DISCUSSION PAPER

July 2013 ■ RFF DP 13-16

Holding Distribution Utilities Liable for Outage Costs

An Economic Look

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RESOURCES FOR THE FUTURE

Holding Distribution Utilities Liable for Outage Costs: An Economic Look

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Abstract

Storm-related service outages in electricity and telecommunications have created public controversies regarding the adequacy of ex ante efforts to prevent outages and ex post efforts to restore power. Product liability rules, used to promote quality of service throughout the economy, might seem to offer a solution to this problem in the utility context. Strict liability rules avoid the need for determining whether utilities were appropriately careful but increase ratepayer costs because of moral hazard and, in effect, force ratepayers to buy outage insurance from the utility. By leaving customers exposed to damage, negligence rules can avoid these shortcomings but force upon regulators and courts the need to make difficult decisions regarding efficient care levels. Profit regulation, risk aversion, regulatory commitment failures, and distributional considerations add further complications. Still, the consideration of liability rules may provide worthwhile reminders that increased reliability is neither free nor guaranteed by public provision of service.

Key Words: electricity, distribution, reliability, outage, blackouts, liability, negligence

JEL Classification Numbers: L51, K13, L94

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Timothy J. Brennan*

"If a conservative is a liberal who's been mugged, a liberal is a conservative who's been arrested."—Tom Wolfe

"If a conservative is a liberal who's been mugged, a liberal is a conservative whose power has gone out for three days."—updated version

1. Introduction

Recent experience with storms and power outages, suggesting this paraphrasing of Thomas Wolfe, leads one to ask whether and how to respond to beliefs that utilities are doing too little to reduce the chance of outages or to mitigate damages by quickly restoring service. Specifically, the focus here is on whether liability rules—when, if ever, to require utilities to compensate ratepayers for outage-related losses—would be a useful step toward creating incentives to prevent and restore that would otherwise be inadequate.

The primary motivating examples arise from hurricanes in recent years, the "derecho" in the summer of 2012 in the eastern United States and Superstorm Sandy along the New Jersey coast. These have engendered concern regarding whether distribution utilities did enough ex ante, to limit the scope and severity of outages, and ex post, to restore power following those outages.[1] Displeasure with the service of the local public utility led to calls in the Washington, DC, area

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[1] In the electricity sector, most outages involve local distribution system failures. Wide-area outages due to failures at the transmission system level are far less frequent but can be notable; the August 2003 Northeast US blackout is an example. For a discussion of incentives to mitigate damages applied to the transmission sector, see Office of Gas and Electricity Markets (2004).

for replacing Pepco, the local utility, with a publicly owned utility; one congressional primary campaign in the Maryland part of Pepco's service territory adopted "Replace Pepco" as a slogan, even though Pepco's status is primarily a matter of state rather than federal policy.[2] Less widespread but notable, the 2013 Super Bowl football game was held up for over 20 minutes due to a power outage in the stadium caused by a failure of a relay installed by the local distribution company (Battista 2013).

In a report issued three months after the derecho, the State of Maryland's Grid Reliability Task Force, created by the state's governor, said, "The current level of reliability and resiliency during major storms is not acceptable" (Office of Governor Martin O'Malley 2012, 6). In the view of many, these problems are likely to become more frequent and severe as climate change affects the occurrence of storms and water levels (Office of Governor Martin O'Malley 2012, 6–7). Among other recommendations, the report suggested that utilities get "tracker cost recovery" for accelerated investments to promote reliability beyond business-as-usual improvements.

The response of the Maryland Public Service Commission (MDPSC) to the derecho outage indicates the nature of the specific behavioral responses regulators put in place (MDPSC 2013). Although utilities were not found to have violated regulations so far (with restoration to be judged annually, not storm-by-storm), MDPSC ordered utilities to accelerate short-run reliability improvements and undertake cost–benefit studies regarding improvements necessary to restore power to 95% of customers within specified times after a major storm, including personnel needs and dispatch practices. More specific requirements included strengthening "poorest performing feeders" and improving communications systems internally, to customers with medical needs, and to the public at large.

The outage concern is not limited to electricity. Also in Maryland, the local telephone company has come under fire for poor performance of its 9-1-1 emergency calling system during storm outages (Flaherty and Stephens 2012). Duration of the outage is not a factor, but short-run unavailability during a storm can have tragic consequences. The Federal Communications Commission (FCC) recently issued a report finding that such outages were "unacceptable" and the result of "avoidable planning and system failures" (FCC 2013, 1). The FCC recommended spe-

[2] Regarding the former, see Hensal (2012). Regarding the latter, I live in the Maryland part of that service area, and I wish I'd taken a picture of the sign bearing that slogan.

cific practices, including circuit audits and testing, adequate central office backup power, and improved monitoring.

