, and *approval*. Requests are SRP until they transition into another state. The EPA publishes a notice of receipt in the Federal Register and solicits public comments only under specific conditions, although those conditions are quite broad (USEPA OPP 1998a). The state agency itself can issue a “crisis” exemption that allows unregistered use for 15 days, conditional on the EPA’s review. For a standard exemption request, the EPA can either deny or issue an emergency exemption and issue a formal tolerance (maximum allowable residual level), which is time-limited to correspond to the use season (USEPA OPP 1998d).⁶ The state agency can withdraw its request at any point. Figures 1 and 2 shows the emergency exemption and crisis exemption processes.

[Insert Figures 1 and 2 about here.]

⁴ Emergency exemptions are meant to address neither the modification of the use of pesticides in unique situations (a Special Local Need registration) nor the use of nonregistered pesticides in experimental tests (an Experimental Use Permit).

⁵ See the Nebraska Department of Agriculture (NDA) *Pesticide and Noxious Weed Newsletter* (Summer 1999).

⁶ Some crisis exemptions eventually become emergency exemption requests.

The state's first choice is to pursue either a crisis or a standard emergency exemption. The EPA decides whether to issue, deny, or wait for a withdrawal in the case of emergency exemptions. The EPA, the states, and agricultural constituencies all care about the EPA's processing time (Guillebeau 1996). The EPA claims it tries to decide within 50 days of receipt, but states often note the EPA decides between 50 and 90 days. The EPA claimed an average time of 56 days in 1998 (USEPA OPP 1998e). The biggest problem for the EPA, state agricultural agencies, and constituencies is agreeing on what is an emergency (Coble 1998, NASDA 1999).⁷

MODEL SPECIFICATION

When states choose a crisis or an emergency exemption, they weigh the costs and benefits of getting the EPA's agreement against the limited benefits of the very short window of a crisis approval. The three possible outcomes that are possible in an emergency exemption petition (approval, denial, or withdrawal) are unordered and polychotomous; moreover, at a given point in time, we do not know how some cases will turn out since they are right censored. States value approval over denial or voluntary withdrawal if only because of implicit opportunity costs. Both approval and denial are costly actions for federal agencies because of the possibility of wrong decisions, temporal irreversibility, or setting precedents.

⁷ The FQPA enhanced the EPA's public health protection mandate and so made its job harder (see Goldman 1996; Lavy, Skulman, and Spradley 1997; USEPA OPP 1997). Risk measurement and management changed with the FQPA's new standards and has made the tradeoffs between health protection and productivity much more explicit. The FQPA required that data on all requests be posted on the Internet as part of the Agency's continuing mission under the National Performance Review to achieve greater "customer satisfaction" (OPP EPA 1998b). There is also discussion of a fee structure (see Olson 2000 for the impact of fee structures on processing time).

We observe two items for each case: the processing time (in days) taken by the EPA for requests, and the status of the case with regard to these four states. Time is a fundamental productivity measure for the EPA, and is meaningful, manipulable, and public under the FQPA. Studies of processing time in bureaucracies are relatively rare (but see Carpenter 2002, Olson 1997 and 2000), and involve specific modeling issues addressed below.

Uncertainty and Information

How does an agency incorporate technical information (or uncertainty about that information) when balancing national uniformity and local flexibility? The EPA's mandate is to enhance social value through risk reduction in pesticide regulation. To do this the agency must identify technical merits for regulating a chemical entity. The risk associated with the use of any substance, especially pesticide agents, is a function of its identified risk, risk perceptions held by decision makers and stakeholders, and risk management schemes in place to mitigate exposure and the effects of hazards in the environment to workers and others. Although identified risk often can be quantified, this measurement process is fraught with intentional and unintentional error. Measurement is complicated by judgements that incorporate "cascading conservatism" or the behavior of maximally-exposed individuals. Yet, not surprisingly, agencies adjust their decisions based on available risk information. For instance, in the 1970s and 1980s the EPA based its decisions on a special review of pesticide registrations on risk information (Cropper, et al 1992).

