

# Taking into Account Extraordinary Circumstances in Regulatory Pricing

*by*

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Extraordinary events cause significant supply disruptions for major utility industries. When the relevant suppliers are regulated firms, standard market responses to extraordinary events, such as individual customer contracts with an allocation of liability, are unavailable. Both the existence of regulation and political necessity mean that such events often involve a costly response by government, the regulated firms and/or the public. State-based regulators around Australia are grappling with the problem of how to deal with these costly responses in on-going utility regulation. In this paper, we provide a framework for analysing regulatory responses to extraordinary circumstances. We note that dealing with the risk of extraordinary events is a standard insurance problem. The regulatory issue involves incorporating relevant insurance principles into the on-going system of regulation. This is likely to involve a balance of mandated precautionary activity combined with government and public liability, together with risk-bearing and self-insurance by the regulated firm. This balance determines the liability for expenses and compensation arising from an extraordinary event. It also determines both the pre-event and post-event regulatory procedures that will govern the utility. In particular, it is impossible to separate the pre-event regulatory regime and the post-event liability for costs.

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## 1. Background

Infrastructure regulators are currently investigating the establishment of pricing principles to cover investments made either under extraordinary circumstances or in response to an extraordinary circumstance.<sup>1</sup> These regulators set the prices and vet the costs for regulated firms in gas, electricity, water and other infrastructure industries. The key issue they face is how to use their regulatory powers to allocate the costs of unexpected investments that are needed to address an extraordinary circumstance. While the precise definition of an extraordinary circumstance is still to be established, there is some confidence that the severe drought conditions affecting Gladstone's water supply, the electricity outage in Auckland, the Longford gas disaster in Victoria and the Sydney water crisis, all fall into any reasonable definition.

In this paper, we provide an overview of the pricing instruments and trade-offs associated with extraordinary circumstances and regulatory pricing. We consider both the definition of an extraordinary circumstance and the underlying regulatory economic issues raised by the possibility of such extraordinary circumstances. In particular, we note that the way a regulator deals with investments made in response to an extraordinary circumstance is critically dependent on the regulatory approach to risky events established prior to any extraordinary circumstance occurring. In other words, dealing with extraordinary circumstances involves a regulatory role and requires consistency of regulatory approach both before and after an extraordinary circumstance. In this sense, it is impossible to consider the appropriate regulatory response to be taken after an extraordinary circumstance unless the regulatory approach to risk before such a circumstance is fully articulated.

This paper proceeds as follows. We begin by considering the definition of an extraordinary circumstance. Then in section 3, we consider the relevant regulatory approaches that can be adopted to risk *before* an extraordinary circumstance arises and in preparation for such a circumstance. We also discuss how these *ex ante* regulatory alternatives feed into compensation for extraordinary circumstances.

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<sup>1</sup> For instance, there are on-going investigations by the Queensland Competition Authority and the Essential Services Commission in Victoria.

## 2. Definition of ‘Extraordinary Circumstance’

Regulators use the term ‘extraordinary circumstance’ (or EC) to characterise events that have two specific characteristics. First, regulators define an extraordinary circumstance as an event that occurs with low probability. Second, to be an extraordinary circumstance, the relevant event must involve some major disruption to supply that can be mitigated either by reduced consumption and/or increased investment in capacity. Regulators control either the ability of a regulated infrastructure firm to invest or the ability of that firm to recover its investment expenses, so this second characteristic means that there is potential for a regulatory response to the EC.

Both of these characteristics involve a continuum. The probability of an event occurring can range between zero and unity. An event that raises supply risk may be relatively unlikely (say a one-in-one-million chance event) or significantly more likely. Similarly, supply disruptions can range from inconvenient, short-term interruptions to prolonged and widespread loss of supply. As a result, any definition of an extraordinary circumstance that captures both of these characteristics will either rely on arbitrary boundaries on both the probability and degree of disruption, or will have a significant ‘grey area’ for dispute.

At its simplest, the term EC as used by regulators an EC could be defined as a highly unlikely event that involves a prolonged and widespread loss of supply. Such a definition would, however, be inadequate. Neither the probability of a particular supply-side event nor its intensity are outside the control of the infrastructure firm and the regulatory authority. Further, this definition of an EC would capture a wide range of events in industries that require no government intervention what-so-ever.

Let us begin with the latter point. There are many industries that involve the possibility of a major disruption to supply. For example, in 2003 the Australian car industry was brought to a stand-still due to an industrial dispute that prevented a key component being delivered to automotive plants. This was a major disruption to supply in that industry. However, it did not lead to a regulatory response for the simple reason that the supply shock was an internal matter between the relevant supplier, the workers and the car plants that purchased the component. From a regulatory perspective, this major supply shock did not require any direct intervention. Thus, if we are to consider the definition of an EC for a *regulated*

infrastructure industry, we cannot simply refer to it as a significant supply shock without considering why the supply shock calls for a government regulatory response.

