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Cserne, P.; Szalai, A.

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ON THE NECESSITY OF *NECESSITY*: AN ECONOMIC ANALYSIS OF CONTRACTS CONCLUDED IN A SITUATION OF NEED

Péter Cserne* - **Ákos Szalai****

*Tilburg Law and Economics Centre, Tilburg, The Netherlands

**Corvinus University Faculty of Economics, Budapest, Hungary

Abstract

An important characteristic of necessity cases is that *ex ante* and sometimes even *ex post* both parties have an interest in upholding the contract. From an economic perspective, the policy objective of regulating necessity is to give optimal incentives for precaution, search and rescue. These incentive effects have been widely discussed in the law and economics literature, the received view being that price control based on the costs of the rescue plus a small reward provides optimal incentives. In this paper we argue that the received view is unwarranted. Our model suggests that in many cases the socially efficient contract price is higher than the rescue costs. To be sure, due to serious information problems the practical implementation of this theoretical optimum is much more difficult than the cost-plus price setting supported by the received view. While the policy implications of our model are rather tentative we suggest that the judicial costs of estimating policy variables should be taken into account. A second objective of this paper is to argue for an economic interpretation of the term ‘necessity’ in contract law. Instead of various substantive criteria suggested in the philosophical literature we suggest defining the term by working backwards from the possible remedies. The excuse of necessity should be available for contracting parties when, all things considered, a judicial control (modification) of the contract price is desirable. Necessity is thus “defined” by what courts can and should do.

1. Introduction

Necessity as a legal term figures in many different areas of the law. In criminal law, it refers to cases when one is permitted or excused to do what otherwise would be a serious crime. For instance, when one saves his own life in an extreme emergency by killing an innocent other, necessity may provide a moral and eventually also a legal excuse for him (Cohen, 1985; Ghanayim, 2006). In constitutional law necessity is a part of the test that some constitutional courts apply in deciding whether to allow the limitation of fundamental rights for the benefit of other rights or interests. In international constitutional and criminal law, it is currently heavily debated whether the state, i.e. public officials and institutions should be allowed to invoke necessity in order to legitimately exercise some exceptional powers. For instance, it is often with reference to “necessity” or “emergency” that governments or officials attempt to justify employing torture, stepping beyond certain procedural rules in the name of “higher interests” or stopping the repayment of sovereign debts.

Private law rules also refer to necessity in various contexts. In tort law in the narrow sense, the doctrine of necessity refers to the question whether one has to compensate for damages caused while exercising self-help in emergency (Symposium, 2006; Visscher, 2008). More generally, in non-contractual contexts necessity concerns situations where the injurer breaches a duty and causes losses to the victim but the harm is either not regarded as being caused unlawfully or at any rate damages are not due because the duty was cancelled by an interest of a higher order. The standard example is when somebody forces the door of an empty house in order to find shelter against a heavy storm.

As for contracts, when an offer is made or an agreement is reached in a situation when one of the parties is in “necessity” in the sense of having inadequate alternatives the question arises whether courts should consider the agreement as a valid contract, modify it or invalidate it. In many national contract laws promises made under necessity are either void or voidable or the party claiming that his vulnerability was exploited may seek a judicial modification of the contract.

This paper provides an economic analysis of such transactions. In order to give an idea of what type of cases might be concerned we start with briefly mentioning a few possible scenarios (Trebilcock, 1993: chapter 2). (1) The highwayman case: creation and exploitation of life-threatening risks. A mugger holds up a passer-by confronting him with the proposition: ‘Your money or your life’ and the passer-by commits himself to hand over the money. (2) The tug and the foundering ship case: exploitation but not creation of life-threatening risks. A third party encounters the highwayman and the passer-by before the transaction is consummated and offers to rescue the passer-by for all his money, less one dollar. Or a similar situation occurs between the captain of a foundering ship and a rescuing tug on the stormy sea. (3) The dry wells case: exploitation but not creation of life-threatening risks with one supplier and many bidders. In a remote rural area all wells except from A’s dry up in a drought and A auctions off drinking water to desperate inhabitants for large percentages of their wealth. Or imagine the maritime rescue situation in (3) with several ships and one rescuer. (4) The Penny Black case: exploitation but not creation of non-life-threatening situations. A comes across a rare stamp in his aunt’s attic and sells it to a collector B, exploiting his idiosyncratically intense preferences. Alternatively, he sells it to the highest bidder through a Sotheby’s auction. (5) The lecherous millionaire case. A agrees to pay for a costly medical treatment of B’s child (or offers B an academic position or a