The first filter a bureaucrat can apply to this problem is "what information do I have on the technical merits of this request?" The EPA's primary source of information is the Integrated Risk Information System (IRIS), an electronic database containing information on human health effects that may result from exposure to various chemicals in the environment. IRIS provides

toxicological information for use in risk assessments, decision making, and other regulatory activities. If a chemical is included in IRIS, the Oral Reference Dose (RfD) (in mg/kg bodyweight/day measurements) is a standard numerical indicator for chronic noncarcinogenic health effects. For the EPA and the states then, IRIS provides two sources of risk information: whether IRIS contains any numerical information on risk, and if it does, the specific risk measurement. In this study, for the 2107 known requests made in the sample time period, IRIS information included an assessment of the RfD deemed safe for 759 of the requests. Whether IRIS contains an RfD number reveals how much information the EPA and states hold about a pesticide. Given IRIS contains a listing, the actual number provides information about a pesticide's perceived risk. A higher reference dose indicates a higher threshold at which health effects are rare; a higher RfD may indicate a "safer" pesticide.

All other things equal, having IRIS information should speed the EPA's decisions – especially for those petitions where the EPA issues a waiver. Not having information means that the EPA faces significant policy uncertainty, and the implicit tradeoff between uniformity and flexibility is made even more difficult. The baseline (is this substance a major concern?) is not clear. For the agency, having information – regardless of whether that information says the chemical is nice or naughty – is better than not having information, and should pay benefits for the timely processing of cases under the petition process. Suppose though that a strategic state agency understands this motivation on the part of the EPA. Knowing that the EPA is both endowed with and required to exercise the power to administer waivers, it may shift potentially troublesome cases out of the emergency exemptions and into the crisis exemptions process. In that case, having IRIS information may actually slow the EPA's treatment of crisis notifications after they are forwarded to the EPA because it signals a reason for greater oversight to insure that

flexibility does not undermine national pressures for uniform application of the law (see Lavy, Skulman, and Spradley 1997; see also USEPA 1998c).

For those cases where the EPA holds information on the hazards associated with a pesticide in the form of an RfD measurement, I expect that higher RfD measures (lower toxicity) will speed the processing of the states' waivers by the agency. In this case, the agency holds substantial technical information, and if the agency uses that information as a way of insuring the uniform application of the law, then it will take longer to process cases where the chemical has a lower RfD measurement (higher toxicity).

Together these measures form two bases for assessing the distinct roles of scientific information in the discretionary allocation of power between the federal and state governments by bureaucrats. In the first case, having or not having technical information defines states of uncertainty, and higher levels of uncertainty will slow the process of making decisions that allocate power from the national government to the state, and so err on the side of flexibility over uniformity. In the second case, given the availability of technical information, I expect that if the agency conditions its discretionary choices on that information, then it will take greater care in considering the "flexibility over uniformity" tradeoff, and slow the processing of cases involving chemical entities known to carry greater human health hazards.

Distributive and Political Factors

However, pesticide regulation illuminates a fundamental tradeoff between local agricultural and environmental constituencies. Pursuing waivers benefits agricultural and affiliated constituencies at the expense of those advocating strict controls on potentially hazardous activities to the general environment and human health. The economic impact of the agricultural economy creates "value chain" affiliations between specific growers and equipment

retailers, banking, and local businesses, which agricultural interests often exploit in lobbying states for waiver petitions (see Baron 1997). My first measure of the agricultural economy is the percentage of Gross State Product (GSP) in 1996 current dollars due to agricultural and affiliated production (1996 U.S. Department of Commerce Bureau of Economic Analysis).⁸ For this measure, the top three states are South Dakota, North Dakota, and Nebraska; the bottom three are New York, New Jersey, and Massachusetts. If the EPA respects the role of local distributive and political pressures from agricultural constituencies, I expect that cases will be processed more quickly for states dependent on agriculture. A second measure of the state of a state's agricultural community is the number of acres under production. Given the varying prices for specific crops, the overall size of the agricultural sector in terms of dollars may not represent the incidence of agriculture within a state. In this case, the top three states are Wyoming, Arizona, and New Mexico; the bottom three are New Jersey, Rhode Island, and Connecticut. These data are from the 1997 U.S. Census of Agriculture. I expect the same direction in the relationship as for the first measure.

