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Trade-offs in a Tempest: Stakeholder Influence on Hurricane Evacuation Decisions

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Stakeholders often control vital resources for decision makers, and this can lead decision makers to take stakeholder opinions into account when making important decisions. This process can be complicated by a number of factors. First, many important decisions involve risk and uncertainty. When the outcome is uncertain, how does a decision maker take the views of stakeholders into account? Second, many decision makers are accountable to multiple different stakeholder groups with different preferences. How do these heterogeneous stakeholder groups affect the process of decision making? More generally, do these stakeholder considerations lead to decisions that are not socially optimal?

We explore these and related questions by focusing on a specific type of high-stakes decision making in a context featuring significant risk and heterogeneous stakeholders—the decision to evacuate a community during the threat of a hurricane hitting land. There is research on weather forecasting techniques and individual evacuation behavior; however, there is no research on the behavior of local officials in making hurricane evacuation decisions. These decisions provide an excellent context for an exploration into the specific processes by which stakeholder considerations may affect the process of decision making.

This study offers a simple model of the process underlying evacuation decision making. The model focuses on how the evacuation threshold is set based on the anticipated costs of Type I versus Type II errors. We then use the model—supplemented with rich qualitative and quantitative data—to offer a series of propositions about the conditions under which nonsocially optimal evacuation decisions may be made. This paper contributes to the literature on decision making by offering a simple model that integrates decision making and stakeholder considerations and by offering specific and novel propositions about this integration.

Keywords: decision making; uncertainty; stakeholders; politics; hurricane evacuations
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1. Introduction

Decision making is a central aspect of organizational life (Simon 1947, March and Simon 1958), and scholars from a variety of disciplines have investigated the decision-making process. Most work on decision making has focused on one of two approaches—investigating heuristics and preferences at the individual level or investigating the role of group and aggregation processes in multiactor scenarios. The former includes classic work on biases (e.g., Tversky and Kahneman 1974) and risk taking (e.g., March and Shapira 1987); the latter includes work on the aggregation of biases (e.g., Kerr et al. 1996), groupthink (e.g., Janis 1972), and aggregation mechanisms (e.g., Hastie and Kameda 2005).

A significant but less studied complication in real-world decision making is that the decision maker is forced to make trade-offs that weigh the interests of one stakeholder group versus those of others. This may be true of external stakeholders, including communities and governments, and of internal stakeholders, including different divisions or geographic locations. For example, as part of the Carnegie tradition's work on decision making, Cyert and March (1963) note that decision making is affected by conflicting interests within the organization. Although research has examined the role of politics and stakeholder pressures (primarily in terms of organizational identity) in organizational adaptation (Tripsas 2009) and learning (Kogut and Zander 1996), the decision-making literature is largely silent on how stakeholder pressures influence the decision-making process. Gavetti et al. (2007) highlight this gap, citing political pressures as a missing pillar of recent work in the Carnegie tradition, especially as they relate to decision making. Similarly, Reynolds et al. (2006, p. 285) open their study on ethics in decision making with the statement that "stakeholder theory is widely recognized as a management theory, yet very little research has considered its implications for individual managerial decision making." Classic literature on decision making in political science highlights the role that power and politics

play in decision-making processes (see Eisenhardt and Zbaracki 1992, for a review), but it has largely focused on politics between different decision makers and has taken the heterogeneous preferences of decision makers as given while ignoring the stakeholders that likely drive much of this heterogeneity. Literatures on stakeholder management and managerial accountability have discussed the idea that managers might take the preferences of stakeholders into account (Lerner and Tetlock 1999), but the mechanisms of these effects are underdeveloped. Meanwhile, the broader literature on stakeholders does not typically consider behavioral factors affecting decision making. In fact, a recent view of the "state of the art" in stakeholder research by notable experts in the field (Freeman et al. 2010) contained only a single reference to decision making, stating that the decision-making process should be clear to stakeholders so that they can decide where to be involved (pp. 188–189).

We seek to deepen the field's understanding of the process linking decision making and stakeholders from both an individual perspective and a multiactor perspective. We investigate how stakeholder influence affects decision making by focusing on the context of hurricane evacuation orders. Hurricane Katrina, which devastated New Orleans in 2005, illustrates both the complexity of hurricane evacuation decision making and the role of stakeholder influence. The predicted strength of Katrina at landfall was uncertain, as it dropped to a tropical storm categorization after brushing Florida before strengthening to category 5 before landfall. The trajectory was also uncertain, with the storm first headed toward the Florida panhandle, then toward Mississippi, before finally turning toward New Orleans. Additionally, because of the time needed to evacuate a city such as New Orleans, decisions on evacuation must be made 72 hours before landfall. New Orleans Mayor Ray Nagin had multiple stakeholders providing input to his decision-making process. President George W. Bush and Louisiana Governor Kathleen Blanco both urged evacuation, as did the director of the National Hurricane Center (NHC). Nagin's staff members also had their own opinions that they conveyed to him, as did elected officials in nearby regions. Local residents and businesses were frustrated by an unnecessary evacuation from Hurricane Ivan in late 2004, and the costs of unnecessary evacuations (financially and politically) were significant enough that Nagin was concerned about the government's legal liability from another false evacuation (Nolan 2005). Nagin eventually ordered a mandatory evacuation, but it was made less than 24 hours before Katrina's landfall, and many residents did not prepare amply. This example illustrates the complexity of the decision and also the multiplicity of stakeholders with vested interests.

Hurricane evacuation decision making is an appealing context for understanding the influence of stakeholders on individual and multiactor decision making because the significant uncertainty and high stakes create opportunities for costly mistakes that attract stakeholder attention. Stakeholders include elected and appointed officials, local businesses, and individual citizens. Based on our initial study, we identify that the cost of errors—and the stakeholders that differentially bear those costs and could withhold resources—is vital to understanding how stakeholder opinions matter to decision makers. We use this perspective to offer a simple model demonstrating how the action threshold—the point past which the decision maker will order an evacuation—depends on the costs of the potential mistakes, both Type I and Type II.

Building from this systematic understanding of the costs of mistakes and stakeholder influence, we offer a series of specific propositions about hurricane evacuation decision making that are grounded in our model and that focus on the role of errors. We focus on these propositions because each emphasizes that stakeholders bear the costs of errors and because each offers a novel perspective—a completely new proposition, new and different boundary conditions for existing expectations, or a different mechanism for known behavior—contrary to the existing literature on decision making. These include propositions about (i) how stakeholder salience changes over time, depending on the stakeholders' means of exerting influence; (ii) whether decision makers may imitate others to provide political "cover" for potential mistakes; and (iii) whether political concerns may make overriding decisions especially difficult. Where available, anecdotal qualitative and quantitative data illustrate the propositions. We analyze decisions that are made in organizational contexts where incentives play a stronger role than in decisions that are studied in laboratory settings. The decisions we study are also embedded in a political context and are made along a temporal dimension. Together, our simple and flexible model, combined with the novel propositions, offers a starting point to reintegrate politics and stakeholders into the *behavioral theory of the firm* (Cyert and March 1963), where politics was seen as important originally, but most subsequent work has either focused on internal politics or ignored politics altogether (Argote and Greve 2007, Gavetti et al. 2007).

2. Hurricane Risk Management

Making evacuation decisions in the face of approaching hurricanes is especially complex. Despite technological advances, there is still an irreducible level of uncertainty. Despite the repeated nature of hurricanes, different hurricanes in different locations require different responses. Despite efforts to minimize the cost of any given decision, the effective costs of mistakes—in terms of unnecessary evacuations or unpredicted direct hits—are enormous. And despite the fact that the ultimate

decision often rests with a single person, there are many stakeholders that are passively or actively involved. This section provides background on hurricane evacuations.