This invites an assessment of how to give utilities appropriate incentives for ex ante outage risk reductions and ex post service restorations. Focusing on electricity distribution, ex ante efforts to reduce the likelihood of an outage include relatively low-cost (but sometimes controversial) trimming of trees near above-ground lines and relatively high-cost burial of lines. Ex post practices that can reduce the severity of an outage by reducing outage durations include keeping a greater inventory of parts on hand, having more employees and equipment for restoration work, and contracting for supplemental repair crews and restoration equipment as a storm approaches. Some ex ante practices can reduce severity as well, including having more full-time personnel and equipment on hand and, perhaps most notably, installation of "smart meters" that can communicate outage information back to the utility when a customer loses power.

The purpose of this paper is to assess the value of using liability rules—holding utilities responsible in some fashion for losses suffered by ratepayers as the result of outages—as a method for providing incentives for efficient mitigation and restoration. The analogy is to the kinds of product and service liability rules employed in other sectors—such as consumer products and medical care—that, from an economic perspective, take the place of inadequate market incentives to provide the level of quality for which buyers are willing to pay (Daughety and Reinganum, forthcoming). Ideally, requirements to compensate ratepayers for outages could place the incentive to reduce the likelihood of outages and restore power with the utilities that have the information on the costs of doing so. My conclusion (at this juncture) is that this is either likely to be either impractical or will fail to avoid controversial postoutage assessment of utility practices.

Ken Costello of the National Regulatory Research Institute has provided the closest substitute I am aware of for the argument constructed here (Costello [2012b], which is an abbreviated version of Costello [2012a]). In contrast to the primary focus here on economic incentives, he introduces fairness concepts into the discussion (although the penultimate section here will focus on some distributional considerations he does not examine). He also treats as a fairness consideration the ability of the utility to recoup outage damage mitigation costs; I assume here that that is already required as part of the overall legal requirement that utilities are allowed to earn returns commensurate with those of similar firms with “business undertakings which are attended by corresponding risks and uncertainties.”[3] He does note that promised compensation for all outages under strict liability can create moral hazard, as modeled below, but he does not address other potential deleterious effects described below under a full model incorporating relevant ratepayer and utility behavior.[4]

The paper proceeds as follows: Section 2 provides some background on incentives facing regulated firms and practices. Section 3 describes two basic types of liability rules—strict liability and negligence—and outlines some of the considerations they present in both market and regulated settings. To illustrate specific implications of these rules in the electricity outage context, Section 4 presents a model in which a utility chooses the level of effort ex ante to reduce the likelihood of an outage and ex post to reduce its duration, and where consumers determine potential losses—for example, by deciding how much food to keep in their refrigerators and freezers. Section 5 examines the implications of this model for the strict liability and negligence rules. Section 6 adds other issues presented by liability rules, such as whether wealthier neighborhoods should get, or should be able to get, more reliable electricity service. Section 7 summarizes and offers two concluding observations on customer payment and public provision.

2. Quality Incentives: Background

Price-cap regulation has long been viewed as a method to provide utilities with incentives to produce efficiently, essentially treating service quality as given (Brennan 1989). The efficiency issue is primarily one of creating incentives to hold down costs, with some attention to the product mix. Incentives to control cost while leaving price fixed will lead to suboptimal product quality given price, as a firm cannot raise price to capture all of the gains from increasing quality (Sappington 2005). However, reductions in quality also reduce demand, limiting the incentive to cut quality. Moreover, since the price in a price-cap regime is typically above marginal cost (for the utility to expect to be able to recover costs), there may be an excessive profit incentive to stimulate demand, making quality relative to the optimal level unclear. Joskow (2008) observed that price cap regulation is often accompanied by performance and quality standards to mitigate any incentive to reduce these in order to reduce costs. However, he reported a study of UK elec-

[3] Bluefield Water Works v. Public Service Commission, 262 US 679, 680 (1923).

[4] Costello (2012a) describes incentive plans in some of the states in the United States.

tric distribution that found little evidence that incentive regulation increased frequency and duration of supply interruptions.

Joskow has also described incentive mechanisms based on rewarding firms for service quality. The Maryland Grid Reliability Task Force recommended something somewhat along these lines, with rewards for exceeding and penalties for failing to meet "established reliability metrics" (Office of Governor Martin O'Malley 2012, 82). In the United Kingdom, The Office of Gas and Electricity Markets (OFGEM) had instituted a scheme based on performance in 2004 (OFGEM 2004). Ascertaining the basis for the calculation is not easily determined, but for the 2005–2010 period, the "losses incentive rate will be £48/MWh (in 2004/05 prices)," where losses are measured against company-specific annual improvement benchmarks (OFGEM 2004, 40).