This tension between agricultural and environmental constituencies is often represented through the membership of groups representing these broad constituencies. Because emergency exemptions are local and apply only to the petitioning state, local constituencies can take priority status. For agriculture, the Farm Bureau has an almost mythical status as an advocate for farming interests, either as small family farms or agricultural industrial farms (Wallace 2000; see also Truelson 2000). The power of the Farm Bureau is its enrollments, generated in part through its

⁸ Alternative instruments would be agricultural use statistics on pesticide use or even the economic value of specific crops; this information either is fraught with error and bias or is rarely used by the EPA itself.

sales of insurance. My measure of the Farm Bureau's penetration of a state is the 1997 number of Farm Bureau "families" (Farm Bureau 1997) divided by the 1998 estimated number of households in the state (U.S. Census Bureau), expressed as a per 1000 families rate. For states, organized agricultural interests may force pursuit of crisis exemptions. For the EPA, the tension between local and national constituencies again arises. If the agency respects the role of local distributive and political pressures from agricultural constituencies, farm family penetration should cause the agency to slow requests from those states. The three states with the lowest penetration are Alabama, Massachusetts, and Connecticut; the highest are Kentucky, Tennessee, and Arkansas. However, if the EPA respects the role of local distributive and political pressures from environmental constituencies, conservation group penetration, measured as the number of conservation group members as a per 1000 person rate (Hall 1991), should slow the processing of claims from the states. The top three states in conservation group penetration are Vermont, New Hampshire, and Connecticut; the bottom three are Mississippi, Alabama, and Louisiana.

Yet, states can make good faith regulatory efforts that complicate how informative petitions are to the EPA. Because FIFRA is largely implemented by state agencies operating under cooperative agreements with the EPA, the EPA's central concern is the long-term perceived effectiveness of the state agencies in their enforcement and oversight of pesticide programs in the field. Section 18s present a quandary for the EPA because of the nature of pesticide registration and enforcement: are these situations truly emergencies requiring the use of pesticides for nonregistered and possibly hazardous purposes? The EPA can condition its behavior on the states' history of stringent pesticide regulation in two different ways. First, the agency might view state agencies perceived to be effective as acting "outside their interest" when they bring requests to the OPP. In this type of trust relationship, the federal agent uses reputation

information about a state agency's past performance as a signal of its long-term commitment to enforcement and oversight, and insight into how the state agency processed the request by state agricultural interests for an exemption. Under this scheme, the EPA processes requests quickly when the agency's past performance signals strong and effective pesticide regulation.

Alternately, the EPA may act as if the state agency is acting under duress and process the request accordingly. For state agencies, an advantage of Section 18 is that they act only as conduits between state-level interests and federal decision makers. A state agency can "pass the buck" to the EPA by requesting a decision that is clearly not in the state agency's interest. This request ("wink, wink") may be seen by the EPA as an opportunity to intervene on the behalf of the state agency and to slow down the decision making process. Under this scheme, my expectation is that the EPA processes requests slowly if the state agency is known for strict pesticide regulation. The instrument for the past effectiveness of the state agency is its ranking on a ten-point scale from Hall (1991); the top state is California and the bottom is Wyoming (which does not have a formal pesticide regulation program).

A second complicating factor for both states and the EPA is the role of a state's congressional delegation as political overseers of the EPA. For states, this delegation can serve as both friend and foe. Delegations can advocate on the behalf of states, encouraging the EPA's compliance with requests for waivers. Delegations can also serve as advocates for constituencies, possibly environmental ones, at odds with state requests. I expect that the EPA will take longer to process requests from states with delegations with such preferences. My measure of delegation environmental preferences is the median League of Conservation Voters score for a state's House delegation. Those states with the highest median scores are Rhode Island, Vermont, and Hawaii; those with the lowest are Wyoming, Idaho, and Louisiana.

Waivers are regular and important decisions and provide a unique test case for assessing the relative weight in bureaucratic choice processes of competing uncertainty/information factors and other distributive and political factors. They are not just “one-time only” interactions between state and federal agencies, where the federal government is troubled by the reversibility of decisions. Their emergency status means they are not wholly unimportant decisions where processing time is meaningless. Table 1 provides sample statistics for dependent variable (shown for the entire dataset and for the non-“crisis” requests alone) and the independent variables for post-FQPA requests made to the EPA from October 1996 to March 15, 2000. Three variables are logged to account for high skew. Again, the EPA does not simply accept or reject the claims of state agricultural agencies. Four states are possible for any request at a point in time; SRP coincides with right-censored data. The four polychotomous states are tabulated in Table 2. Clearly, emergency exemptions are more often issued than denied or withdrawn. The relevant question is what drives how long it takes the EPA to process a request. Empirically, the average review time for emergency exemptions is 62 days; however, Table 2 also shows how this time varies with the outcome of the process. This causes specific complications for the estimation of models of processing time that I now address.