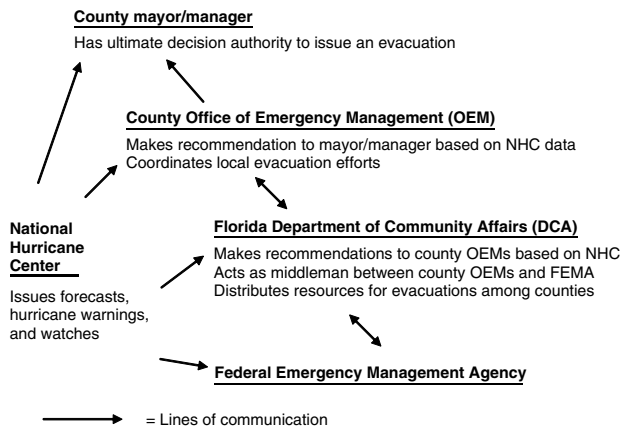
2.1. The Evacuation Decision-Making Process

The process of deciding whether to issue an evacuation involves many parties. One primary party is the NHC, which issues forecasts on the projected path and intensity, as well as hurricane watches and warnings for threatened counties. In Florida, the Department of Community Affairs (DCA) acts as a middleman between the Federal Emergency Management Agency (FEMA) and state counties. The DCA is responsible for providing a recommendation to counties regarding evacuations. It holds conference calls with county representatives throughout the progression of the storm and gathers information on what each county is doing about the storm and what resources are needed. The DCA allocates resources across counties before, during, and after a storm. At the county level, most of the decision-making analysis occurs at the Office of Emergency Management (OEM). Staff at the OEM sift through information provided by the NHC and recommend whether to evacuate and when to begin evacuation procedures. Although the OEM staff and director make a recommendation, the mayor or county manager (we use these terms, as well as "decision maker," interchangeably) has the sole authority and responsibility to issue an evacuation. Major players and their interactions are summarized in Figure 1.

2.2. The Complexity of Evacuation Decision Making

Deciding to issue an evacuation grows more complicated every year with continued population growth in the coastal regions prone to hurricane activity. Between 1980 and 2004, 38 hurricanes hit the United States (13 categorized as major hurricanes, i.e., category 3, 4, or 5), with the majority making landfall in the southeastern United States (Blake et al. 2005). Of the 10 costliest hurricane hits during that period, 8 hit the southeast (5 in Florida alone), causing an estimated total of $86.7 billion in damages. Meanwhile, during that same period Florida's population increased by more than 75%, from just under 10 million to more than 17 million (Smith and Cody 2010).

Figure 1 Personnel and Agencies Involved in the Evacuation Decision, Including Lines of Communication



A key complication is *clearance time*, or the amount of time needed to evacuate a community before the storm arrives. Clearance time increases with population, topping 48 hours in metropolitan areas and 84 hours in Miami. Hence, evacuation decisions are often made prior to an official NHC hurricane warning (typically issued 48 hours in advance) based on extremely unreliable forecasts. In 2010 the margin of error for a 72-hour forecast was about 125 miles in either direction (Berger 2010). Additionally, this unpredictability in both path and intensity is strongest for storms on the Gulf Coast (Wilkens 1995). This was evident in August 2005 when Hurricane Charley was predicted to hit land near Tampa but turned east as it intensified. Although much of Tampa was evacuated, the storm hit land farther south, near Fort Myers; residents who had not evacuated were caught off guard and were enraged. Technological investment has increased prediction accuracy for forecasting storms by about 1% each year since 1970 (Goldenberg et al. 2001), though predictions of hurricane intensity have not improved between 1990 (average three-day error of 20 miles per hour (mph)) and 2010 (average three-day error of 21 mph) (Berger 2010). Thus, only very near-term forecasts have a high degree of accuracy but do not offer enough time for an evacuation (Regnier and Haar 2006), and making decisions based on early forecasts requires accepting greater forecast error.

2.3. The Outcomes of Evacuation Decision Making

Since hurricane evacuation decisions are made using less-than-perfect forecasts, some evacuations may be made "needlessly," an event we label a *false alarm*. At the same time, a community may be hit by a storm but not evacuate in time, resulting in an *unpredicted hit*. Both events can be viewed as "mistakes"—even if the decision was probabilistically correct—particularly by constituents who feel they have been inconvenienced (monetarily or otherwise), since the decision as to whether to evacuate or not does not correspond to the eventual landfall of the storm.

Each mistake type has an associated cost. The costs of a false alarm include expenditures for personnel to staff shelters, extra emergency staffing (e.g., police, fire), and transportation of citizens to shelters. Additionally, indirect costs include lost business and tourism revenues. The NHC estimates the total cost to evacuate one mile of coastline at approximately $1 million (Massey 2002), reaching $50 million per mile depending on the types of businesses (McQuaid and Schleifstein 2002). Thus, despite the natural tendency of county managers

to be conservative (evacuate to minimize loss of life), the rising costs of unnecessary evacuations have made county managers carefully weigh the inherent trade-offs (Lindell and Prater 2007). This has been amplified by a growing trend of angry business owners questioning the decision of authorities and demanding compensation for the lost business in the case of false alarms (e.g., Schultz 2006).

For an unpredicted hit, costs include the loss of human life and damages to infrastructure and homes not adequately secured. Although lives may be lost even in an evacuation, the loss would no doubt be greater without an evacuation. The late decision to evacuate New Orleans as Hurricane Katrina approached could be considered an unpredicted hit, since the evacuation was inadequate to minimize risk to inhabitants.

As one county manager explained, the responsibility for issuing evacuation orders is not for someone who dislikes ambiguity or who lacks confidence in his or her decisions (Smith 2002). Our model in §3 begins to formalize how this decision is made, given the complexities mentioned above.

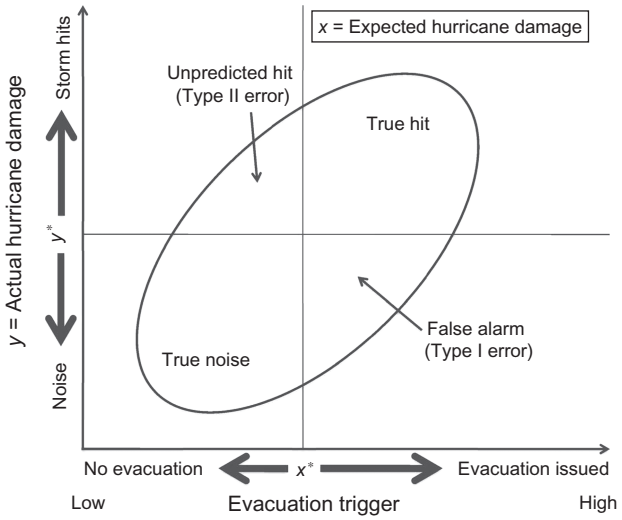
3. A Model of the Decision Maker's Dilemma

To investigate the effect of stakeholder pressures in hurricane evacuation decision making, we construct a simple model of inputs, choices, outcomes, and updating. The model identifies how stakeholder pressures may produce nonsocially optimal outcomes. For the individual decision maker, personal reliance on stakeholder support affects both choices of trade-offs and how those trade-offs update based on experience. Such considerations may be optimal for the decision maker without being socially optimal.

3.1. Action–Outcome Combinations in the Model

We model the dilemma in terms of Type I and Type II errors, a traditional view of decision trade-offs. The core idea is derived from signal detection theory (SDT) (Green and Swets 1966), which has been used to illustrate risk analysis problems between buyers and sellers (Lampel and Shapira 2001) and failures in due diligence (Puranam et al. 2006). In essence, the decision maker faces the possibility of committing one of two errors, both costly. We focus on SDT for three reasons. First, SDT includes both judgments and outcomes, and it is useful for considering both the probability of an event and the severity of the event (versus probabilities alone). Second, SDT is especially useful for framing the trade-off between Type I errors (commission errors or false alarms) and Type II errors (omission errors or unpredicted hurricane hits). The job of the decision maker is to balance these two errors, and SDT focuses on this trade-off. Third, as we focus not just on individuals but also on entire decision-making systems, SDT applies well to organizational decision making (Einhorn and Hogarth 1978, Sorkin et al. 2001). The consequences associated with the evacuation decision are described in Figure 2.