OFGEM rescinded its losses incentive program in 2012, however (OFGEM 2012). OFGEM found that "we cannot support an incentive mechanism that results in potentially unwarranted rewards and penalties of significant value" and instead is "introducing a reporting requirement" (OFGEM 2012, 3). The source of the volatility seems to be that the losses incentive mechanism exaggerates the financial effect of revisions to data on how much electricity was actually delivered by a distribution company. However, a contributing factor may be that the benchmark is based on annual improvements, not on how well the distribution company anticipated or responded to severe events. Volatility in weather alone could lead to either loss penalties to distribution companies with good overall performance or rewards to firms that did little but got lucky with the weather.

OFGEM's difficulties in instituting a financial incentive system anticipate some of the potential problems with instituting a product liability scheme for encouraging practices to reduce the likelihood and severity of outages. The next section provides an overview of how liability rules work; the subsequent section describes a model to assess the different effects of liability rules.

3. Liability Rules: Overview in the Product Context

In the view of many in the public and the legal community, the purpose of liability rules is to compensate victims of negligent or careless conduct. However, if compensation were the sole justification, victims could obtain insurance. The justification for adding the assignment of blame and a compensation requirement to an injuring party must go beyond compensation. The economic perspective is that, rather than punishing or compensating, liability rules provide incentives to take precautions that would otherwise not be taken. For a variety of reasons, potential victims cannot pay potential injurers to be more careful, leading courts to set, as a payment for being careful, the avoided risk of having to pay for losses incurred if accidental harm takes place.[5]

From that economic perspective, a liability rule should induce those who might cause harm to take the efficient level of care, equating marginal benefit with marginal cost. The marginal benefit of care is the reduction in the expected harm from being incrementally more careful, through a reduction in either the likelihood of harm or its severity. (In the model below of utility behavior, the utility can affect both—the likelihood of an outage and the harm resulting from slower restoration.) It may be worth noting that efficient care can, and usually will, leave some residual expected harm. Beyond some point, small additional reductions in the likelihood or severity of an accident will not exceed or justify the extensive effort and expense it may take to achieve them.

One way to do this is to have the potential injurer, who can choose how careful to be, bear the cost of harms that may arise from his carelessness—strict liability. In this case, the person choosing the level of care internalizes the external benefit of being more careful, in that the benefit to that person from being more careful is the reduction in the expected harm. This, in principle, leads to the efficient outcome. Like other forms of incentive-based regulation, such as emissions taxes, it has the advantage of presenting to the person taking care only the price of being careless—the expected harm. This leaves it to the person to decide how to respond to that price, leading to an efficient outcome.

Strict liability, however, has one major difficulty: paying the victim removes (or reduces) the victim's incentive to take care.[6] One could avoid this problem by having the injurer pay damages, but not to the victim—for example, perhaps to the government. However, this not only ignores, but also runs counter to, the compensation sentiment justifying liability law; it also has the

[5] The analysis is different for intended harms, in which case, the initial purpose of punishment is to force people to make a voluntary exchange rather than for one party to force its will on another (Posner 1985).

[6] The expression in parentheses arises because the "no victim care" result requires full compensation in the sense of restoring utility to the pre-harm level. For some losses (e.g., mortality), compensation is impossible. The economic purpose of paying damages for these sorts of losses is to induce the potential harming party to take the same level of care the potentially injured person would take if the latter could set that level of care. But even with such payment, the potential victim retains an incentive to take care with noncompensable losses.

second-order effect of reducing, if not eliminating, private incentives to sue and thus implement the incentive mechanism the liability law creates.

The general response, then, is a negligence rule. The key to a negligence rule is that the potentially injuring party is liable only if it failed to take “due care.” If efficiency is the objective, “due care” will be the efficient level of care, where the marginal benefit equals the marginal cost. The injurer’s least cost tactic, then, is to exercise just that level of care, minimizing how much care it takes subject to avoiding liability for harms that may yet occur. Believing that the potential injurer will take that much care, the victim now bears the costs of damages and now has the incentive to take the efficient level of care on her part—where its marginal benefit equals its marginal cost.

On the other hand, a negligence rule has a significant disadvantage. Under strict liability, the court or liability assigner does not have to determine what the right level of care is. It need only set the cost of carelessness through damage if an accident occurs. The potential injurer can use his private information to determine the efficient level of care. Under a negligence rule, the court not only has to determine the cost of carelessness, it has to determine the right amount of care, in setting the “due care” minimum for which a potential injurer can escape liability. Such determinations are likely to be difficult and error-prone, introducing litigation and risk costs that the basic theory of liability (and the model presented in Section 4) ignores.