From an economic perspective, there is a *prima facie* role for government intervention relating to a supply shock on efficiency grounds if the supply shock gives rise to large effects that are not internalized by the relevant market participants. If a supply shock simply leads to a relevant market response without external costs, then there is little if any need for government regulation relating to that shock. For a regulated infrastructure provider, however, such a market response to an external shock will be muted at best. The contracts between regulated firms and their customers are usually controlled by the regulator. The regulator vets investment both before and after an EC and any responses to an EC by a regulated firm usually require regulatory approval. Customers have a limited ability to seek compensation for the costs of an EC through the legal system.<sup>2</sup> Politically it is often impossible for governments to just ‘stand by’ and let the market work out the consequences of an EC.<sup>3</sup> As a result, an EC for a regulated infrastructure industry will often lead to external costs that cannot be internalized by the market. Therefore, when considering the definition of an EC from the perspective of a regulated industry the relevant dimension for analysis is not the size of the supply disruption per se, but rather the size of the external costs to the community of the supply disruption. In other words, when considering an EC, we need to focus on the size of the external social costs of the supply shock.

The second problem with a definition that focuses on small probability events that involve large supply shocks is that the definition fails to recognise the roles of the infrastructure firms and regulators in determining the probability of specific events. There are clearly a wide range of potential factors that create supply risk in any specific industry. For example, supply risk could be related to acts outside the relevant firm’s control (e.g. acts of God, acts of terrorism) or they could relate to factors such as maintenance and investment in capacity that are directly controlled by

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<sup>2</sup> A regulated firm will usually have little liability for the losses created by an EC unless it was explicitly negligent. Rather, it could appeal to the fact that it had satisfied its regulatory obligations. Even if negligence could be shown consumer compensation would be limited. Further, the consumers would likely have little success in suing either the regulatory or government so long as the regulatory had satisfied its statutory obligations.

<sup>3</sup> The likelihood that the government will intervene to at least partially compensate customers after an EC means that customers have a muted incentive to take precautionary action and little incentive to buy their own insurance against an EC. The failure of drought insurance for farmers the regular assistance provided by governments to farmers for ‘drought relief’ provides a simple example of this.

the firm. In many circumstances, an extraordinary event will involve both controllable and uncontrollable risk. For example, in the case of the Gladstone Area Water Board, drought resulted in a severe reduction in the local supply of water, and the potential for the area to literally run out of water. Clearly the extraordinary drought was beyond the Water Board's control. But the potential supply disruption created by the drought was not outside the Water Board's control. The Board could have lowered the risk of an extraordinary drought creating supply disruption by building larger water storage facilities before any drought occurred. In other words, while the probability of extraordinary drought was outside the Board's control, the probability of an extraordinary drought causing a significant supply disruption was within the Board's control.

Similarly, the regulator's actions leading up to the drought also affected the probability of a significant supply disruption. The regulator (or another government agency) could have required the Water Board to build extra storage capacity in the past. It chose not to do so. While this could be an economically sensible decision, it highlights that the probability of supply disruption is not exogenous to the regulatory process.

The relationship between the probability of supply disruption and regulation highlights two factors. First, to the degree that supply disruption depends on events outside the control of the relevant parties, regulation dealing with supply disruption will resemble insurance. If there is exogenous risk of supply disruption then some party must bear that risk. This may be the community serviced by the regulated firm, the regulated firm itself, the broader community – either State-wide or Australia-wide – or a combination of all three groups. Whichever party bears that risk, that party will need to be compensated for bearing the risk and the principles of good insurance suggest that the risk should be borne by the parties who (a) are the least risk averse in the sense that they place the lowest cost on bearing risk; and (b) are in the best position to pool risk in order to lower the total variance of risk faced. At the same time, these principles will need to fit in with practical regulatory constraints.

Second, to the degree that supply disruption and the intensity of any disruption depend on the individual firm, the regulator has a role in *risk regulation*. The regulator needs to establish regulatory principles that lead the regulated firm to take appropriate care in order to reduce the probability of a severe supply disruption that creates significant external community costs. This does not mean that risk should be

reduced to zero. Such risk minimisation will generally be prohibitively expensive and the costs will outweigh any benefits. Rather, the regulator needs to determine (a) the optimal level of risk for society; and (b) how best to lead the regulated industry to have that desired level of risk.