Figure 2 The Relations Between Severity of Signal, Threshold Level, and Storm Damage



Initially, the decision about whether to evacuate is made by comparing the decision maker's evaluation of the threat (x) to the county-specific evacuation threshold (x^*). If $x \geq x^*$, then an evacuation is issued. The hurricane threat (x) includes factors such as the strength and path of the hurricane and the accuracy of hurricane forecasting technology; x^* includes evacuation costs and population density (see §3.2 for more). After the decision is made, success is determined primarily by whether the storm hits land and causes damage in the particular community, which may or may not have been evacuated. A critical level y^* is set as a benchmark against which damage is measured.[1] If the ex post damage is greater than y^*, an evacuation decision is considered necessary. It is classified as a failure if $y \leq y^*$, that is, if it becomes clear ex post that evacuation was unnecessary. The predictive validity of the evaluation criteria used in making the evacuation decision is described by the correlation coefficient r_{xy}. The higher the correlation, the thinner the ellipsoid in Figure 2.

We encounter four possible action–outcome combinations as a result of a decision. If an evacuation is ordered (i.e., $x \geq x^*$), it can eventually be deemed either necessary ($y > y^*$) or unnecessary ($y \leq y^*$). The first is a "true hit," and the second is a false alarm. If an evacuation has not been made (i.e., $x < x^*$), the two possibilities are an unpredicted hit if an evacuation would have saved lives and "true noise" if an evacuation would have been unnecessary.

3.2. Origin of the Evacuation Threshold (x^*)

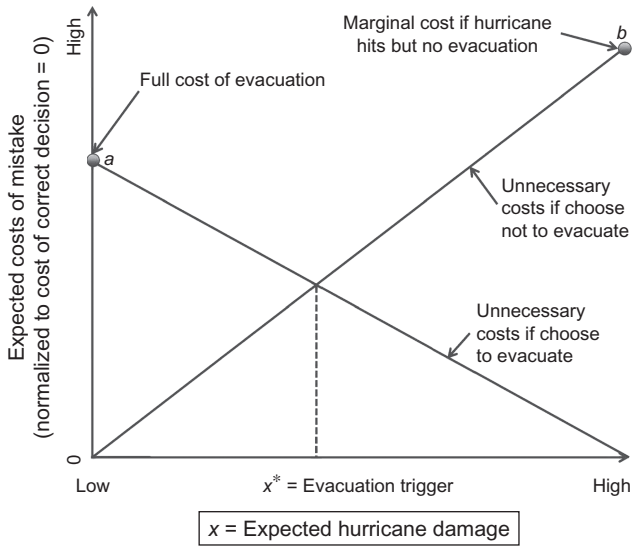
The decision maker determines the county-specific evacuation threshold (x^*) based on input from other

parties (§2). The derivation of x^* is intuitive but complex. In essence, the threshold derives from the point where the decision maker is indifferent between evacuating or not—if the perceived hurricane threat is above that indifference point, an evacuation will be called. This indifference point can be thought of as the point where the costs of making each type of mistake (a false alarm or unpredicted hit) are equal.[2] Figure 3 captures the costs of these mistakes. In the figure, the horizontal axis is the same range of x as in Figure 2, and the vertical axis depicts the unnecessary costs generated by a decision to evacuate or not, which we label as "Expected costs of a mistake," as the axis denotes the cost times the probability of incurring the cost needlessly.

Figure 3 features two curves. The downward sloping curve captures the cost of a Type I error (false alarm). At the lowest level of x (where the hurricane poses no threat), the unnecessary cost is a, which is the full cost of evacuation for the community (police and rescue costs, lost business revenues, shelter costs, etc.). Much of a is based on population size and transportation availability. Other important factors include local businesses that depend on tourism. Also included in a is the potential for loss of life *during* the evacuation process, such as when 35 people died during Houston's evacuation for Hurricane Rita (Ackerman and Markley 2005). As noted, as the population in hurricane-prone areas increases, the costs of unnecessary evacuations increase. At the right of Figure 3, there is a point where this curve meets the x axis and the unnecessary cost of evacuation goes to zero, as it is clearly necessary to evacuate in the face of such a threatening hurricane.

The second curve in Figure 3 slopes upward to the right and captures the cost of a Type II error—the cost of an unpredicted hit. At low levels of x, where the hurricane is not a threat, there is very little cost in not evacuating, but as the expected storm severity increases, the costs of not evacuating rise. These costs are driven by human elements (mortality, injury, trauma, etc.), behavioral factors (the reduced likelihood that residents will take necessary precautions), and liability factors.[3] These costs rise to a maximum level of b, the cost of total devastation if the community is not evacuated in the face of an exceptionally dangerous storm.[4]

Figure 3 The Process for Setting the Evacuation Threshold



At the intersection of these two curves is an indifference point—the point at which the decision maker is indifferent between issuing an evacuation or not, considering the potential costs of being wrong. This point is the source of x^*, the evacuation threshold. Thus, Figure 3 suggests that x^* depends on two factors, such that $x^* = f(a, b)$, where a is the full cost of evacuation and b is the maximum theoretical cost of not evacuating. We have discussed the aspects of the costs (a and b) that are borne by the general public. The goal of this paper, however, is to understand how stakeholders affect those costs as perceived by the decision maker to alter the decision from being only about risk of life and evacuation costs to include the potential risk to the decision maker's political future and the preferences of different stakeholder groups, as we discuss in §4.

4. Stakeholders and Hurricane Evacuation Decision Making

In this section we use our model of threshold setting (see Figure 3) introduced in §3.2 to describe how stakeholders actively and passively (by having expected concerns considered) affect hurricane evacuation decision making. Each proposition not only builds on prior research on decision making and stakeholders but also shows a perspective filtered through our model emphasizing the costs of Type I and Type II errors that analyzes how stakeholder pressure affects decision making in a setting of significant uncertainty. Where available, we offer data (qualitative and quantitative) to illustrate the proposition. We also state each proposition twice—first as it specifically applies to hurricanes and second as it relates to broader theory on decision making.

Our quantitative data cover eight storms making landfall in Florida during 2004–2005 and document landfall outcomes and evacuation decisions for 67 coastal Florida counties. Following the NHC, we classified a county as threatened if there was a 10% or higher cumulative chance that the center of the storm would come within 65 nautical miles of the county over the three days before a storm hit land. We consider a storm to have hit a county if the wind speed for any part of the county reached 70 mph (a proxy for damage; hurricane force winds are those above 74 mph). Thus, a county is considered to have suffered a false alarm if people were evacuated and local wind speeds never rose higher than 70 mph. The data are reported in Table 1.

Table 1 Classification of Florida Counties Threatened by Each Hurricane for 2004 and 2005

Hurricane	No evacuation	Evacuation	No evacuation (%)	Evacuation (%)
		2004 hurricanes		
Charley, 8/9–8/15				
Storm hits	5	8	12.5	20
Storm does not hit	15	12	37.5	30
Frances, 8/24–9/10				
Storm hits	2	13	4.4	28.9
Storm does not hit	23	7	51.1	15.6
Ivan, 9/2–9/24				
Storm hits	0	4	0	23.5
Storm does not hit	4	9	23.5	53
Jeanne, 9/13–9/28				
Storm hits	5	18	10.4	37.5
Storm does not hit	10	15	20.8	31.3
		2005 hurricanes		
Dennis, 7/4–7/13				
Storm hits	0	8	0	26.7
Storm does not hit	8	14	26.7	46.7
Katrina, 8/23–8/30[a]				
Storm hits	1	1	2.9	2.9
Storm does not hit	31	2	88.6	5.7
Rita, 9/18–9/26				
Storm hits	0	1	0	25
Storm does not hit	0	3	0	75
Wilma, 10/15–10/26				
Storm hits	4	10	13.9	34.5
Storm does not hit	10	5	34.5	17.2

[a]Katrina's data are for the landfall in south Florida on August 25, 2005, not the landfall in New Orleans.