Before applying these liability concepts to utility service outages, it is important to note that the analysis is not as clear-cut when it comes to product or service liability. A cornerstone of using liability is the absence of a market in which the potential injurer and potential victim can contract with each other on how much care to take and, if necessary, how much one party should pay the other. In the context of liability for problems caused by defective products or services, the potential injurer and victim have already contracted with each other—to purchase the product or service that may become defective.

Thus, the overarching question with product liability is why parties who can contract on the sale of a good cannot do so on attributes of that good. There are explanations to which one can appeal. Reliability may be very difficult for buyers to observe prior to purchase, and claims regarding reliability may be difficult, if not impossible, to validate. Contracts identifying such claims may be difficult to write and, especially, to enforce. Finally, and of particular importance in the utility context, consumers are not able to shop around to choose a different provider offering a more expensive but more reliable product.

For all of these reasons, liability rules may be able to improve on market outcomes. But when they are implemented, it is important to keep in mind the market context in which they usually arise. Assigning liability for product sellers, under either strict liability or negligence, imposes a cost of care and thus increases the cost of production. Strict liability imposes an additional cost, however. Optimal care usually means that harmful events will still occur, albeit with a lower probability and severity than would occur if no care was taken. Consequently, the cost of compensation for those events—the expected damages payment—also becomes a cost of doing business that would show up in the price. The expected damages are also the expected cost of providing insurance against a loss equal to the value of the compensation.

In effect, strict liability in the product context forces customers to purchase insurance against the accident, where the value of the claim is the amount of compensation that would be paid (Calfee and Winston 1988). Generally, this can be inefficient, as the supplier of the product may not be the most efficient insurer once the costs of assessing damages and providing compensation through litigated or settled lawsuits is taken into account. Moreover, when the loss is one for which compensation is impossible, the buyer may not want to purchase insurance at all.

4. Liability Rules in a Utility Outage Context

4.1 The Basic Model and the Social Optimum

A number of models exist to illustrate the overall points made above. I offer here one illustration of their potential applicability to the context of utility outage liability, using electricity distribution as an example. Suppose that a distribution utility can exercise ex ante care $c \geq 0$ at cost $h(c)$ to limit the probability $p(c)$ of an outage, where $h' > 0 > p'$, $h'' > 0$, and $p'' > 0$. The distribution utility can also exercise ex post restoration effort $e \geq 0$ at cost $g(e)$ to minimize the fraction $d(e)$ of the losses that a consumer suffers from an outage, with $g' > 0 > d'$, $g'' > 0$, and $d'' > 0$. By ex post, we assume that e is undertaken only if an outage occurs. One can think of $d(e)$ as related to the duration of an outage, although we model $d(e)$ as the fraction of the maximum potential loss, between 0 and 1, with $d' < 0$. Finally, the consumer chooses that maximum potential loss f, which one might think of as how much food the consumer buys to put in his or her freezer or refrigerator. If there is an outage, the consumer loses $p(c)d(e)f$ of food. The gross benefit the consumer gets from food f is $v(f)$, with $v' > 0$, $v'' < 0$.[7] After an outage loss, the consumer's benefit is $v(f[1 - p(c)d(e)])$. The price of a unit of food is k.

The variables of choices are c, e, and f. A risk-neutral social planner would want to choose these to maximize net surplus

$$v(f[1 - p(c)d(e)]) - h(c) - p(\mathrm{c})g(e) - kf.$$

The first-order conditions (FOCs) for socially optimal preventive care c^*, restoration effort e^*, and food consumption f^* are

$$c^*: -v'fp'd = h'$$

$$e^*: -v'fd' = g'$$

$$f^{*'}: \mathrm{v}' = k/[1 - pd].$$

These have fairly ready interpretations. The FOC for restoration effort e says that the marginal benefit of restoring power given an outage, $-v'fd'$, the marginal food not lost times its marginal value to the consumer, just equals the marginal cost g' of that effort. The FOC for taking care c to avoid an outage is that the expected marginal benefit from avoiding an outage—the marginal reduction in the likelihood of an outage, $-p'$, times the value of the lost food if an outage takes place, $v'fd$—equals h', the marginal cost of that care.

The FOC for food may be less obvious and more interesting. It says that the marginal benefit of a unit of food must be greater than the price, because the probability that it will be consumed is only $1 - pd$. Consequently,

> Proposition 1: Less food will be purchased than if the marginal benefit of food, v', just equaled the price, k.

[7] One can think of this gross benefit as net of the price of electricity delivered. A more complete model would include the benefit from the electricity and its generation cost. For purposes of illustrating the effects of different liability rules, I step away from that aspect of the situation here. One could treat f as the benefits from using electricity under the control of the customer.