In summary, a naïve definition of an extraordinary circumstance as a major supply disruption that occurs with a low probability is unsatisfactory because it does not address the key social costs and because it ignores the endogenous nature of the probability of a supply event.

For this reason it is better to define an EC in terms of the magnitude of the external cost that is imposed on the community through a supply disruption for a regulated firm. Such a definition focuses clearly on the issue of importance for regulatory intervention and draws attention to the necessity of isolating the regulatory reasons why the social costs are not internalized.

### **3. The Economics of Risk Regulation**

In order to consider the relevant issues that need to be addressed by regulators when considering the pricing principles for investments by regulated firms made under extraordinary circumstances, we need to consider the economic principles underlying risk regulation. Why is risk a matter for concern in regulated infrastructure industries? How can regulators deal with risk regulation *ex ante* before there is an extraordinary event? How does the regulatory response after an EC tie into the general framework of regulatory risk adopted by the regulator?

#### *The basic problem*

The basic concern is that the level of supply security provided by a regulated firm in an infrastructure industry may not be socially optimal. In particular, there is concern that interruptions may occur too frequently and at too high a cost to the general community.

The socially optimal level of supply security is unlikely to be a standard of perfect reliability where there are no interruptions. While there are benefits to the community from reducing the probability of an interruption to zero, doing this would often entail prohibitively high costs. These costs are associated with actions that can

be taken by agents in the economy that are directed towards increasing the security of supply. These actions may be conveniently labeled, *precaution*, although they comprise actions such as investments in redundancy, safety protocols, substitute supply sources, alert-awareness and the like. Each of these actions is costly. Hence, their cost must be compared with the benefits they generate in order to evaluate whether they are worthwhile.

A competitive firm in a private market will often face incentives to invest in a socially appropriate level of precaution, particularly if consumers can hold that firm liable for the costs of any supply disruption. To the degree that different consumers require different levels of security, this can be written into supplier-customer contracts. While standard issues asymmetric information and moral hazard may limit the ability of competitive markets to achieve optimal solutions, market outcomes will often be adequate and require no further intervention.

Such a market-based approach cannot be relied on for large infrastructure firms that are subject to strong regulation. First, the prices for such firms and the relevant service standards are usually set by the regulator. There is no scope the standard market solutions to achieve an optimal level of precaution. Second, regulators usually vet investments and other activities such as maintenance expenses to ensure that the regulated firm is not artificially 'gaming' the regulatory system.<sup>4</sup> Thus, even if the regulated firm wished to alter its level of precautionary activities, it would need to satisfy the regulator that this was legitimate. Asymmetric information between the regulated firm and the regulator may make this vetting process difficult.

Third, to the extent that the infrastructure involves networks and security is part of network integrity, then it is difficult for one consumer in a locality to have secure supply while another does not. Thus any private market solution is likely to fail as customers who purchase higher supply security are likely to create a positive benefit for other customers, even if those other customers do not pay for the improved security.

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<sup>4</sup> Depending on the type of regulatory regime and the type of precautionary activities, a regulated firm may have incentives to over-provide or under-provide precaution. For example, underrate-of-return regulation, a regulated firm may have incentives to over-invest. In contrast, under price-cap or benchmark regulation, a regulated firm may take inadequate precaution in order to raise its profits. See M. Armstrong, S. Cowan and J. Vickers (1994) *Regulatory Reform: Economic Analysis and British experience*, MIT Press, London. Here we focus on the case of too little precaution as this is of most interest to Australian regulators.

Finally when an EC occurs there are often large costs that, politically, cannot be ignored. If a major town runs out of water or loses power, it is politically impossible to regulators to refuse to respond even if they believe adequate precaution was taken. Further, advising consumers to “sue the regulated firm” is unlikely to be considered an appropriate response.

### *The issues*

Given that the privately provided level of precaution by a regulated infrastructure provider is likely to differ from the socially optimal level, there are three key regulatory issues to be resolved.

First, should the government specify a set of precautionary investments and activities (that is, mandate standards) or should it let the regulated firm decide these for itself? This is a question of the allocation of decision authority with regard to precaution.

Second, how should the regulated firm be compensated for its precautionary activities, whether mandated or not? This is a question of how precautionary expenses and risks are built into regulated prices.

Third, if an extraordinary event occurs and there is a supply shock that requires significant rapid investment or other mitigation costs, who should bear the costs of this mitigation? This question recognises that optimal risk regulation will not eliminate risk of significant supply disruption, and the regulator needs to have well defined rules established in advance to deal with such a disruption if and when it occurs.

We consider each of these issues in turn.

### *Allocation of decision authority*

Consider a situation where, left to itself, the level of supply risk is too high from a social perspective for a regulated infrastructure industry. Regulators have an incentive to raise the level of precaution undertaken by the firm. How might regulators approach the regulation of supply risk to ensure appropriate precaution is taken?