[Insert Tables 1 and 2 about here.]

ESTIMATION APPROACH AND RESULTS

Survival analysis methods are well-suited for this type of application. The key departure from traditional methods, though, is dictated by the four ways a case can exit the data. These competing risks make it difficult to assess the nature of censoring; while a full discussion of competing risks is beyond the scope of this paper (e.g., Crowder 2001), it is important to note

that I assume independent competing risks for this application, as is usually the case.⁹ For estimation in the presence of k competing risks, it is necessary to estimate each model k times (once for each of the k competing risks), with all failures due to the other $k-1$ competing risks considered right censored; SRP cases are considered censored in all of the k models. I estimate parametric Weibull models of the underlying baseline hazard with included covariates; the Weibull model is estimated in accelerated failure time (AFT) metric because post-estimation inspection of the residuals from Cox semiparametric models indicated violations of the proportional hazards (PH) assumption (details available on request). I include Huber-White robust standard errors (Huber 1967, White 1980).

Table 3 presents estimation of five models to address the role of uncertainty in framing the agency's decisions: the Weibull model for the full data (not accounting for competing risks), a Crisis model, a Denied model, a Withdrawn model, and an Issued model. It is important to note that the first model discards information by not accounting for possible unmeasured heterogeneity across the four non-SRP states. Two models have basic problems: for both Denied and Withdrawn the Wald test indicates a basic lack of fit. Note that negative coefficients mean slower processing times and positive coefficients mean faster processing times.

First, while the full data model indicates no role for uncertainty, the competing risks specification provides compelling evidence that the agency differently conditions its behavior on

⁹ Independent risks models are more computationally feasible, elements of dependence enter through the covariates, and independent risks models are often just as appropriate for estimating the covariates of interest (Sueyoshi 1992). Independent risks models make assumptions similar to the independence of irrelevant alternatives (IIA) assumption in polychotomous choice models, an assumption that is truly data-dependent (e.g., Quinn, Martin, and Whitford 1999).

basic uncertainty about the technical merits of these petitions. For crisis exemptions, having IRIS information speeds the process presumably because given the state's choice to unilaterally allow the use of the chemical, the problem for the agency is to then determine the allowable length of its use. Having information in this case means that the agency must consider that information in making that determination. However, IRIS entries speed the process of making decisions for petitions that the agency eventually approves. Not having information in this case means that the agency must make hard choices that could have significant consequences – due in part to the higher risk of failure given that the agency has discretionary authority to make a decision, is required to make a decision, and does not have high-quality information to do so.

The way the agency responds to distributive and political factors also depends on underlying these competing risks. The full data model suggests no role for the agricultural community, but this masks the different responses in the Crisis and Issued models. In the first, the agency goes slower for agriculturally dependent states; for the second, the agency moves faster. This indicates that the nature of the discretionary choice problem for the agency depends on the procedural protections allowed for states when they petition for waivers from nationally-uniform standards. Both farm family penetration and environmental group penetration speed the issuance of waivers. The full data shows no evidence for any role for farm families, and while it shows evidence for the same role for conservation groups that role is not replicated in any other competing risk model. (I choose not to interpret coefficients in models that generally lack fit.) The Issued model also shows that the agency speeds cases where the petitioning state agency brings with it a reputation for stringent environmental protection. Last, strong environmental state delegations speed response to crisis exemptions, counter to my expectations.

[Insert Table 3 and Figure 3 about here.]

One advantage of this approach is that it allows the estimation of separate baseline hazards for each of the competing risks. The estimated value of σ shows in the full data suggests a downward-sloping baseline hazard rate – a finding that resembles only that for the Crisis model. As Figure 3 shows, the flexibility in the Weibull parameterization produces clearly divergent baseline hazards for the four subpopulations. The Issued model's baseline is almost flat (exponential), and both the Crisis and Withdrawn models produce upward-sloping baseline hazards.

Table 4 presents the same five models for a subset of the data to address the role of high-quality information in framing the agency's decisions; these data are for only those cases where the IRIS contains RfD information on the chemical, and so the EPA has a numerical characterization of its underlying hazard. Two models again have basic problems: for both Crisis and Withdrawn the Wald test indicates a basic lack of fit. At this point it is important to note that no explanatory model has been developed that sufficiently explains the withdrawal of petitions by the states. The only answer is that the upward-sloping baseline hazard for both Withdrawn models suggests that the states tire of waiting.