4.2 No Liability

The next step is to examine the effect of various liability rules: no liability, strict liability (where the distribution utility always compensates the consumer for outage-related losses), and negligence (where the compensation occurs only if the utility fails to take the efficient level of preventive care and restoration effort). To do this, we assume that the distribution utility is risk neutral and minimizes costs, specifically the sum of its spending on care $h(c)$, expected restoration expenditure $p(c)g(e)$, and any expected liability payment. Neither risk neutrality nor cost minimization necessarily holds; I discuss the implications of their not holding in the penultimate section of the paper.

With no liability, it is easy to show:

> Proposition 2: With no liability, the distribution utility will take no preventive care or restoration effort, and the consumer will buy less food relative to the optimum.

Before showing this, two caveats are in order. In practice, the utility has some incentive to take preventive care and to undertake restoration effort. A primary reason is political—as something of a ward of the regulatory state, a distribution utility presumably has substantial if imprecise incentives to avoid the costs associated with alienating regulators, legislators, and voters. Distribution utilities also presumably lose money by not being able to charge users for electricity they are not receiving after an outage and before restoration.[8] One can think of preventive care and restoration effort in this model as the amount of effort that might be added to that resulting from these incentives, although the overall purpose of this model is to illustrate qualitative effects, not to underpin empirical estimations.

With these caveats, the proof of Proposition 2 is straightforward. With no liability, the utility has no incentive to exercise care in the model, so e and c are zero. This means that the probability $p(0)$ of an outage and the fraction of food lost to restoration $d(0)$ are larger than they would be in the optimum. With those larger, the denominator $1 - p(0)d(0)$ in the FOC for food choice is

[8] This incentive may be less than it might seem because a number of states have adopted "decoupling" policies to divorce distribution utility revenues from delivered power. The purpose of these policies is primarily to take away incentives for distribution utilities to oppose "energy efficiency" policies that would otherwise reduce sales, revenues, and profits (Brennan 2010a). Ironically, the same revenue guarantees in principle limit incentives to restore power—a phenomenon noticed following recent large storm-related blackouts (Maryland Public Service Commission 2012).

smaller than in the social optimum condition above, implying that the consumer will stop buying food at a point where the marginal utility v' is greater than at the optimum. As marginal utility falls with increases in food purchases, the consumer buys less food. Intuitively, knowing the utility will take no (additional) care to prevent power outages and effort to restore power, the likelihood of having to discard the food rises, reducing demand for it.

4.3 Strict Liability

We next turn to strict liability, in which the utility always compensates the customer for the lost food. With that compensation, the customer expects not to lose from an outage. In that setting, we have the following:

> Proposition 3: Under strict liability, the customer buys more food than in the optimum. The utility takes more (less) care than under the social optimum if the customer's demand for food is elastic (inelastic).

If the customer believes she will be fully compensated, then she will not increase the effective price she pays for food by the chance that she will not get to consume it. In that case, maximizing utility implies that the marginal willingness to pay equals the price; in other words, $v' = k$. Let f° be the quantity of food purchased when $v' = k$. Declining marginal willingness to pay for food implies $f^\circ > f^*$, the socially optimal amount. This is the moral hazard that strict liability regimes can induce, in that when losses are covered by compensation, nominal victims have no incentive to take precautions, in this case, to purchase less food (Cooter and Ulen 2012, 202–3).

The utility chooses care c° and restoration effort e°, expecting that it will have to pay $kfd(e^\circ)$ each time there is an outage, with probability $p(c^\circ)$. It thus will want to minimize total expected cost,

$$p(c^\circ)kfd(e^\circ) + h(c^\circ) + p(c^\circ)g(e^\circ),$$

leading to the FOCs

$$c^\circ: -p'kf^\circ d = h'$$

$$e^\circ: -kf^\circ d' = g'.$$

To compare these to the social optimum levels of care and restoration effort, it is useful to use the FOC for f^* to substitute for v' in the FOCs for care and effort, obtaining

$$c^*: -[k/[1-pd]]f^*p'd = h'$$

$$e^*: -[k/[1-pd]]f^*d' = g'.$$

Whether these lead to more or less care with strict liability compared to the social optimum depends on whether kf° is bigger or smaller than $[k/[1-pd]]f^*$. The former is the expenditure on food when the price is lower (k), and the latter is when the price is higher ($k/[1-pd]$). If the demand for food is elastic, $kf^\circ > [k/[1-pd]]f^*$. When this inequality holds, the marginal benefit of more care and effort will exceeds marginal cost at the social optimum, implying that the utility will exercise more care than it would at the social optimum as the customer exercises less. If the reverse holds, that is, the demand for food is inelastic, the marginal benefit of care and effort would be less under strict liability at the social optimum, implying that the utility will reduce both of them.

4.4 A Negligence Rule

It is easy to show:

> Proposition 4: The outcome under a negligence rule will be the same as under the social optimum.