One approach would be that of *mandated standards*.<sup>5</sup> In this situation, the government makes an assessment of the precautionary actions, procedures and investments an infrastructure provider should be required to make and requires the regulated firm to carry out these appropriate activities.

Alternatively, the government could specify the *penalties* that would be imposed on a regulated infrastructure provider in the event of a disruption to supply. It would then be up to the provider to consider how to manage the risks associated with potential penalties.

Thus, there are two broad classes of regulatory approach and instruments for managing supply risk:<sup>6</sup>

- *On-going regulation*: these instruments are designed to monitor (or audit) the current (or historic) levels of precaution taken by regulated infrastructure owners and provide incentives or performance sanctions to ensure that they achieve a socially optimal level of precaution.
- *Liability*: these instruments come into operation when triggered by an actual interruption. Each specifies a set of sanctions and compensations that must be paid by the regulated infrastructure firm in the event of an interruption occurring.<sup>7</sup>

Thus, both liability rules and on-going regulation have in common a set of sanctions that are imposed on infrastructure owners. However, for liability rules, these sanctions are triggered by actual supply interruptions, while on-going regulation focuses on performance criteria and on precautionary actions (regardless of whether an interruption has occurred or not). In what follows we will review instruments of each type in turn. It will be argued that a reliance on one type alone will generally be inadequate for the optimal regulation. Hence, it is likely that a combination of on-going regulation and liability will be the appropriate policy.

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<sup>5</sup> The regulator could determine these standards by using a cost-benefit framework. A cost-benefit approach is used in Australia under the regulatory test imposed on new electricity transmission investments.

<sup>6</sup> A referee pointed out the possibility of consumers insuring against a supply risk. As noted above, network effects may limit the effectiveness of private insurance. Further, as consumer insurance places no cost on the regulated firm, it will not alleviate the problem of the under-provision of precaution.

<sup>7</sup> Under a liability approach, the firm must be able to fund any payments. Clearly, if the costs of compensation payments are just passed through to customers after an EC then they provide no sanction on the firm. We formally discuss the linking of payments and funding in section 4 of this paper.

### *On-going regulation*

On-going regulation involves more active government involvement in the actions of infrastructure firms. The objective of on-going regulation is to reduce the likelihood of a major interruption through the development and review of operating standards.

Possible instruments include:

- *Periodic audits*: the government periodically holds inquiries into the level of precautionary actions undertaken by infrastructure providers.
- *Standards*: standards for precautionary actions are taken and monitoring used to ensure those standards are being met on an on-going basis.
- *Incentive regulation*: rewards and sanctions are instituted on a recurring basis for failure or otherwise to undertake precautionary actions.

On-going regulation has the potential to generate a socially optimal level of supply security. However, it places incentives directly on precautionary actions rather than indirectly on the observed consequences of those actions. As such, the information requirements for the regulator are more onerous. The regulator needs to have some way of assessing the optimality of desired levels of precaution as well as monitoring whether those actions have been taken. Each of these tasks is potentially costly.

There are two key features that determine the success of on-going regulation:

- *Observational difficulties*: in order to be effective, it must be possible for the regulator to observe the level of precautionary actions undertaken. If measures of these are easily manipulated, it will be difficult to impose sanctions on infrastructure providers for non-performance.<sup>8</sup>
- *Regulatory commitment*: there may be changes that alter the regulator's view of the optimal level of precaution. However, if these changes are based on the past actions of infrastructure owners (for instance, the ease with which they achieve some standards) this may tempt regulators to 'ratchet-up' performance standards. Foreseeing this, infrastructure firms may not perform as well. Hence, applying on-going regulation requires commitment on the part of the regulator to standards previously set.<sup>9</sup>

The key to the success of on-going regulation is the identification of appropriate levels of precaution and the ability to link these levels of precaution to sanctions if

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<sup>8</sup> For a discussion of these types of informational issues see Paul Milgrom and John Roberts, *Economics, Organization and Management*, Prentice-Hall, 1992; and George Baker, "Incentive Contracts and Performance Measurement," *Journal of Political Economy*, 100, 1992, pp.598-614.

<sup>9</sup> See Milgrom and Roberts, *op.cit.*

non-performance is detected. If either of these factors is difficult, on-going regulation will be less effective.

On-going regulation also has the advantage of creating incentives for *user* investment in precaution. Users can respond to the level of precaution set for the regulated firm where appropriate. For example, a hospital might invest in back-up generation as a precaution against a power failure.