4.1. Stakeholders and Individual Decision Making

Prior research suggests that managers consider stakeholder perspectives when making decisions (Greening and Gray 1994, Berman et al. 1999). Building on this literature, we suggest that decision makers may be conscious of how stakeholders (including local businesses and individual constituents) will judge the appropriateness of their actions. This awareness of stakeholder considerations creates political costs that are added to the actual costs of Type I and Type II errors, effectively increasing a and/or b in Figure 3. Note that these costs are felt by the decision maker alone and do not reflect societal costs; they thus represent a resource dependence argument where actors rely on others for key resources, deferring to their preferences (Thompson 1967, Pfeffer and Salancik 1978). In the case of hurricane evacuation decision making, mayors and county managers depend on stakeholders for reelection votes (individuals) and campaign contributions (individuals and businesses). Thus, stakeholders can be seen as creating a filter through which information about the environment (i.e., the hurricane and the needs of the community) is perceived by county managers (Boyd et al. 1993).

4.1.1. Outcome Bias and Worst-Case Scenarios. *Outcome bias* refers to the likelihood that ex post evaluations by stakeholders judging a decision will be based on actual outcomes and not on whether the choice was right given pre-event conditions (Baron and Hershey 1988). Ex post evaluators have been shown to rate the decision-making process as better if it comes to the correct decision in the context of uncertainty (Kamin and Rachlinski 1995). Two hurricane-related examples demonstrate outcome bias. Our first example occurred during the 1998 hurricane season, when Monroe County Emergency Manager Billy Wagner issued an evacuation of the Florida Keys for Hurricane Georges, even though the storm was three days and 1,000 miles away—the earliest evacuation ever issued. When Max Mayfield, director of the NHC, heard about Wagner's action, he said, "I hope you don't lose your job" from issuing the evacuation (Hampson 2001). The storm ended up having a direct hit on Key West and, ex post, Wagner was viewed as making the best decision. As our second example, one director of emergency management from Chatham County, Georgia, was fired two years after evacuating the county for Hurricane Bertha. County commissioners claimed the evacuation was unnecessary since the storm hardly affected Georgia, and the evacuation caused much economic loss (Hampson 2001). These examples demonstrate how the evaluation of the decision may be made based on outcomes, so that a lucky guess (in either direction) may be rewarded more than a sound judgment.

Outcome bias is important to the extent that it affects ex ante decision making, as decision makers consider how stakeholders will evaluate them (Baron and Hershey 1988). We suggest that consideration of ex post stakeholder evaluation is likely to make the decision maker fixate on the worst-case scenarios in extreme conditions. Many officials have shown a public concern with worst-case scenarios, especially after experiencing the devastation such as from Hurricane Andrew in 1992. As one official in Pinellas County (west of Tampa) stated, "If there is an error to be made, I would much rather be talking to someone who is mad because we told them to leave than to a widow we didn't tell to leave and [her] house is 40 miles out in the ocean" (Gilpin and Shaw 1998, p. 1). Such a focus on outcomes (and not on the process of decision making) may lead decision makers to be more proactive in defending their judgments to those to whom they are accountable (Simonson and Staw 1992). For more dangerous hurricanes, the potential costs of an unpredicted hit may be seen as most salient, and decision makers may be more likely to lower their evacuation threshold and evacuate even if the hurricane is highly unlikely to hit. By contrast, for weaker hurricanes, the expectation may be that any evacuation or pre-storm preparation may be too costly, as the storm is unlikely to cause significant damage. This may in part explain why Vermont was unprepared for Hurricane Irene in 2011, as the storm had been downgraded long before reaching Vermont but was nearly guaranteed to hit the region, which suffered massive flood damage. Earlier, Governor Tom Corbett of Pennsylvania expressed concern that residents would let their guard down based on the downgrading of Hurricane Irene's strength (Murphy 2011).

This perspective—that decision makers may fixate on the worst-case scenarios of severe (but unlikely), unpredicted hits and needless evacuation costs—suggests that decision makers charged with allocating resources to avoid disasters will see as salient the costs of both Type I and Type II errors. Interestingly, this contrasts with how the costs of errors may be perceived in cases where decisions may result in net positive benefits (such as accepting or rejecting potential projects or considering investments). When investing in strategic projects, Type I (false-positive) errors may produce swift and obvious feedback. Type II (false-negative) errors, however, may only produce feedback if competitors visibly accept a similar project that carries obvious competitive implications. Thus, in cases where decision makers are assessing whether to accept projects that they hope will be beneficial for the organization, we might expect only the costs of false positives to be considered as a worst-case scenario, which might bias decision making toward minimizing false positives. By contrast, in our context, the presence of stakeholders who bear significant costs for *both* types of errors may lead decision makers to focus on two different worst-case scenarios (the chances of devastation for a highly unlikely but strong storm and the chances of stakeholder outrage over an unnecessary evacuation for a weak storm) more than on the classic "expected value" of probability times expected damage. Such consideration is likely to subjectively increase the worst-case costs of Type I and Type II errors (*a* and *b* in Figure 3).

Proposition 1 (P1). *Stronger storms will produce an increase in the number of false alarms, whereas weaker storms will result in an increase in the number of unpredicted hits. In general, the presence and interests of cost-bearing stakeholders provide immediate and salient feedback on errors, which leads decision makers to consider the costs of errors for which there typically is limited postdecision feedback* (*namely, Type* II *errors*).

In line with Proposition 1, Table 2 shows the occurrence rate for false alarms and unpredicted hits (Type I and Type II errors) for the four strongest versus the four weakest hurricanes (assessed by wind speed at landfall). The data suggest that false alarms were nearly twice as prevalent during stronger versus weaker storms, whereas the occurrence of unpredicted hits was approximately 50% higher during weaker storms.

4.1.2. Prior Errors and Increasing Costs. For a county manager, prior errors may alter the costs of future errors. For example, in 1999, two early storms threatened south Florida (Hurricane Floyd and Tropical Storm Harvey). Evacuations and school closings were issued for both Miami-Dade and Broward counties, but neither storm hit the area. The media pay significant attention to stories of money lost through needless evacuations, giving the issue more prominence in the manager's mind (Deephouse and Heugens 2009) and increasing the legitimacy of claims from unhappy business owners (Julian et al. 2008). The result is that decision makers who have upset a powerful stakeholder group through past actions that have (ex post) been deemed unnecessary are likely to accommodate the desires of that group when making future decisions. About a month after Floyd had missed Florida, Hurricane Irene was brewing off the Gulf Coast. After two unnecessary evacuations, local officials were reluctant to issue another. The decision came down to politics; officials felt that they could not politically afford to issue a third "unnecessary" evacuation, and therefore no evacuations were issued. However, as "luck" would have it, the storm went

Table 2 Prediction Errors by Storm Size (Florida, 2004–2005)

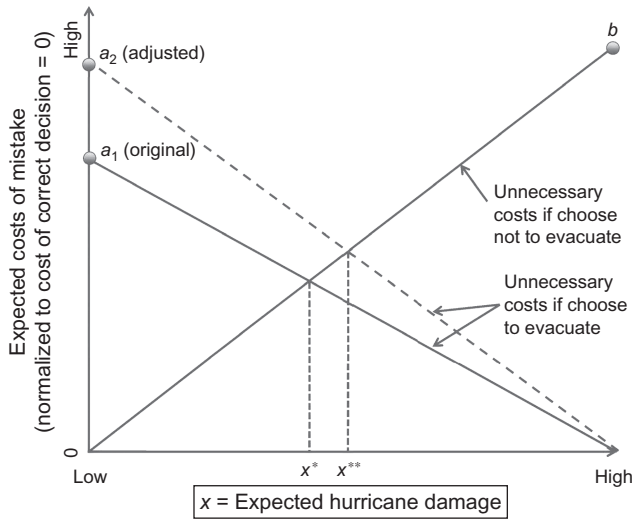
	False alarms (%)	Unpredicted hits (%)
Four strongest storms	43	4.2
Four weakest storms	25	6.8

right over Miami-Dade and Broward counties. Many citizens were in disbelief that no evacuations were issued (Norcross 2002).