Under an efficient negligence rule, the utility will avoid having to pay any liability if it exercises the efficient levels of preventive care c^* and restoration effort e^*. Assuming certainty, the utility will not want to spend any more on care and effort to ensure that it avoids liability, so it would choose c^* and e^*. Knowing that the utility chooses c^* and e^*, the customer realizes that it will not be compensated. It will then choose f to maximize the net value of food purchases,

$$v(f[1-p(c^*)d(e^*)]) - kf,$$

giving the quantity of food where

$$v' = k/[1-p(c^*)d(e^*)],$$

which is the FOC giving f^* in the social optimum.

4.5 Ratepayer Costs

The public calls for having utilities pay penalties or compensation for outages and spend more on prevention and restoration often resemble those for having the government pay for something: the assumption is that these improvements come about for free. As noted above, the expected costs sellers incur under a product liability regime will typically end up as costs paid by the buyers, depending on the relative elasticities of supply and demand. Thus, one should think about product liability as a device for providing consumers with just the level of service quality for which they are willing to pay, but no more, having justified the usually implicit premise that the market is failing to supply the optimal level of product quality in the first place.

In the case of blackouts, one argument for believing that the level of outage prevention and power restoration that a distribution utility provides may be suboptimal is that consumers cannot shop for a more reliable provider. However, regulation of the distribution utility can complicate the assessment of who pays. A natural assumption is that the costs associated with meeting different liability standards will be passed on to consumers. However, I have already assumed that the utility wants to minimize its costs, which assumes that costs are not automatically passed on.[9] On the other hand, a regulated utility cannot be saddled with a cost that it would not reasonably expect to be able to cover.[10]

Therefore, I assume here that the ratepayers will eventually pay the costs of a liability regime, as one assumes regarding product liability in the unregulated context. With no liability, there are no care and restoration payments to cover. The only effect on customers is that the utility engages in too little care and restoration activity, and the customers will buy less food because of the greater exposure to loss.

The more interesting case is when the utility is subject to liability. Consider first the negligence case. That liability rule adds the expected cost $h(c^*) + p(c^*)g(e^*)$ to the utility's expenses. Those costs would be passed on to the ratepayers.[11] But those levels of care and effort were chosen essentially as if they were maximizing the customer's utility. We can interpret this effect as

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[9] If the utility knows it can pass along costs, one could imagine that it would overspend on prevention and restoration, especially if the regulator allows an excessive rate of return on capital used to limit the likelihood or duration of outages, such as burying distribution lines or installing smart meters.

[10] See *Bluefield*, n. 3 *supra*.

[11] I ignore here whether this cost is or should be recovered through fixed monthly bills or on a per–kilowatt-hour basis. If the likelihood of an outage and the cost of restoration are independent of use, it should be recovered on a fixed basis unless electricity is underpriced—for example, because of uninternalized greenhouse gas externalities or because efficient cost allocation requires surcharges above the marginal cost for both use and connections to the grid (Brennan 2010a, 2010b).

providing the optimal level of service to the customer, given that the customer has to pay for it. It serves the purpose of a rule that would get distribution utilities to provide just the level of reliability that customers are willing to pay for.

The situation with strict liability is qualitatively different, and not merely because the consumer buys the quantity of food $f°$ rather than f^*. Under strict liability, even after the utility takes care, it will still be exposed to some outage costs. It still will have to cover the expected cost of payments it would make for those outages that would occur and where power is not immediately restored. Consequently, ratepayers will be exposed to two costs—the costs of care, and the expected costs of outages that were not worth preventing or mitigating.

In terms of the model above, the costs of strict liability passed on to the customer will be

$$h(c°) + p(c°)g(e°) + p(c°)d(e°)kf.$$

The first two terms are the costs of the utility's prevention and expected restoration efforts, given that the customer is now buying food as if there were no risk of an outage. The second term is the expected cost of an outage—what the premium would be if the customer were to buy insurance from an actuarially fair, risk-neutral insurer. In effect, a strict liability rule has customers paying not only for the costs of care and effort to reduce damages—albeit a potentially different amount—but also for the costs of insuring against an outage.

5. Implications for Utilities

The foregoing analysis is based on the premise that we could hold utilities liable for damages from outages, as we do in other sectors to induce efficient care to mitigate damages. Because the cost of efforts taken to prevent outages or restore power will be borne by ratepayers under cost-of-service regulation—as they are by customers in competitive markets—the design of a liability rule should be thought of as inducing utilities to provide just enough, but no more, care than ratepayers would pay to prevent outages and restore power.

Despite its highly stylized simplicity, this model is nevertheless able to offer some useful insights into the benefits and costs of extending liability rules to the utility context. In principle, liability rules could improve the performance of utilities, as performance in the absence of such rules would lead utilities to take to too little care to avoid and mitigate outage losses and excessive actions by consumers to limit their exposure. The model characterizes this as reducing food purchases, but one can imagine examples of other adaptive measures, such as purchasing generators.