### *Liability rules*

A liability rule specifies a set of sanctions or compensatory mechanisms that are triggered by actual realisations of interruptions to service. These include:

- *Strict liability rules*: these are rules that hold infrastructure owners liable for the costs of all supply interruptions (regardless of how they are caused).
- *Contract damages*: these are imposed contractual terms that specify the compensation that must be paid to users in the event of supply interruptions.

If specified correctly, each of these instruments has the potential to encourage socially optimal precaution on the part of infrastructure owners. Each is an obligation on infrastructure providers to ensure supply. If they cannot, then these mechanisms specify the penalty they must pay. If this penalty reflects the harm actually caused by the interruption, then a private infrastructure owner will internalise any social costs imposed by interruptions.<sup>10</sup>

Liability rules, if working properly, have a key advantage: they have relatively low informational requirements.<sup>11</sup> The only information required is an evaluation of the actual harm done; observed when that harm is realised. Thus, information can be gathered *ex post*. So no information regarding the precautionary actions undertaken

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<sup>10</sup> This logic is a standard one in economics when there are external effects. It is akin to a system of Pigouvian taxes. The logic there is that private agents will internalise the true social costs of their actions if they are forced to bear those costs. In this case, the costs are realised when an interruption occurs. For a discussion of such Pigouvian mechanisms see Joshua Gans, Stephen King and Gregory Mankiw, *Principles of Microeconomics*, Thomson: Melbourne, 2003, Chapter 11.

<sup>11</sup> That is, they have a lower information burden on the regulator who only needs to determine the magnitude of harm following an actual accident. The information requirements in forecasting, etc., remain on the infrastructure managers under liability rules.

by the infrastructure provider is required. Indeed, liability rules demand no ex ante judgment on the levels of these actions whatsoever.<sup>12</sup>

However, there are several conditions under which liability rules may not operate well.

- *Incomplete enforcement*: for a liability rule to work properly, compensation based on actual harm faced must actually be paid. If the court system only weakly enforces the rule, too little supply security will be realised.<sup>13</sup> Similarly, if after the EC occurs the payments by the regulated firm are deemed to be excessive and reduced or subsidized by government, then a liability rule will not work properly.
- *Limited liability*: if the magnitude of harm is so large that a firm cannot pay out this amount to users, then this will limit the ability of a liability rule to encourage firms to internalise the costs of their actions.<sup>14</sup>
- *Risk aversion*: notice that a liability rule means that an infrastructure provider is liable for interruptions even if they were not related to precautionary actions at all. This is a key part of the informational advantage of liability rules. However, risk-averse agents will bear additional costs from these risks. This may raise the cost of capital to infrastructure and deter investment.<sup>15</sup>
- *Many responsible agents*: liability rules presume that the infrastructure provider is the only agent responsible for precaution, or that fault can be easily assigned when multiple players are involved. In reality, other agents may be responsible as well, including users, government regulators and even debt providers. Determining the optimal liability rule when this is the case is difficult.<sup>16</sup>
- *Governance issues*: an additional problem with liability rules relates to corporate governance. Interruptions, almost by definition, are rare events. So while the probability of one occurring in a given year, five years or

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<sup>12</sup> This said, liability rules do require an on-going system of funding that raises information problems. In this sense, the information advantage of liability rules over ongoing regulation should not be exaggerated. Funding is discussed below.

<sup>13</sup> See Steven Shavell, *Economic Analysis of Accident Law*, Harvard UP: Cambridge, 1987.

<sup>14</sup> In principle, the government could provide some subsidy or other benefit to an infrastructure provider to compensate for this. However, subsidies, protection of monopoly and similar schemes introduce additional distortions. See Steven Shavell, "A Model of the Optimal Use of Liability and Safety Regulation," *Rand Journal of Economics*, Summer 1984, 15, pp.271-80; and Donald Wittman, "Prior Regulation Versus Post Liability: The Choice Between Input and Output Monitoring," *Journal of Legal Studies*, January 1977, 6, pp.193-211.

<sup>15</sup> See Mitchell Polinsky and Steven Shavell, "The Optimal Tradeoff between the Probability and Magnitude of Fines," *American Economic Review*, 69 (5), 1979, pp.880-891. An additional related concern is the uncertainty faced by the infrastructure owner over the extent of harm. Users may have better information regarding this and hence, this may lead to sub-optimal provision of supply security if a liability rule is imposed. See Charles Kolstad, Thomas Ulen and Gay Johnson, "Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements?" *American Economic Review*, 80 (4), 1990, pp.888-901.