In this case, the full data model suggests that the EPA takes longer to process petitions for chemicals with lower RfDs (lower hazards). This result is even more puzzling in the competing risks specification, for the Issued model shows that the EPA takes longer in that case for less-risky chemicals and the Denied model shows that it takes less time in that case for less-risky chemicals. Presumably, the agency, given high-quality information and faced with making a decision, allocates time to those chemicals that have the greatest risk characterization. This means that other, less-risky chemicals become low-priority concerns. However, even though this is the case, the agency approves high-risk chemicals more quickly than low-risk ones, and

disapproves low-risk chemicals more quickly than high-risk ones. Figure 4 shows roughly the same results as Figure 3.

These models are subsets of the models shown in Table 3, so the interpretation of the coefficients for the distributive and political factors is more their effect in the case where the EPA has high-quality technical merits information. I will concentrate on two broad effects. First, the EPA is slower to process cases in the Denied equation when the state's agricultural acreage is high or when farm family penetration is high. This suggests that even though having IRIS information does not generally speed cases for this competing risk, when IRIS information is available the agency continues to balance perhaps-inevitable denials against the strength of the agricultural community in the local area. In other words, the push for national uniformity continues to bump up against the drive for local flexibility even when the agency holds high-quality technical information. This tension is emphasized again in the divergent effect of the state's agency reputation. The EPA moves more slowly when the state agency is reputable in the case of denials, and moves more quickly in the case of issuances.

[Insert Table 4 and Figure 4 about here.]

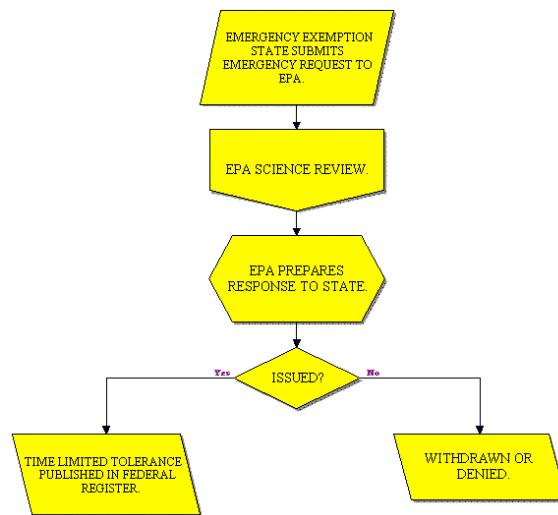
CONCLUSION

The conditional effect of information, distribution, and discretion in policy making is central to a full understanding of the power of bureaucrats to navigate the divide between national uniformity and local flexibility. Having high-quality information allows the agency to allocate time, energy, and attention from one set of problems and to another set. Having low-quality information makes the agency's job as an arbiter of federal-state relations more difficult, not less difficult. Once high-quality information is available, the agency faces the next difficult task of balancing that information against other, competing distributive and political pressures.

This study reveals that uncertainty about technical merits information, the information itself, and these competing distributive and political pressures permeate the agency's task of balancing uniformity and flexibility. Moreover, the effect of each of these factors (information, distribution, and discretion) depends on the available choices to petitioner and respondent.

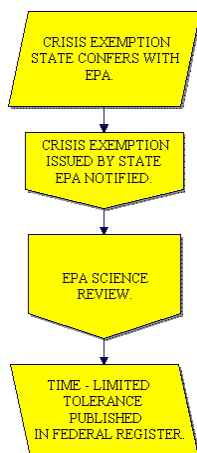
This role for the agency as an agent of representational federalism provides unique and important insights into the diverse motivations and roles of federal agencies when they arbitrate power allocations between state and nation. The agency is a protector of national uniformity and social pluralist outcomes in these allocational decisions, but consistently balances these pressures with those realized by petitioning states and their agencies. The fact that the agency responds to technical merits information in regularized ways may limit concerns of some that agencies become captured by the interests of those with whom they regularly interact. Perhaps more importantly, while the EPA remains responsive to those interests, its choices also depend on how the state-level agencies develop reputations over time. The conditional role of information, distribution, and discretion for one agency is itself conditional on the practice of discretion, based on information and distributive pressures, by other agencies.