But both primary types of liability present major difficulties in the utility outage context. A strict liability rule could hold a utility responsible for damages. This would lead it to take care, without the public service commission or legislature having to determine how much care is appropriate. In effect, the rule could take the place of complex regulatory oversight, just as setting price caps can, in principle, get regulators out of the business of measuring cost of service and determining which costs were prudently incurred.

Strict liability, however, increases the cost utilities incur, not only by the expense of reducing the likelihood of an outage and restoring service more quickly. It also increases cost by the payments utilities have to make for outages for which prevention was too costly and for restoration delays that were too costly to avoid. As ratepayers will have to cover these expected costs, this effectively compels all ratepayers to purchase fully compensatory insurance against losses from outages. Moreover, as with such insurance, strict liability also creates moral hazard, as loss recovery removes ratepayer incentives to mitigate outage losses when a storm is coming. The insurance payments will be based on the expectation of high losses, with no copayments or deductibles to provide customers with some mitigation incentives.

Moreover, the payments ratepayers make are the same regardless of any precautions they may have taken to mitigate outage costs, for which they are compensated in the event of an outage. Consumers might prefer to purchase such insurance from their residential insurance provider, who might be expected to be a more efficient provider of insurance than a regulated utility. In addition, it is important to note that, for outage losses for which there is no compensation (e.g., from failure of electrically powered life support or absence of 9-1-1 emergency response), ratepayers may not want any insurance (Calfee and Winston 1988).

These shortcomings warrant consideration of a negligence rule, which would hold a utility liable only if it fails to exercise efficient care and would avoid the involuntary insurance and moral hazard problems. Utilities would exercise that care to avoid outage liability. Because utilities cannot be expected to absorb these costs in the long run without the opportunity to cover them with additional revenues, customers would have to pay for that care. But in principle, that is the cost they would be willing to incur were they able to choose the level of care that maximized the difference between the gains from making outages less likely and shorter and the cost of being more careful. Moreover, they would do so knowing that they would be taking efficient action to mitigate outage losses—buying less food when a storm is coming and, for those who place a high value on avoiding outage costs, purchasing backup generators. As compensation is not forthcoming, the moral hazard problem disappears.

This, however, comes at the high cost of reintroducing the difficulties in determining “due care” that currently plague regulators, utilities, and the public. While “marginal benefit equals marginal cost” is clear as a rule, determining the levels of ex ante and ex post efforts—and, to do so, the efficient level of customer mitigation the rule should induce—is somewhere between difficult and impossible. Looking first at the ex post effects of a power outage, the damage function is likely to be a complex, nonlinear function of time and other circumstances. To take just three factors, some costs of an outage may be instantaneous—for example, work that disappears when a computer loses power. Other costs pile on over time, as food goes bad and, in some cases, customers decide to go to hotel rooms or travel to stay with others rather than suffer the consequences of no heat or air conditioning. On the other hand, if a storm was bad enough to destroy a customer’s residence, the marginal cost of the outage on top of it could be negligible.

All of these factors then go into determining the marginal benefits of ex ante efforts to reduce the likelihood of an outage. Many of these efforts, such as trimming trees, hiring personnel, purchasing repair equipment, installing smart meters, and burying lines, will necessarily be done before any particular outage. The marginal benefit of these efforts will necessarily be based on the expected severity of storms over the time period for which these efforts may have an effect. Not only will this be complicated, but it exacerbates the controversies reflected in press reports and political accusations, especially after unexpectedly severe storms. It is just these sorts of controversies that a liability rule would ideally prevent, and it is unlikely that they will be avoided by shifting the debate from the public service commission to a state civil court.

6. Other Contextual Considerations Raised by Liability Rules

Considering the application of product liability rules in the regulated utility context raises a host of other issues. Three of these have to do with assumptions underlying the model developed in Section 4. First is the assumption that utilities maximize profits. To the extent that regulators hold profits equal to a fixed target, a utility may lack the incentive to take action to avoid damages in order to escape future judgments. On the other hand, the flip side of the “costs don’t matter” coin may equally apply: a regulated firm indifferent to costs could have an incentive to overspend on quality, especially if doing so limits its exposure to political threats to reduce its profits. Moreover, if the regulator allows the firm to earn a return on capital in excess of its costs, the firm may have an incentive to make capital-intensive investments to reduce the likelihood or severity of outages—such as by burying power lines or installing extra 9-1-1 access lines.