<sup>16</sup> For a discussion of holding debt holders liable see Rohan Pitchford, "How Liable Should the Lender Be? The Case of Judgment-Proof Firms and Environment Risk," *American Economic Review*, 85 (5), 1995, 1-1186.

even decade is small, over twenty or fifty years that probability becomes much higher. Precaution is likely to be effective in reducing probabilities of interruptions over that longer time horizon. However, the time horizon of managers and equity holders of infrastructure is much shorter. So while the costs of precautionary actions are borne immediately, the beneficial consequences are not realised during the economic life of those decision-makers. This means that the incentive effects of a liability rule might be weak.<sup>17</sup>

- *Equity issues*: if the risky event is perceived as potentially severe, in that it could cause substantial physical damage to humans, then there is likely to be an emphasis on prevention rather than compensation in policy design. It is also likely that community concerns regarding substantial environmental damage would limit the scope for liability rules to be considered fully effective.

Each of these difficulties limits the ability of a liability rule to ensure that decision-makers responsible for precautionary actions internalise the full social costs of those actions.

#### *Combining instruments*

Both on-going regulation and liability rules are imperfect instruments to promote precaution. The appropriate policy to promote optimal supply security will rely on each of these approaches to the degree that the marginal benefit of each approach is equated. This is likely to lead to a mixture of liability rules and on-going regulation unless one approach strictly dominates another for a particular regulated firm. The relative strengths, or alternatively the limitations of the different policies in influencing risk management practices, will drive the mix.

The trade-off between the alternative policy approaches will depend on their relative efficiency. For example:

- How large is the magnitude of possible harm? If an interruption results in harm whose monetary value exceeds the ability of a corporation to pay (i.e., it would go bankrupt first), then liability rules will be less effective.
- Are many agents responsible for precaution? If many agents are responsible for precaution then liability rules are unlikely to be fully effective. However, if there is scope for negotiation among those responsible, such rules could be effective.
- How easy is it to evaluate the social costs and benefits of a precautionary action? If a government inquiry could establish that certain precautionary

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<sup>17</sup> The problem of policy myopia is not limited to private sector participants. Arguably governments also have relatively short-term planning horizons and may therefore neglect policies that have only long-term payoffs.

actions were worthwhile, then on-going regulation of their performance is desirable. If cost-benefit analysis is difficult or impossible before an EC then liability rules may be preferred.

- Is on-going monitoring of performance costly? If it is costly to periodically monitor the performance of infrastructure providers, then it may not be easy to ensure that firms are complying with desired standards under on-going regulation.
- Do community standards regarding a desirable level of supply security change infrequently? If they are more or less constant over time, then the temptation of regulators to increase performance standards is reduced and on-going regulation is more effective.

### *Summary*

In summary, there are two main approaches to deal with the decision to determine the level of ex ante precaution for extraordinary circumstances. The regulator can respond to the potential risk of an EC by:

- Regulating actions to mitigate risks; or
- Establishing liability for outcomes.

The choice between these alternative policies depends on the particular circumstances facing the regulator, including the information available to the regulator and the regulator's ability to monitor precautionary activities over time. As we have indicated, legal, political and commercial limitations undermine sole reliance on liability rules.

The choice between regulatory alternatives and the degree of intervention depends fundamentally upon the nature of the interruption. The discussion above provides a basis for characterising the interruption and for determining whether policy instruments for risk regulation lie more with liability assignment or regulation of business practices.

## **4. Compensation for Precautionary Activities**

In the previous section, we discussed alternative approaches to ex ante risk regulation. In particular, such regulation can involve mandated standards or ex post liability. These alternative approaches have different implications for on-going price regulation of infrastructure firms.

First, consider liability rules. These rules involve the regulated firm itself determining and carrying out the relevant precautionary activities. Given the liability

rules set by the regulator and the probabilities associated with relevant events, the regulated firm will decide which precautionary activities to engage in and the extent of these activities. For many potential ECs, it will not be socially desirable to reduce the probability of an event to zero and even under strict liability rules it will often not be privately optimal for the regulated firm to reduce the probability of a particular EC to zero. In other words, the firm will optimally trade off the cost of precautionary activity with the probability of an EC and the cost to the firm of an EC.

Of course, the advantage of liability rules, as already noted, is that they leave the degree of precaution to the firm itself and the regulated firm is likely to be in the best position to judge both the cost and effectiveness of different precautionary activities.

At the same time, it needs to be recognised that using liability rules effectively requires the firm to self insure against the possibility of an extraordinary event. The firm will undertake relevant actions to optimally mitigate the risk of an EC but will bear the residual risk (subject to the relevant liability rules) itself.<sup>18</sup>

Thus, using liability rules to deal with risk regulation is similar to requiring the firm to 'self insure' against extraordinary circumstances.