Figure 1: FIFRA Section 18 Emergency Exemption Process Overview



(Source: U.S. Environmental Protection Agency, Office of Pesticide Programs)

Figure 2: FIFRA Section 18 Crisis Exemption Process Overview



(Source: U.S. Environmental Protection Agency, Office of Pesticide Programs)

Figure 3: Estimated Weibull Hazard Distributions for Processing Time under Uncertainty for Four Competing Risks

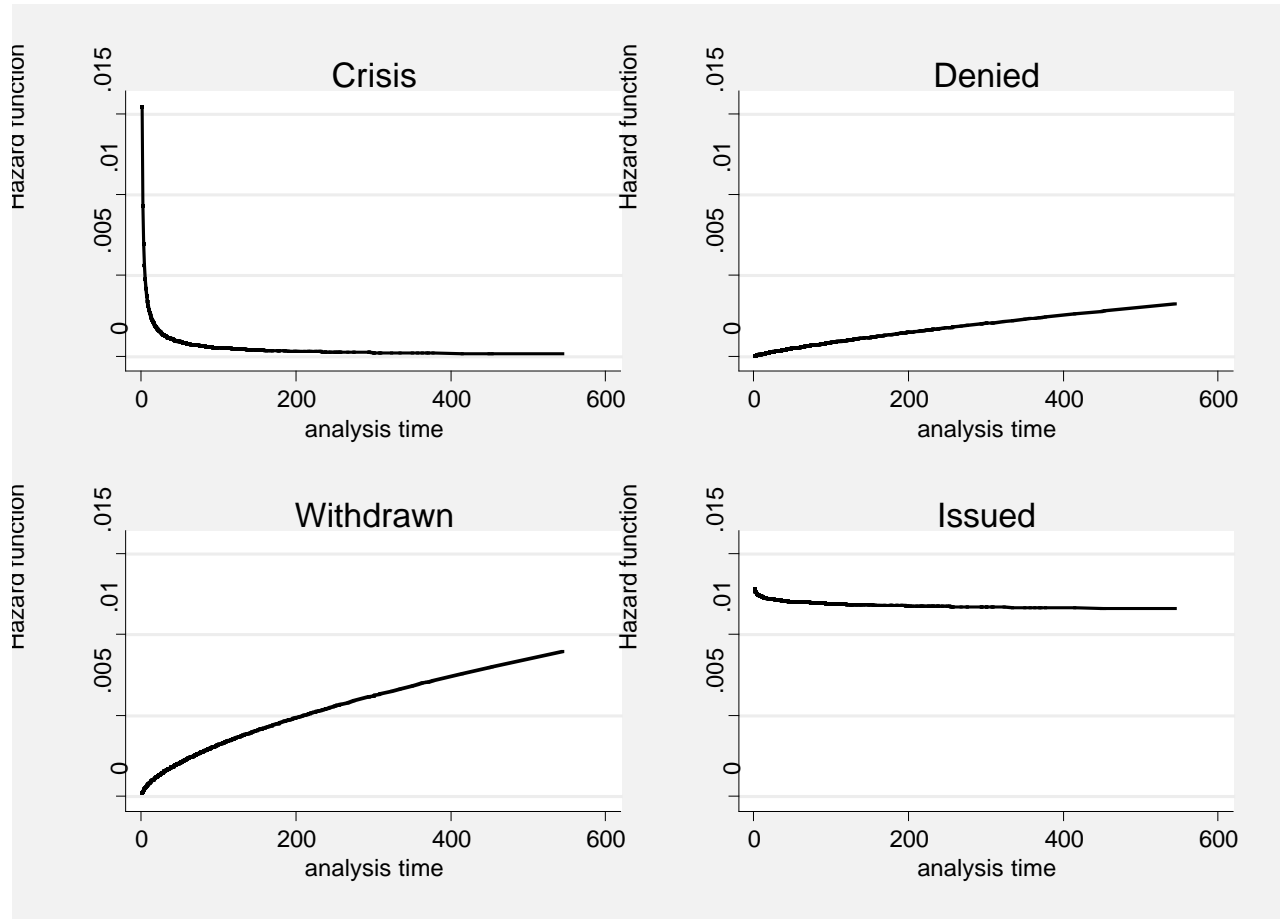


Figure 4: Estimated Weibull Hazard Distributions for Processing Time under High Information for Four Competing Risks