Miami's experience with Floyd, Harvey, and Irene is an example of how previous errors can lead county managers to increase their evacuation threshold, resulting in a higher chance of unpredicted land hits. Political considerations can be considered as additional costs that increase a for the next decision, the cost of a false alarm. The impact of this change on the threshold (x^*) can be seen in Figure 4. In this figure, the original evacuation cost level (a_1) is increased to a_2 after multiple previous false alarms. This shifts the cost curve for Type I (false-positive) errors upward, which shifts the evacuation threshold upward from x^* to x^{**}. Transferring this new threshold back to Figure 2, it is apparent that the increased threshold results in fewer false alarms but an increased risk of unpredicted hits. Thus, decision makers perceive a rise in the costs of making the same type of error repeatedly, producing a threshold adjustment that reduces the risk of making that error again while increasing the risk of the opposite type of error. In typical models of decision making and uncertainty, decision makers may overcompensate for errors initially, as they have little information, but then develop more confidence in their estimates over time. We suggest that decision makers may still appear to overcompensate for errors even if they feel confident in the socially optimal approach—specifically to avoid political fallout for repeating the same error and limit their own personal liability.

Proposition 2 (P2). *Previous evacuation decisions that resulted in errors* (*either false alarms or unpredicted hits*) *lead to reductions in the same error but increases in the opposite type of error. In general, as stakeholders penalize decision makers more for making the same type of error repeatedly than for making different types of errors, decision makers will respond to one type of error by trying to minimize the chances of that error occurring again.*

Figure 4 Raising the Threshold for Evacuation Trigger by Increasing Evacuation Costs



Our data illustrate this proposition, though only for false alarms leading to unpredicted hits.[5] Table 3 reports the results of a logistic regression showing that the likelihood of an unpredicted hit increases when the prior storm that threatened the county resulted in a false alarm. The model uses standard errors clustered at the level of the county and includes dummies for each storm in the data. The results show that a false alarm for one storm increases the likelihood of an unpredicted hit for the next storm by more than 400% ($p < 0.01$). These results are consistent with Proposition 2, suggesting that false alarms may force managers to raise their threshold, thus exposing them to greater risk of unpredicted hits.

4.1.3. Stakeholder Salience and Timing. Decision makers may face different stakeholders with conflicting perspectives, raising the question of how conflicting preferences are reconciled. In the following propositions, we present two complementary views of reconciliation in the context of hurricane evacuation.

First, disagreements in stakeholder opinions are more likely to the extent that different stakeholders differentially bear the costs of Type I versus Type II errors. For hurricane evacuations, false alarms are more costly for businesses than the general public. False alarms force businesses to close unnecessarily and may have reputational implications for perceived riskiness (for potential business partners or insurance companies). For example, the 2011 New Jersey coastal evacuations for Hurricane Irene cost Atlantic City casinos up to an estimated $45 million in lost gaming revenue for a one-weekend closure (Parry 2011). The unnecessary evacuation of Miami in the face of Hurricane Floyd in 1999 resulted in an estimate of over $2 billion in cost, largely driven by lost business revenue for the evacuation of more than 2 million people (Schleifstein and McQuaid 2002). The financial implications of a false alarm for individual

Table 3 Impact of False Alarms on Subsequent Unpredicted Hits (Florida, 2004–2005)

	Model 1	Model 2	Model 3
False alarm ($t-1$)		4.192**	4.190*
		(2.333)	(2.560)
Storm dummies	Included	Included	Included
Random effects			County
N (observations)	153	153	153
Pseudo-R^2	0.037	0.094	Na

Notes. Coefficients are odds ratios; standard errors appear below coefficients, clustered by county. The dependent variable equals 1 if the storm is an unpredicted hit and 0 otherwise (logit model).
*$p < 0.05$; **$p < 0.01$.

residents are painful but less costly. By contrast, unpredicted hits present huge costs for both businesses and individuals but are likely to disproportionately present risks for individual citizens. Many homes lack proper safety mechanisms and many homeowners lack adequate insurance, yet many areas prone to flooding from hurricanes are residential areas. Examples include parts of New Orleans (Mid-City and the Lower Ninth Ward are both below sea level), the coastal areas of North Carolina's Outer Banks, and Staten Island in New York. For residents in these areas, the costs of an unpredicted hurricane hit—in terms of loss of life, as well as property not adequately secured—may be catastrophic.

The degree to which a manager's cognitive frame takes into account the perspective of a stakeholder group is related to the power and legitimacy that the group has with respect to the manager (Agle et al. 1999), the extent to which these stakeholders may withhold key resources if their perspective is not accommodated (Frooman 1999), and the degree to which their demands fit the manager's existing cognitive frame (Bundy et al. 2013). We therefore expect that public officials with different dependencies on businesses versus community groups may adjust their evacuation threshold to accommodate priorities of these groups.

In the Florida Keys, heavy financial losses from false alarms made local residents resist evacuation orders, since they made tourists leave and led to economic losses (Morgan and Johnson 2009). Brinkley (2006) reports that even after the Louisiana governor declared a state of emergency, Mayor Nagin said that he "needed to talk with his lawyers about what his options were" (p. 20) for alternative levels of evacuation in the face of Hurricane Katrina. And Brinkley (2006) adds that "on Saturday afternoon, Nagin endangered the welfare of the poor and the elderly as well as the tourists—and in the end, the city—by holding legal discussions about the impact of an evacuation on the hotel trade" (p. 34). These examples show how stakeholder group opposition might affect decision making.

Prior work on stakeholders (Hill and Jones 1992) and accountability (Tetlock et al. 1989) highlights that decision makers may take the perspectives of stakeholder groups into account when making decisions. Decision makers may "simply adopt positions likely to gain the favor of those to whom they are accountable" (Lerner and Tetlock 1999, p. 256). These prior works, however, focus largely on certain outcomes (e.g., where to locate a new manufacturing facility, laying off employees). Our focus on hurricanes extends this perspective by emphasizing that cases of extreme uncertainty may make the costs of mistakes in judgment the most salient factor when considering stakeholder influence; it also provides a specific mechanism through which stakeholder preferences are taken into account. Decision makers may alter their own perception of the costs of different types of errors to mirror those of salient stakeholders. Building from our model, we expect that officials who are closely aligned with business lobbying interests may raise their evacuation threshold (x^*) through a corresponding rise in the cost of false alarms (a rise in a). Political officials relying on support from community groups would be more likely to err toward evacuation, increasing the risk of false alarms based on a rise in the cost of unpredicted hits (a rise in b).

Proposition 3 (P3). *Business-oriented decision makers will be prone to more unpredicted hits, whereas community-oriented decision makers will be prone to more false alarms. In general, decision makers will seek to minimize errors of the type most costly to those stakeholders that control important resources for the decision maker's future.*

If the first view on how decision makers reconcile conflicting stakeholders focused on power (P3), our second perspective focuses on timing. Three possible scenarios affect timing. First, a stakeholder group might be able to pressure the decision maker before the decision is made. Second, a group might be able to voice its displeasure with a decision *soon after* the hurricane passed. To the extent that the group's concerns are clear to the decision maker ex ante, this may influence the decision itself. Third, a group might have a specific opinion but might not have its voice heard *until much later*, such as a group that would not be heard until reelection time. With perceived discounting of future costs and benefits, the three cases would affect the decision in declining order—the perspective of a group that has influence before a decision is made would receive the most weight, whereas a group that had to wait until election day would receive the least weight.

This suggests that decision makers might frequently lean toward business-oriented stakeholders (who prefer to minimize false alarms), as these businesses are represented by preestablished chambers of commerce. Since the lobbying group exists independently of the hurricane, the group would have influence predecision or (at the latest) immediately after. By contrast, the general public (who prefer to minimize unpredicted hits) must wait until Election Day to have a direct influence, which limits the extent to which this opinion affects decision making. This discounting would depend on the timing of the next election—a decision maker facing a hurricane evacuation decision in September before a November election may prioritize the preferences of the community because of the proximity of the election. Jointly, this perspective suggests that the influence of the business lobby may be consistent, whereas community influence may be limited except before Election Day.