How should the regulated firm be compensated for this self insurance? From an economic perspective, the preferred approach would be to consider the actuarially fair premium for self insurance and to allow the firm to recover that premium through its on-going pricing.

The efficacy of such an approach depends on the ability of the regulator to accurately measure the relevant insurance premium. It should be noted that under liability rules, the regulator cannot directly compensate the regulated firm for precautionary activities. There are two reasons for this. First, the precautionary activities chosen by the firm will often be difficult for the regulator to verify. Using liability rules reduces the information burden on the regulator, and having compensation based on actual precautionary activity simply reintroduces the information difficulties that liability rules are meant to avoid. Second, if the firm under liability rules can choose its own level of precautionary activity and is directly compensated for those activities, then the firm will choose an excessive level of

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<sup>18</sup> For the purpose of this paper, we assume that relevant external insurance is unavailable to the regulated firm. If such insurance were available then the firm may choose to buy this insurance. This has no effect on the discussion below except that any insurance premium would be explicit rather than implicit.

precaution. The cost of any precautionary activity is 'refunded' through the regulated price of its goods or services, but increased precaution lowers the risk faced by the firm. Thus from the firm's perspective, direct compensation for precautionary activities under a liability approach means that precautionary activities have benefits but no costs. The firm will engage in too much precaution from the social perspective.

An alternative to the firm self-insuring under a liability approach would be for an external party, such as the government, to effectively insure the firm. There are significant benefits from such an approach in terms of risk pooling. Under self insurance, a firm is exposed completely to the idiosyncratic risks that face its industry. Under a pooled insurance scheme, however, those risks are shared between all firms covered by the insurance scheme.

If the government effectively insured the firms, then the government might seek to recover the implicit insurance premium directly from the regulated firm or through broader tax instruments.

A significant problem, however, associated with 'government insurance' for extraordinary circumstances, is that, in its role of insurer, the government would most likely need to set minimum precaution levels for the relevant firm and would need to monitor such precautions. In other words, the government would have to move away from a liability approach back to a regulatory approach based on strict standards. The government may avoid this to some extent by only offering partial insurance. In other words, the government could offer EC insurance subject to a deductible that is borne by the firm if an EC occurs. Of course, this is really just a mixture of 'liability regulation' and 'standards regulation', being presented under another guise.

If risk regulation is based on mandated standards, then the approach to compensation for precautionary activity is likely to be significantly different. Under a mandated standards approach, the government sets the minimum required levels of precaution and compensates the firm directly for the costs of these precautionary activities through the regulated prices of the firm. These costs would most likely be set according to some 'efficient' standard to avoid regulatory manipulation.

Under a pure mandated standards approach, the regulated firm would face no further liability for any community loss due to an EC so long as it had satisfied the mandated standards. In this situation, the government and the community served by the regulated firm would be bearing the risk of an EC. In particular, if an EC occurred

and this required government intervention then effectively the state tax payers are bearing the risk of an EC.

It might be felt that a better approach to EC risk bearing would involve the state adopting an insurance type approach. For example, the state government could require that all regulated firms contribute to an extraordinary circumstances fund each year. This fund would accumulate over time and would be used to fund expenditure brought on by an EC (community assistance, community compensation or sudden infrastructure expenditure). As noted above, a mandated standards approach exposes the government to EC risk. In effect, however, such a fund simply involves the regulated firm's customers paying for the pool of funds to cover the costs of an EC. Also, the accumulation of these funds may face political risks, particularly if the EC fund became very large.

## **5. Cost Recovery Following an Extraordinary Circumstance**

If an EC occurs, then there is likely to be significant expenditure borne by either the regulated firm or the government. The party that bears the expenditure depends on the exact nature of the liability rules established *ex ante*. In other words, the issue of *ex post* cost recovery cannot be separated from the issue of *ex ante* risk regulation.

To see this, consider a regime of strict liability. Under such a regime, the regulated firm determines the degree of precautionary activities and is compensated for both these activities and the risk it faces through a 'self insurance' premium or some other payment that the firm receives each year prior to an EC. But as the firm is 'self insuring', when an EC occurs the regulated firm would be required to bear the relevant EC costs without further compensation. The firm has already been effectively compensated for the *ex post* payments through the *ex ante* 'insurance premium' built into its prices.

Thus, under a strict liability approach, the firm is not compensated for any extraordinary expenditure associated with an EC. Rather, the firm itself must choose the appropriate way to tackle the EC. This may involve direct customer compensation, possibly tied in with customer incentives to minimise use of the relevant supply-constrained output. Alternatively, it could involve the regulated firm having to invest suddenly in substantial new infrastructure to overcome the supply interruption. The

firm chooses the best way to limit the ex post damage associated with the EC because it is fully liable for this damage.