promotion in the firm) in return for *B*'s sexual favours. (6) The cartelized auto industry case: contrived monopolies. Major automobile manufacturers form a cartel to curtail drastically consumers' legal rights with respect to personal injuries. (7) The single mother on welfare case: non-monopolized necessity. A person in necessity *A* contracts with *B* who lacks monopoly but the terms of the deal (high risks and low return) are especially burdensome to *A*.

In economic theory the term most commonly used to capture problems of this kind is *holdup*. In a recent paper Steven Shavell argues that besides information asymmetry and externalities holdup situations provide a third general economic justification for limiting freedom of contract (Shavell, 2007). From an economic perspective duress, rescue, usury and contract modification are all situations with a potential for holdup, i.e. one party opportunistically takes advantage of the other (Muris, 1981).

Our focus in this paper is somewhat narrower. First, we are only dealing with fresh contracts and not with contract modification. The reason for this is that although the underlying economic issues are similar, both the contractual techniques available and the legal doctrines regulating contract modification significantly differ in these two cases.¹ Second, in our economic model we do not discuss coercion (duress), i.e. cases when one party forces or threatens the other into a contract by *creating* a situation where the other has to choose between two evils (Cserne 2010). Although duress raises questions which are worth discussing from an economic perspective, the model we develop in section 3 is only concerned with "dire constraint[s] imposed on the promisor by someone else than the promisee" (Cooter, Ulen, 2008: p. 286).² From an economic perspective, the policy objective in regulating necessity is to give optimal incentives for precaution, search and rescue. Under this view, an important characteristic of necessity cases is that, in contrast to duress, both parties have an interest in upholding the contract, often even *ex post*. In other words, if rescue contracts were unenforceable at least one party would suffer significant losses.

We are not the first to discuss this topic from a law and economics perspective (Landes, Posner, 1978; Buckley, 1991; McInnes, 1992; Hasen, 1995; Bouckaert, De Geest, 1995: pp. 481–485; Wonnell, 2000: pp. 797–801; Esposito, 2002; Bar-Gill, Ben-Shahar, 2004a; 2004b; 2005; Buckley, 2005; Hermalin, Katz, Craswell 2007: pp. 48–50; Posner 2007: pp. 115–118, 190–191). While throughout the presentation of our model we shall draw attention to specific points where our analysis deviates from and criticises the existing literature, it is useful to summarise the main differences right at the beginning. The standard law and economics literature has two main propositions on the regulation of contracts concluded in necessity. First, these contracts may, in some cases, increase social welfare. When rescue reduces net social losses, such contracts should not be voided. Rather, an *ex post* regulation of the contract price is suggested, taking into account the incentive effects on activity level, care, rescue, investment, etc., as well as the welfare effects of risk-bearing. If the contracted price is higher than the costs of the

¹ The law and economics literature on contract modification is voluminous. See, e.g. (Robinson, 1983), (Alvazian, Trebilcock, Penny, 1984), (Graham, Pierce, 1989), (Jolls 1997).

² This is the way Cooter and Ulen define necessity in their textbook, contrasting it with duress which "concerns a dire constraint imposed on the promisor by the promisee" (Cooter, Ulen, 2008: p. 286). To note, this duality of duress and necessity roughly corresponds to Steven Shavell's distinction between engineered and non-engineered holdup (Shavell, 2007: pp. 225–226). The first refers to the case when *A* creates an opportunity for himself to exploit *B*. In the second case, *A* does not create but only uses the necessity of *B*. In still other terms, the origin of the dire situation can be *endogenous* (duress) or *exogenous* (necessity) (Bar-Gill, Ben-Shahar, 2005).

rescue plus a small reward, it should be reduced to this latter amount. Second, the contract price should reflect whether the rescuer invested *ex ante* in increasing his capacity to rescue or came to help the party in necessity accidentally. Professional rescuers should be compensated with a higher reward.