This idea that stakeholder influence may vary over time is related to what Barnett (2007) terms the "stakeholder influence capacity," where factors beyond those

that traditionally drive salience such as power, legitimacy, and urgency (Mitchell et al. 1997) will affect how decision makers view stakeholders. The idea that (for example) unionized employees may influence decision makers more than nonunionized employees is clearly akin to the role of power, but the idea that influence may vary over time is a novel concept that emerges from our model. This variance over time, and its implications for current decision making, stems from the fact that stakeholders exert influence at particular moments, and the impact of influence in the distant future is discounted back to the present. Research on accountability has considered the role of timing of accountability (e.g., Fox and Staw 1979) but has focused exclusively on pre- versus postdecision accountability and not on potential lags between decisions and accountability. Overall, we expect the following.

Proposition 4 (P4). *For elected decision makers, the rate of false alarms should increase near Election Day and recede otherwise. In general, stakeholders with a clear means of influencing decision makers before decisions are made* (*or immediately after*) *will have more influence over the decision than stakeholders whose means of influence is more abstract and distant in time.*

4.2. Stakeholders and Multiactor Decision Making

Section 4.1 focused on stakeholder influence over a single decision maker. However, as discussed earlier, hurricane evacuation decisions are never made alone. Two aspects of the multiactor nature of this process deserve attention. First, multiple counties are likely threatened by the same storm, so the microlevel processes discussed above are happening in multiple places simultaneously. This may encourage decision makers to pay attention to what other decision makers are doing, and the prior failures of others may force stakeholders to increase pressure on the focal decision maker. Second, even within a single county, multiple staff members may advise the decision maker. Aggregation processes affect how perceptions and errors are altered by group discussion (Kerr et al. 1996, Csaszar and Eggers 2013) and how different opinions are aggregated may be affected by the perceptions of stakeholders.

4.2.1. Stigma and the Failure of Others. Stakeholder pressures are likely to affect a decision maker based in part on the prior decisions—and mistakes—of other, similar decision makers. Stigmatization of one agent by the actions of similar agents is an important part of sociological research on norms (Pontikes et al. 2010). In our context, a string of recent storms hitting one region might have practical and political effects. From a practical/political view, frequent storms may increase the costs of additional evacuations as the county runs short of funds to manage evacuations (increasing a in Figure 3 and increasing the evacuation threshold), or the damage caused by prior storms may increase the risks to residents (e.g., New Orleans after Hurricane Katrina, where broken levees endangered residents), which would result in more evacuations. From a political view, mistakes by similar others increase pressure on a focal decision maker to avoid the same fate. Unpredicted hits may be especially threatening, as seeing the damage of a bad decision in a similar context should put local decision makers even more at risk of reputational damage from making the same mistake. Our perspective extends existing work on stigmatization by the actions of others (Yu et al. 2008, Jonsson et al. 2009), which has typically focused on stigmatization based on accepted categories of actors and not on similarity in actions. It suggests (1) that the mistakes of others can increase the costs of making the same mistake for other, similar organizations, and (2) that decision makers will factor this increased error cost into their decision-making process and thus be encouraged to minimize that type of error in the future (which raises the likelihood of making the opposite type of error).

Illustrating this effect, Table 1 shows storm-level data for the eight Florida storms discussed earlier. The table shows that in the first storm (Charley), a high percentage of counties were caught off guard and did not evacuate. This was especially important because Charley was the strongest hurricane to hit Florida since Andrew and killed 25 people. Throughout the remaining storms in 2004, and for the beginning of 2005, the number of counties being caught off guard decreased (especially in relation to the number of counties evacuating needlessly). The effect of previous storms may have a limited time frame, as the last storm in 2005 (Hurricane Wilma) also resulted in a series of unpredicted hits.[6]

Proposition 5 (P5). *Recent storms that hit nearby regions—especially when those regions failed to evacuate—may increase the number of false alarms. In general, salient and highly public mistakes* (*either Type* I *or Type* II) *of other actors may increase political pressure to avoid the same mistake for the focal decision maker, which then increases the chances of making the opposite type of mistake* (*Type* II *or Type* I).

4.2.2. Imitation of Larger Actors. This perspective suggests that county-level decisions are not independent, but interdependent. Interdependence provides an opportunity for decision makers making mistakes to deflect blame onto others. Consider the case of Hurricane Floyd in 1999. Despite Floyd's path toward the eastern Florida coast, NHC forecasters were almost certain that Floyd would turn north and miss Florida. Even with this forecast, several county managers wanted to issue an evacuation (including the mayor of Miami). In their minds, the storm was too big to take chances, and an evacuation was warranted in case the forecast was wrong.

But because of the NHC's confidence in its forecast, the organization had not issued a hurricane warning for the eastern Florida coast. Many local officials requested that the NHC issue a warning so that they could issue an evacuation irrespective of the forecast (Sheets and Williams 2001). These county managers needed the legitimacy of an NHC warning in part to reduce potential criticism if they were wrong. Similarly, Governor Blanco, in ordering a state of emergency before Hurricane Katrina, made it clear that her decision was in response to President Bush's urging. Her hope may have been that, if the storm did not hit, she would not be deemed responsible for an unnecessary evacuation.

But how does this consideration of blame deflection affect ex ante decision making? One interview subject in our fieldwork suggested that, to lower the chances that a county manager may be blamed for a wrongful decision, smaller counties often waited to see what larger counties were doing before deciding (Collins 2002). Once a larger county issues an evacuation, the county manager of a smaller county would most likely also issue an evacuation. This is consistent with Marcus and Nichols' (1999) suggestion that organizations lacking resources may look to others to help with decision making. Such imitative decision making shifts some responsibility from the smaller to the larger county. We expect that when multiple counties make the same wrong decision, the largest and highest-status county is likely to bear the largest volume of public displeasure over the mistake—the media and the public typically focus on high-status decision makers as responsible for the mistake (Merton 1968, Giordano 1983, Wiesenfeld et al. 2008, Graffin et al. 2013). This deflects blame for decision makers who imitate higher-status actors (e.g., the mayor of the largest nearby county that made the same mistake). Imitation may provide personal benefits for the decision maker in the event of a mistake, but it is not socially optimal. As shown earlier, ideal evacuation decision making depends on the perceived threat (x), which is dependent on the county-specific threat of the hurricane, and on the evacuation threshold (x^*), which includes such county-specific factors as the costs of evacuation and the costs of a direct hit. As these factors change from county to county, imitating another county's decision is unlikely to improve social outcomes.

This perspective agrees with recent theorizing that there may be important boundary conditions on the benefits of imitation (Csaszar and Siggelkow 2010). Much of the existing literature on imitation argues that imitative behavior is beneficial (Lieberman and Asaba 2006). Our perspective complements existing explanations for imitation in highly uncertain contexts—instead of looking to high-status actors to provide legitimacy for *actions* (Haunschild and Miner 1997, Henisz and Delios 2001), decision makers may imitate to provide legitimacy for *potential mistakes*.

Proposition 6 (P6). *Smaller counties are likely to imitate the decisions of neighboring larger counties, which may increase evacuation decision-making errors (both Type* I *and Type* II*). In general, the decision to imitate larger, higher-status actors may be based in part on the expectation that these actors will bear a disproportionate amount of stakeholder scrutiny in the event of an adverse outcome.*

Once again, our quantitative data provide anecdotal evidence. First, Table 4 shows the likelihood that a small (less than 90th percentile in terms of population) county will evacuate based on the percentage of larger counties (90th percentile or higher) that evacuated, conditional in each case on being threatened by any given storm. The data show that when a higher percentage of large counties evacuates, a higher percentage of small counties also evacuates. Second, if we group the counties according to the median of population size and consider both types of mistakes together (false alarms and unpredicted hits), the error rate for larger counties (> 120,000 residents) is 28.8% and the error rate for smaller counties is 37.5%. Although there may be other plausible explanations, the data illustrate consistency with the proposition.