Note that this means that any capital investment made by a regulated firm in response to an EC under a strict liability approach would not be added to the regulated firm's asset base. Rather the firm would bear those costs entirely by itself.<sup>19</sup>

Such an approach raises important practical issues. As noted above, if the payment is of such a size that it will bankrupt the firm, then placing the full cost burden on the firm is infeasible. Similarly, in the face of an EC, the government may face substantial pressure to 'step in' and 'help out' the regulated firm and the community.

To the degree that the government does assist the regulated firm with cost recovery in the face of an EC, either directly or by allowing it to add emergency infrastructure to its regulated asset base, the risk of an EC is shifted back from the regulated firm on to the government and/or the public. This undermines the incentive effects of the strict liability approach to risk regulation. It might also distort the regulated firm's incentives when faced by an EC. For example, if the regulated firm is allowed to recover infrastructure expenditure due to an EC by adding this expenditure to its regulated asset base, but the firm is not allowed to recover once-off customer compensation, then the regulated firm will respond to an EC by building infrastructure, even if this is not the socially appropriate response.

Alternatively, consider the minimum standards approach to risk regulation. Under such an approach, so long as the regulated firm satisfies the minimum standards, it would generally not be held liable for any compensation or expenditure that arises purely due to an EC. If an EC results in new infrastructure, then the funding of this infrastructure would be the responsibility of the government. If the government requires the regulated firm to fund and build the infrastructure then it would compensate the firm for this activity. If the government failed to compensate the firm then it would be imposing EC liability on the firm.

When the response to an EC involves infrastructure expenditure, then this could be funded by rolling the infrastructure cost into the regulated asset base in full.

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<sup>19</sup> In practice, this would be more complex. For example, suppose that an EC led the regulated firm to bring forward capacity expansion of a particular facility. Under strict liability, the firm would only be allowed to include this capacity expansion in the regulated asset base to the degree that it is consistent with the efficient operation of a firm that had not faced the EC.

However, this is simply one form of tax that can be used to pay for the infrastructure. Further, given the narrow base of such a tax, it would most likely be a highly inefficient tax. Effectively, such an approach would simply place all the risk associated with an EC (subject to the minimum levels of precaution being satisfied) back onto the community that suffers from the EC. Such an approach would not be consistent with the economic principles of good insurance as it would effectively prevent the local community from insuring against EC risk.<sup>20</sup>

In summary, under a mandated standards approach, the burden of paying for a response to an EC, including any response that involved new infrastructure, would be borne by the State and would need to be funded through some mechanism. Funding could be through general revenue raising procedures (i.e. debt or taxation), through an EC fund as discussed above, or through the local community by rolling the infrastructure into the regulated asset base.

## **6. Conclusion**

The discussion above shows that ex post cost recovery must be consistent with the ex ante risk regulation. Ex post cost recovery and ex ante risk regulation are inextricably connected and it is impossible to just consider ex post cost recovery in isolation.

The discussion also points out that practical regulation is unlikely to involve a 'pure' liability or a 'pure' mandated standards approach. Rather, a practical regulatory solution is likely to have elements of both approaches.

In practice, while regulators in Australia have tried to address the consequences of an EC when dealing with infrastructure firms, they have not, in general, adopted a consistent approach to extraordinary circumstances. Rather than thinking about the risk implications of these events in advance and incorporating relevant procedures into regulatory regimes, regulators have adopted an ad hoc mixture of pre-EC and post-EC policies. This is unlikely to lead to appropriate levels of precaution and increases uncertainty for both the regulated firms and the public as no-one is sure in-advance where liability for losses arising from an EC will fall. It creates poor incentives for regulated firms to undertake precautionary actions that

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<sup>20</sup> As noted in footnote 19, this raises issues about the separation of the benefits of investment to reduce the impact of an EC and the benefits in terms of future on-going supply.

‘self-insure’ against the risks of an EC. These incentives are exacerbated if regulators mistake legitimate risk-reducing investments as unnecessary cost padding and remove these investments from the regulated asset base.

At its worst, an ad hoc approach to dealing with the costs of an EC means that regulators, governments, regulated firm and the public, rather than knowing their role after an EC, each have incentives to try and force another group to react in the face of an EC. The results can be draconian, as for example the use of a large number of inspectors checking that residential gas supplies had been turned-off by householders and fining non-compliant households in the face of the Longford gas disaster in Victoria.

The key result from this paper is that regulators must act consistently both before and after an EC. Treatment of extraordinary circumstances for regulated firms is like a variety of other insurance problems. Regulators must embed optimal insurance into on-going regulation to prepare for extraordinary events.