With profit maximization, a second assumption likely not to apply is risk neutrality. For purposes of simplicity, all optimizations derived above were in terms of expected values. Investors in regulated utilities may be risk averse; certainly, utility investments in the past were those to which risk-averse investors were likely to be directed. However, outage-related costs might be highly uncertain, following uncertainty in the frequency and location of severe storms—and, inevitably, disputes in the computation of damage awards. As a consequence, investors in utilities may require substantial premiums to invest in utilities if the utilities are exposed to the damage payments under strict liability. Whether regulators would allow utilities to earn higher rates of return to reflect this risk—and have customers bear the monetary cost of this risk—seems an uncertain prospect. To the extent that utilities are unable to hedge those risks, they are likely to be less attractive investments (as well as less attractive providers of outage loss insurance to customers). Moreover, neither a court nor a regulator is likely to impose liability without a determination of carelessness after massive outages, if the damage award would threaten the solvency of the utility and its ability to provide service.

A negligence rule would seem to avoid much of these uncertainty-related costs by absolving utilities from liability as long as they exercised "due care." But uncertainty will nonetheless remain. Political pressure on utilities to hold rates down will inevitably lead utilities to reduce expenses where possible, which can lead to reductions in investments below the due care level. Under a negligence rule, this could leave utilities liable following a storm, introducing the uncertainty problems of strict liability. Even if the utility has exercised what it regards as due care, it may be subject to variance in determinations post-storm of whether it did enough, also putting it at risk for covering outage costs. A further uncertainty lies in the political ability of regulators to honor any commitments not to hold utilities responsible if they met due care standards set prior to a severe storm.

A final concern hidden in the model involves distribution of benefits and costs. To a first approximation, one might expect that outage losses will be roughly based on income (although higher-wealth households may have bought generators, reducing their exposure to outage costs).[12] However, the cost of improvements in reliability would likely be based on usage. Usage is not very sensitive to income, with an estimated elasticity of demand for electricity with respect to income of about 0.23 (Branch 1993). If the elasticity of benefits from reliability exceeds this figure, policies to mitigate outage losses will likely be regressive.

Moreover, apart from direct effects on losses, the level of care that is efficient will vary with income.[13] Those with higher wealth are likely to have a higher willingness to pay for reduced outage likelihood and faster restoration, if only because these are presumably normal goods. To the extent that reliability and speed of restoration are the same over the entire service area, these would be less than what wealthy neighborhoods would want and more than what low-income neighborhoods would be willing to pay for. But if service can be made neighborhood specific, efficient service provision could involve providing greater reliability in areas with higher income while charging higher rates to customers in those neighborhoods. Whether the prospect of “Lexus” service would be politically problematic, even if efficient, is likely to be a nontrivial policy concern—especially if wealthy customers can pay to be first in the restoration queue.

7. Summary and Concluding Observations

Turning to product liability law as a method for promoting utility service quality appears problematic. Fundamentally, it either creates moral hazard, forcing ratepayers to purchase outage insurance from utilities under strict liability, or forces courts and regulators into the political quicksand of ascertaining whether utilities acted appropriately to prevent outages and restore service. Considering whether profit-regulated utilities have incentives to act efficiently as rules prescribe, uncertainty in the application of either strict liability or negligence, and distributional concerns raise further doubts about whether liability law would usefully contribute to better policy regarding outage prevention and mitigation.

[12] The distributional effect where I live is enhanced by the fact that wealthier people live in older neighborhoods less likely to have buried distribution lines and larger, older trees more likely to take down lines after severe wind and snow storms. This is why one sees so much complaining about utility performance from those who might otherwise be expected to take a dim view of regulatory interference in corporate decisions.

[13] One might apply a median voter rule model to get a sense of where a regulator might decide to set reliability standards.

However, considering the question brings to mind two features of the public controversy over utility outages that deserve questioning. One is that advocating for efforts to reduce the likelihood of an outage is easy if someone else, particularly stockholders or executives of utility companies, will bear the costs. Thinking through a model of utility behavior serves as a useful reminder as to why that would not be so. Ratepayer payment is not a shortcoming—the best part of liability rules is that they ideally lead suppliers to provide just the quality of service for which consumers are willing to pay. But the policy discussion would likely be less vituperative if those calling for more reliability were also those paying for it.

A second issue, not in the model, is whether nonprofit public ownership would do better. The problem arises not merely in theory, because a public power company, as a nonprofit, might or might not choose the efficient level of outage prevention and service restoration. The region where I live gets occasional severe snowstorms. The responsibility for restoration of service in that context, street clearing, rests with local and state governments. My sense, not quantitatively measured, is that the complaints from neighborhoods yet to see snowplows are as intense as those from neighborhoods for which distribution utilities have not restored power. Whatever the shortcomings of investor-owned utility outage performance, because of poor incentives, regulation, and the lack of pressure from competitors, the alternative is neither theoretically nor empirically compelling.

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