4.2.3. The Risks of Overruling Subordinates. County managers receive input from a variety of sources, including the NHC, other politicians, and staff members. How decision makers aggregate different opinions is an interesting question. Prior research suggests that individual biases may be either amplified or alleviated by group-level discussion (see a review in Kerr et al. 1996), that different aggregation mechanisms may have different implications for how uncertainty is handled (Csaszar and Eggers 2013), and that decision makers may be more or less likely to take advice in different contexts (Soll and Larrick 2009). To extend these perspectives, consider, for example, a county manager who received a recommendation from subordinates to evacuate in the face of a hurricane. If the county manager agrees, then an evacuation order will be issued. If, however, she does not

Table 4 Likelihood of Small Counties Imitating Larger Counties (Florida, 2004–2005)

	Model 1	Model 2	Model 3
% large counties evacuating		3.149* (1.716)	3.149** (1.313)
Hurricane category	Included	Included	Included
County population	Included	Included	Included
County area	Included	Included	Included
Random effects			County
N (observations)	202	202	202
Pseudo R^2	0.082	0.094	N/A

Notes. Coefficients are odds ratios; standard errors appear below coefficients, clustered by county. The dependent variable equals 1 if county evacuated and 0 otherwise (logit model).

*$p < 0.05$; **$p < 0.01$.

agree, then stakeholder considerations present a challenge. If the county manager overrules her subordinate *and* it turns out that the subordinate was correct (the county should have evacuated), then the political risks to the decision maker if anyone were to discover that she overrode a recommendation to evacuate would be severe.

Given that the politically driven backlash against overriding a recommendation would likely be driven mostly by the traditional media and Facebook and Twitter, we expect that recommendations to evacuate will be more difficult to overrule than recommendations not to evacuate (where the eventual decision maker could be seen as "protecting the common man"). This is not to say that county managers would never overrule their subordinates, only that concerns about the potential implications may marginally raise the necessary evacuation threshold. Thus, we expect that aggregation processes when stakeholders are active and informed may accentuate individual-level effects that incline decision makers to prefer evacuation. The process becomes more complex when subordinates offer conflicting recommendations but feel that the potential risks of overriding a correct recommendation to evacuate outweigh those of overriding a correct recommendation to not evacuate, as the latter can readily be cast as a desire to be cautious. We suggest that the decision *not* to evacuate might then need to be unanimous, to limit the chance of significant negative political fallout. The same would be true for any other decision where one type of error carried much more politically significant risks.

Thus, in formal hierarchical structures such as a subordinate passing along a recommendation to a decision maker, the decision to override the recommendation is not simply a matter of opinion. Instead, the political costs of overriding may become especially large when there is a risk that the subordinate's opinion might become known, especially if one type of error (in this case, the cost of an unpredicted hit) has broad political implications for a number of stakeholders. A clear non-hurricane example is the backlash against the Bush administration under allegations that the Central Intelligence Agency had explicitly predicted terrorist action in the United States in the late summer of 2001 (e.g., *Washington Post* 2006). The perception that the administration may have overridden a security recommendation enraged critics. In another example, a group of National Aeronautics and Space Administration (NASA) contractors that worked on the space shuttle *Challenger* were concerned with the cold launch conditions in 1986 and recommended that NASA abort the launch. One of the NASA officials who overrode the recommendation was pushed into early retirement in the aftermath of the disaster (Fischer 1986). Although work on decision aggregation (e.g., Sah and Stiglitz 1986) has considered endogeneity in the screening process, the focus has been on how subordinates alter their own thresholds based on the knowledge of a higher-level decision maker. What has not been considered is the effect on the decision maker of the subordinates' recommendations. In the case of hurricanes, it is entirely possible that the recommendation by any subordinate to evacuate becomes difficult to override for the decision maker, thus leading to a higher rate of false evacuations than may be socially optimal, creating new types of errors.[7]

Proposition 7 (P7). *Public knowledge of a recommended evacuation will lead to a higher-than-optimal rate of false alarms. In general, the decision to override a subordinate's recommendation may take into account not only the decision maker's beliefs but also the political risks involved with public disclosure of the decision to override the recommendation.*

In our data, it is obviously impossible to ascertain the "optimal" level of evacuations, but the finding that the overall unpredicted hit rate in Table 1 is only 6.9% whereas the overall false alarm rate is 27.0% is consistent with the idea that decision makers will lean toward evacuating more often.

5. Discussion

This study integrates theories on decision making and stakeholder influence to offer a model of hurricane evacuation decision making with implications for decision making in general. Our model illustrates how the costs of errors (Type I and Type II) set the action threshold for decision makers and how stakeholder considerations affect those costs in ways that benefit the decision maker but not society. In general, it is the job of managers and decision makers to properly balance Type I and Type II errors—any attempt to reduce the number of Type I (false alarm) errors increases Type II (unpredicted hit) errors (Csaszar 2012). But this balancing act is complicated by the significant uncertainty and consequences of hurricane evacuation decisions, and consideration of stakeholder concerns—both through direct influence and indirect consideration of preferences by the decision maker—can readily tip this balance.

Stakeholders are particularly salient in the context of hurricane evacuation decision making because decision makers are largely unable to rely on learning to help make decisions. Despite the fact that hurricane evacuation decisions are made regularly and are supported by institutions (e.g., the NHC) with large amounts of data, learning is challenging for five reasons that conflict with some of the basic tenants of learning theory (Argote 1999). First, the key factors that affect decision making differ county to county, based on geography, population, transportation, etc. Second, local communities have changed rapidly as populations migrate and demographics change. Third, lucky guesses and vocal stakeholders distort feedback that could aid learning. Fourth,

decisions involve multiple layers of actors, and coordinating learning across layers is challenging. Finally, the decision maker changes with political changes, limiting memory and learning. Thus, this context is especially beneficial for studying stakeholders, as their salience may be maximized.

Our study contributes to the literature on decision making both by offering a model that integrates decision making and stakeholder influence and by using the model to offer specific propositions that are novel within the realm of decision making. We discuss these contributions in greater detail, and we outline our contributions on hurricane evacuation decision making in particular and crisis decision making in general.

5.1. Integrating Decision Making, Behavioral Theory, and Stakeholders

As discussed earlier, relatively little work integrates decision making and stakeholders (Reynolds et al. 2006, Gavetti et al. 2007), despite the behavioral theory of the firm's emphasis on politics and decision making (Cyert and March 1963). Indeed, March (1962) views organizations as political coalitions of actors with conflicting goals. In general, the role of politics in decision making has focused on conflict within groups, divisions, and organizations (see Allison 1971 for an important exception). To integrate the role of external stakeholders, our model focuses on the costs of errors and how they are borne by different stakeholders. That the costs of errors drive the action threshold (as in Figure 3) is novel in the literature on decision making and links decision making and stakeholders through the political costs that stakeholders impose, depending on their preferences. To the extent that the costs of a type of error (Type I or Type II) are borne disproportionately by one stakeholder group, that group is likely to pressure the decision maker to tip the balance toward minimizing that specific type of error. The decision maker then must consider the degree to which he or she depends on that stakeholder group for resources, which links to common aspects of stakeholder management such as salience and power (Mitchell et al. 1997); it also includes novel aspects such as temporality (P4). Our approach provides granularity on how the key parameters in the classic SDT model are derived and provides a framework for future exploration of factors that affect the costs of mistakes.

More specifically, we state our propositions in two ways—one specific to hurricane evacuation decisions to take advantage of the richness of our context and one generally to provide a series of contributions to the decision-making literature. Some propositions are distinctly novel. For example, P4 emphasizes the role played by time in the consideration of stakeholder pressures, which suggests that the influence of some stakeholder groups will wax and wane, depending on the temporal proximity of stakeholders' influence on events. This highlights not just the resource dependence between decision makers and stakeholders but also the ways in which those resources are made available to decision makers. Proposition 7 suggests that the salience of stakeholders will increase the risks of overruling a subordinate, as the political backlash would be greater if the public became aware of a subordinate's recommendation. Typical models of information aggregation in group decision making (e.g., Sah and Stiglitz 1986) have suggested that the process may affect the decision threshold, but these have typically focused on the role that the knowledge that a recommendation will be reviewed has on the subordinate. We suggest that threshold setting is also endogenous to the presence of subordinate recommendations, which represents a more complete view of the process of group decision making.

Other propositions echo existing themes but offer different nuances. For example, P2 states that decision makers will avoid repeating the same mistake but suggests a rationale tied to the fact that key stakeholders will punish such repeat offenders, not because decision makers overcompensate. Similarly, P6 suggests that decision makers imitate higher-status actors but emphasizes that a significant rationale may be the desire to deflect stakeholder displeasure if the decision is a mistake. Future empirical work could disentangle specific rationales.