We agree with both propositions but for the last sentence of the first one. We shall demonstrate that cost-based price control is optimal only under very special circumstances. As some commentators have already noted without going into further details (Buckley, 2005: p. 194 note 40), the optimal price does not need to be close to the costs of the rescue: the minimization of social costs may require a significantly higher contract price. We argue that in contrast to the general understanding price control in general and cost-based contract pricing in specific only lead to efficiency under specific assumptions.

While the incentive effects of the legal responses to necessity have been widely discussed in the literature, the received view that these incentive effects justify cost-based price control is unwarranted. Our model suggests that the socially efficient price should be higher. Even in cases of accidental rescue, i.e. without *ex ante* investment, the contract price should be above rescue costs. To be sure, to determine this price level in practice is much more difficult than the cost-plus price setting supported by the received view. This is due mainly to the amount of information required for the estimation of risks involved. Our model only provides tentative policy implications but we suggest that in a more comprehensive model the judicial costs of estimating policy variables should be also taken into account.

What is mainly driving the difference between previous approaches and ours is that we model decisions of the promisee (the rescuer) differently. The most recent and most complete model of non-engineered rescue by Shavell (2007) considers only the incentive for the potential victim's precaution and for the rescuer's investment.³ This investment increases the probability of finding the victim if he gets into trouble. Shavell assumes that if the rescuer takes a particular action (at cost c) the victim will escape. The social cost of the necessity is either c (if the rescuer finds the victim) or the victim's loss (if she does not). In our model there is a further decision to be made: once the rescuer found the victim, she may take different actions to rescue him. The attempted rescue, however, may prove unsuccessful. Analysing the incentive effects of various judicial and/or administrative policy instruments on precaution, search and rescue in our model, the price which induces optimal precaution is higher than in Shavell's model. In particular, the optimal price equals the cost of the rescue divided by the conditional probability of success, once the victim has been found. After presenting the basic model we extend it to three specific cases: accidental rescue where search efforts are zero; unforeseeable necessity where a rational potential victim would take no precaution; and the case of risk-averse victims.

A related goal of this paper is to argue for an economic interpretation of the term necessity in contract law. As a commonly accepted legal or philosophical definition is lacking, there is no agreement under which circumstances contract formation problems would or should trigger price control. With reference to some previous commentators (Craswell, 1993; 1995) in the next section we suggest that instead of a criterion based on substantive considerations suggested in the philosophical literature, a better way to

³ Shavell's model is a variant of the one by Landes and Posner (Landes, Posner, 1978) on which Buckley (1991; 2005: 154–156) also relies. A different model can be found in (Esposito, 2002).

define the term is to cut through this discussion and work backwards. Irrespective of the philosophical meaning of the term, for the purposes of contract law the excuse of necessity should be available for contracting parties when, all things considered, a judicial control (modification) of the contract price is desirable. Necessity is thus “defined” by what courts can and should do.

The remainder of the paper is structured as follows. In section 2 we discuss the problems of defining necessity. Sections 3 and 4 present our basic model and the extensions. For the ease of readers less familiar with mathematical models, the exposition is made as simple as possible; some proofs and explanations are presented in the Appendix. In Section 5 we comment on the policy implications and suggest ideas for further research.

2. *Defining necessity: the limited usefulness of philosophy*

In this section our goal is to find an economic interpretation of necessity. In search for an economic sense of the term we should openly face the possibility that a convincing efficiency-based definition cannot be found. Even if we find one, *ex ante* we should be skeptical whether such a definition would be functionally equivalent either with the legal meaning of the term in one or the other legal system⁴ or with non-economic (e.g. philosophical) interpretations.

We start our discussion with a brief overview of the philosophical literature on voluntariness, coercion and exploitation in contractual settings. Confronted with a contract under necessity, it is not always easy to discern what voluntariness means. The seemingly simple question of what constitutes voluntary consent to a transaction involves serious theoretical problems. Ultimately, the question as to where to set the threshold is not a psychological, but a normative one. Suppose there is full information, parties are not subject to cognitive deficiencies and the contract is complete. The question is whether the constrained choice of one party renders his consent involuntary, nevertheless. In one sense, all contracts are “coerced” because of the scarcity of resources and opportunities. On the other hand, except for extreme circumstances such as actual physical force, torture or hypnotic trance, almost every exchange can be viewed as voluntary. As the ancient Romans put it: *coactus tamen volui*.⁵