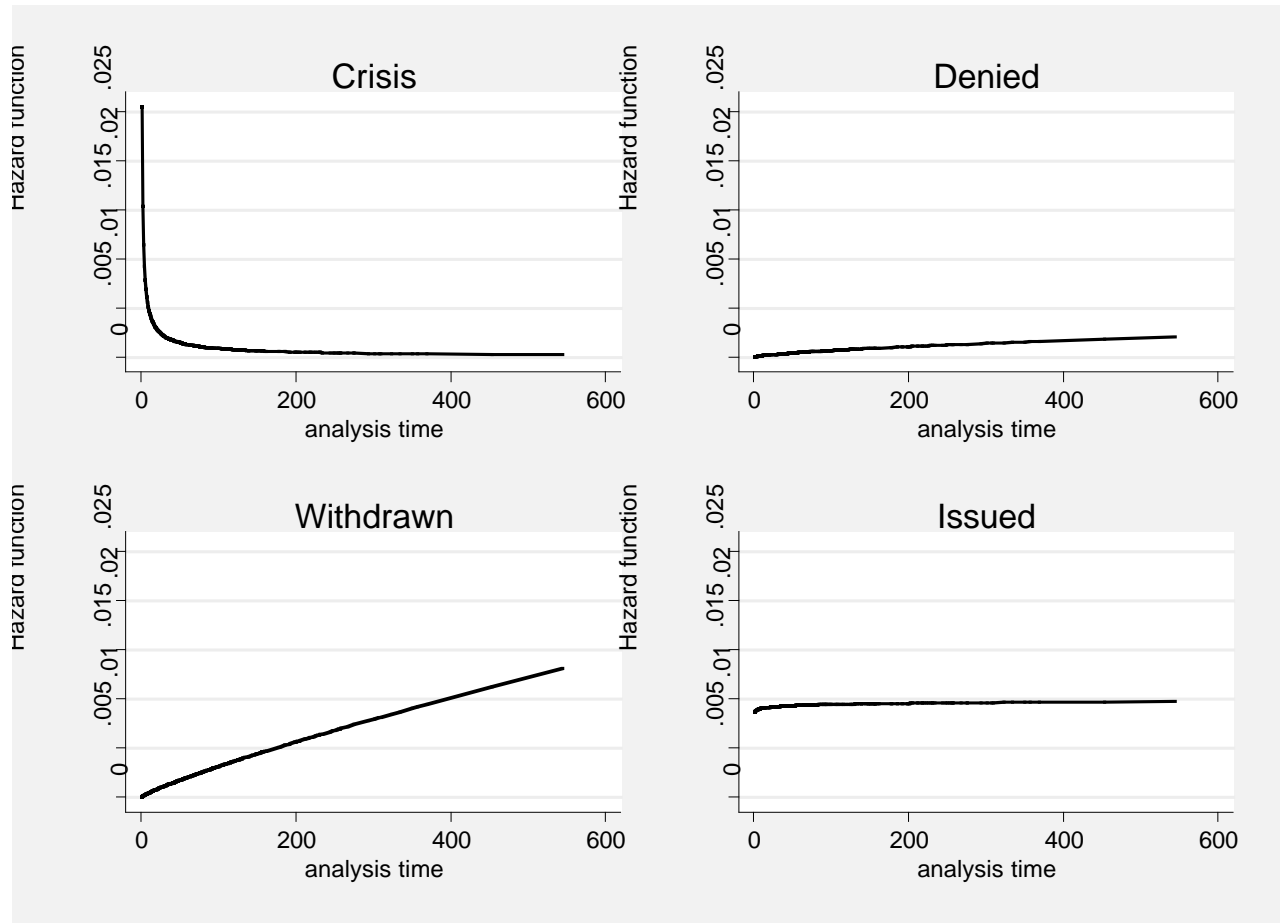


Table 1: Descriptive Statistics

Variable	N	Mean	Std. Dev.	Minimum	Maximum
Processing Time	2088	53.3434	61.3642	1.0000	544.0000
Non-Crisis Processing Time	1758	63.0438	62.1949	1.0000	544.0000
IRIS	2088	0.3611	0.4804	0.0000	1.0000
Ln Oral Reference Dose	754	-3.9898	1.6155	-10.8198	1.0986
Ln Agricultural GSP Percent	2088	0.8052	0.7394	-0.7979	2.3497
Farm Bureau	2088	3.2204	1.2631	0.4603	5.5613
Conservation Groups	2088	8.5857	3.2018	2.4785	20.1591
State Agency Regulation History	2088	5.1542	2.5439	1.0000	10.0000
State Delegation Environmentalism	2088	40.4876	28.6460	0.0000	96.0000