This study suggests that stakeholder influences on decision makers may result in a socially inefficient balance between Type I and Type II errors. Of course, finding the socially optimal balance is not a trivial task, and boundedly rational decision makers may search for the optimal balance through processing stakeholder feedback. But our suggestion is that, when a specific stakeholder group has greater-than-typical influence, we are likely to see an inefficient reaction to stakeholder pressures as the decision maker weights those concerns more than others. It would be interesting for future research to consider ways that organizations could be structured to minimize the effect of this type of imbalance. One would likely be to establish effective means for all stakeholders to communicate their opinions to the organization, to make sure that those with preexisting influence mechanisms (such as lobbying groups) do not receive undue weight. Another would be to utilize group decision making involving individuals with different stakeholder relationships, as different opinions might cancel each other out. In general, steps that lead the organization to proactively consider the role of stakeholders in decision making, as opposed to being reactive to vocal stakeholder groups, would lead the organization to strike a better balance.

Overall, this study represents a step forward in the integration of disconnected literatures on decision making and stakeholders. Each has largely ignored the other, or incorporated a simplified version of the other's theories, and this study seeks to both provide a framework

for future integration and draw initial conclusions from an integrated model. We see this study as a first step toward offering a coherent extension of the behavioral theory of the firm to account for stakeholders and other external actors that influence decision making in organizations (Argote and Greve 2007, Gavetti et al. 2007).

5.2. Policy Implications for Hurricane Evacuation and Other Crisis Decision Making

Our findings offer policy implications for hurricane evacuation decision making, which has largely been ignored in research despite interest on the individual decision process for whether to heed evacuation warnings (Baker 1991, 1995; Gladwin et al. 2001) and improvements in hurricane forecasting accuracy in meteorology (Goldenberg et al. 2001). Hurricanes present a complex challenge for decision making. As Goldenberg et al. (2001) caution, the increased hurricane activity in the 1990s may persist. Kunreuther and Michel-Kerjan (2009) warn that damage from hurricanes has increased rapidly, creating problems for the insurance industry and decision makers. Given this complexity and the increasing threat, what can this study suggest as changes for hurricane evacuation decision making?

Three factors seem most relevant to consider. First, our model suggests that county managers likely know that they will be evaluated largely on the outcomes of their decision, and not the process behind these decisions. This leads to fixation on the worst-case scenario (P1) and the imitation of others to deflect blame (P6). Although it is impossible to alleviate these problems completely, better transparency into the process and data used to make decisions may increase focus on the processes instead of outcomes. Second, the fact that county managers may overweigh the preferences of specific stakeholders (P3 and P4) suggests that policies could reduce the subjectivity of hurricane evacuation decision making and that decisions should likely be made for entire regions instead of county by county (where individual allegiances play a larger role). Such a process may both reduce the inefficiencies of imitation and balance the needs of various stakeholder groups more efficiently. Third, our model raises multiple concerns about decision makers using hurricane evacuations as a stage for political posturing (namely, P4, P6, and P7). In addition to these ideas, taking steps to preserve the secrecy of individual opinions while still increasing transparency in the process may help avoid potential inefficiencies resulting from elected officials caring more about their own political future than the needs of the community, or having an official decision-making committee (with a formal process for aggregating different opinions) might provide a means to include multiple stakeholder opinions and assuage concerns about overriding recommendations. An alternative might be to leave the evacuation decision to nonelected officials to minimize inefficient stakeholder influence, though this also presents complications.

Some policy changes have been implemented or proposed that would address some of the concerns raised in this paper. For example, the NHC has considered eliminating its hurricane classification system and the distinction between hurricanes and tropical storms, as the lower classifications can encourage people to take these storms less seriously (Berger 2009, Harper 2011). As another example, the insurance company ACE USA developed several insurance products that help minimize the subjectivity in the decision to shut down a business during an approaching storm by creating objective trigger points based on NHC forecasts. When a trigger point is reached, an insured private company would be able to recoup costs incurred as a result of shutting down. These products may thus increase the number of evacuations made (as these business stakeholders may decrease their efforts to lobby for increasing the evacuation threshold) but may decrease the costs of doing so to a covered company. The general interest in the products increases and decreases based on the previous season's storm activity. For example, the products were developed shortly after Hurricane Isabel in 2003. Following the 2004 and 2005 hurricane seasons, particularly after Hurricane Katrina, there was a significant increase in the interest of the products. However, following inactive 2006–2009 seasons, interest in the products decreased.

Although these findings apply to hurricane evacuation decision making, there are important analogues with decision making in similar circumstances with high public risks and costs, such as airport safety, military operations, and disaster planning operations within private organizations (e.g., nuclear power plants, mining operations). This study contributes broadly to our understanding of decision making and risk in crisis situations, such as those studied in nuclear power management (Marcus and Nichols 1999), space shuttle disasters (Starbuck and Milliken 1988), and earthquakes (Garmaise and Moskowitz 2009), as well as emerging research on the subprime mortgage crisis. It is likely that many of the influences outlined in this study would be prevalent in these and other settings, which should provide both advice for policy and avenues for future research.

5.3. Conclusions

Overall, this study integrates decision making and stakeholder influence through a model of hurricane evacuation decisions. The model identifies that the evacuation threshold derives from the costs of errors (Type I and Type II) and that those costs are driven in part by consideration of stakeholder preferences. We use the model—augmented with qualitative and quantitative data—to derive a series of novel propositions that illustrate how stakeholders influence the decision-making process. The study represents a first

attempt to focus on evacuation decision makers and contributes to our understanding of how policy makers should approach hurricane evacuation decision-making processes and how researchers can integrate decision making and stakeholders.

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Endnotes

[1]An interesting consideration is the origin of y^*. Although the issue is beyond the bounds of this paper, we suggest that y^* captures the public's perception of a damage level at which an evacuation is warranted and is likely to be socially constructed (Van de Ven and Garud 1993). This likely occurs through media accounts that paint the decision in the most controversial light to attract attention. For example, after Hurricane Irene threatened New York City, enough media outlets praised Mayor Michael Bloomberg's decision to evacuate—even though the storm largely missed New York—that backlash against the false alarm was minimal. The threshold will likely also be based on collective memory, where the most dramatic events in recent years set y^*.

[2]We focus on the costs of making mistakes, instead of the benefits of being right, for three reasons. First, prior research on hurricanes has generally focused on the effects of errors (Howard et al. 1972). Second, prior research on risk management decision making highlights how the public primarily responds to mistakes (Lanir and Shapira 1984). Finally, it is difficult for the public to measure successes, especially with decisions not to evacuate. Thus, we doubt the ability of managers to build up goodwill that provides a benefit, only to avoid mistakes that incur political costs.

[3]It should be noted that although "mandatory" sounds like everyone must evacuate, the decision is still left up to each individual. However, if a mandatory evacuation has been ordered, emergency personnel are not required to assist individuals in the event of emergency if they have not evacuated a mandatory evacuation area.

[4]Note that although we draw these two curves as straight lines, it is quite possible that they are actually nonlinear. They should, however, be monotonically increasing or decreasing, which leads to consistent results.

[5]Our data actually suggest that a few counties repeatedly suffer unpredicted hits, which we attribute to the fact that some counties do not issue mandatory evacuation orders, as they do not have the resources to provide shelters and police services. In most states, the "issuance of an evacuation order generally triggers the provision of a variety of services" (Fairchild et al. 2006, p. 961). A former FEMA director has stated that counties ordering mandatory evacuations must have the resources available to evacuate the poor, elderly, and sick (Nagin 2011, p. 185). These counties may issue voluntary evacuation orders without incurring such costs.

[6]Wilma was also perceived as a relatively weak storm from a wind speed perspective (see P1), though it did significant damage in Palm Beach County near Miami.

[7]Decision makers will also consider the opinions of higher-status actors, as discussed in Proposition 6, and it is notable that these higher-status opinions are often expressed publicly, increasing their salience.

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