Table 2: Processing Time by Outcome

Outcome	N	Mean	Std. Dev.	Minimum	Maximum
Crisis	330	1.6667	6.8871	1.0000	110.0000
Issued	1356	53.4845	46.8031	1.0000	334.0000
Denied	71	102.2113	60.5609	15.0000	242.0000
Withdrawn	238	117.5924	97.5513	1.0000	453.0000
Science Review Pending	93	32.9247	56.2228	8.0000	544.0000

Table 3: Processing Time under Uncertainty with and without Competing Risks

	Full Data		Crisis		Denied		Withdrawn		Issued	
	β	SE	β	SE	β	SE	β	SE	β	SE
IRIS	0.069	0.057	-2.740	0.425 ***	-0.199	0.143	0.028	0.074	0.367	0.064 ***
Ln Agricultural GSP %	0.062	0.048	-0.832	0.405 **	0.305	0.141 **	0.000	0.073	0.123	0.053 **
Ln Farm Acreage	0.044	0.038	0.166	0.333	-0.132	0.127	-0.064	0.057	0.074	0.045 *
Farm Bureau	0.009	0.032	0.017	0.273	-0.349	0.140 **	-0.021	0.056	0.056	0.032 *
Conservation Groups	0.029	0.013 **	0.163	0.100	-0.026	0.039	0.022	0.018	0.024	0.014 *
State Agency History	0.015	0.012	-0.137	0.101	-0.021	0.037	0.001	0.018	0.030	0.013 **
State Delegation Ideology	0.000	0.001	0.016	0.009 *	-0.002	0.003	-0.001	0.002	-0.001	0.001
Constant	3.199	0.303 ***	9.779	2.666 ***	8.449	1.187 ***	5.874	0.489 ***	3.241	0.318 ***
σ	1.308 ***		3.657 ***		0.562 ***		0.622 ***		1.016	
N	2088		2088		2088		2088		2088	
Number of Failures	1995		330		71		238		1356	
Time at Risk (days)	111381		111381		111381		111381		111381	
Log Pseudo-Likelihood	-3836.3		-1633.1		-248.7		-638.0		-2592.9	
Wald $\chi^2(7)$	21.520 ***		71.640 ***		11.780		8.230		83.690 ***	

*** indicates significance at better than 0.01, ** 0.05, and * 0.10 (two-tailed tests).

Table 4: Processing Time under High Information with and without Competing Risks

	Full Data		Crisis		Denied		Withdrawn		Issued	
	β	SE	β	SE	β	SE	β	SE	β	SE
Ln RfD	-0.060	0.030 **	0.139	0.185	0.146	0.065 **	0.023	0.051	-0.156	0.033 ***
Ln Agricultural GSP %	0.126	0.095	-0.310	0.579	0.336	0.259	-0.040	0.100	0.186	0.103 *
Ln Farm Acreage	0.017	0.084	0.237	0.507	-0.397	0.159 **	-0.053	0.081	0.055	0.097
Farm Bureau	0.071	0.063	0.521	0.321	-0.594	0.315 *	0.014	0.086	0.057	0.059
Conservation Groups	0.029	0.024	0.354	0.124 ***	-0.020	0.072	-0.003	0.028	-0.011	0.024
State Agency History	0.027	0.021	-0.042	0.129	-0.101	0.059 *	0.034	0.027	0.043	0.022 *
State Delegation Ideology	0.002	0.002	0.007	0.013	0.000	0.005	0.001	0.002	0.002	0.002
Constant	2.706	0.614 ***	3.235	3.371	11.822	2.297 ***	5.760	0.609 ***	3.189	0.617 ***
Σ	1.466 ***		3.667 ***		0.608 ***		0.542 ***		0.982	
N	754		754		754		754		754	
Number of Failures	728		181		37		99		411	
Time at Risk (days)	44092		44092		44092		44092		44092	
Log Pseudo-Likelihood	-1477.6		-832.2		-114.1		-217.6		-806.2	
Wald $\chi^2(7)$	18.310 **		11.810		24.700 ***		7.070		41.41 ***	

*** indicates significance at better than 0.01, ** 0.05, and * 0.10 (two-tailed tests).

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