Even when someone enters into a contract under a your-money-or-your-life-type threat, it is not the actual consent that is lacking.⁶ To be sure, such a threat is illegal and the contract is void for duress in virtually all modern legal systems. It is illegal because of a normative (moral) judgment about the quality of the choices available. The conventional duress doctrine draws the baseline relatively low: a threat to the physical safety of a contracting party is below this baseline. Lies and abuse of a position of confidence are also considered to be below this line, even though they belong to different doctrinal rubrics, fraud and undue influence respectively. On the other hand, many argue that the law should not be too lenient when allowing formation defenses. There are many

⁴ For a brief comparative analysis of necessity and related doctrines in a number of legal systems see (Zweigert, Kötz, 1998: pp. 327–331, 428–430).

⁵ This problem was also discussed in Aristotle’s *Nicomachean Ethics* (Aristotle, 2006: 1110a–b).

⁶ “A points a gun at B saying, ‘Your money or your life’; B accepts the first branch of this offer by tendering his money. But a court will not enforce the resulting contract. The reason is not that B was not acting of his own free will. On the contrary, he was extremely eager to accept A’s offer. The reason is that the enforcement of such offers would lower the net social product by channeling resources into the making of threats and into efforts to protect against them.” (Posner, 2007: p. 115)

pressures on a person entering into a contract, and the law should distinguish between them. Legal doctrines should restrict the circumstances in which a claimant can escape the contract. What the doctrines of contract formation should provide is a legal protection of the conditions for an autonomous choice. Others argue that the range and quality of opportunities also matter for voluntariness thus the threshold of enforceability should be set higher. One might think of different kinds and degrees of coercion and advantage-taking in this respect. It is here that the divergence of an economic and an autonomy-based philosophical view can be observed.⁷

From the perspective of economics, the question is about Pareto efficiency: “Does this transaction render both parties to it better off, in terms of their subjective assessment of their own welfare, relative to how they would have perceived their welfare had they not encountered each other?” (Trebilcock, 1993: p. 84) This criterion suggests that, regardless of the range of opportunities, when the contract has improved the situation of the person in necessity, the contract should be held valid.⁸

Philosophically minded commentators base their definition on the moral evaluation of individual actions as to their coerciveness. Starting with the classical article by Robert Nozick (1997), philosophical analysis has been concerned with drawing a distinction between (illegitimate) *threats* and (legitimate) *offers*. Threats reduce the possibilities open to the recipient of the proposal, whereas offers expand them. One of the difficulties with this approach is related to the specification of the baseline against which the proposal is to be measured. The positioning of this baseline is not self-evident. It may be statistical (what the offeree might reasonably expect), empirical or phenomenological (what he in fact expects) or moral (what he is entitled to expect). Whichever position is taken, “the distinction between threats and offers depends on whether it is possible to fix a conception of what is right and what is wrong, and to determine what rights people have in contractual relations independent of whether their contracts should be enforced” (Trebilcock, 1993: p. 80).

The main argument here is that the degree of autonomy will depend on the opportunities available to the individual. From the normative premise that individuals are entitled to some minimum level of economic well-being they infer that the law of contracts should invalidate choices when the scope of choice is limited by economic deprivation. In our view, taking this position as a foundation of contract regulation raises at least two problems. The first is that the argument assumes that invalidation is the only remedy available. Price control, administrative or judicial, may be also alternative as remedies. The other problem is linked to the so-called double bind effect (Radin, 1996). The *double bind effect* refers to the problem that „in many contexts prohibiting commodification or exchange may make the plight of the individual whose welfare is central to the commodification objection actually worse” (Trebilcock, 1993: pp. 25–

⁷ Individual autonomy is not only interesting for philosophers. Recent developments in social choice theory suggest that the „freedom of choice” is relevant for economics as well. The intuition behind this line of research is that the extent of opportunities, i.e. the number and diversity of alternatives open to an individual might be valuable in and of itself. The freedom to choose among alternatives might have some value independent of the intrinsic value of these alternatives (Sugden, 1998; Dowding, Van Hees, 2008).

⁸ To note, a full-fledged economic analysis of contracts has to take opposing incentive effects, risk-bearing, and enforcement costs, including information problems into account in their policy suggestions (Craswell, 2001).

26).⁹ If this is the case then invalidating contracts for economic necessity would be an unjustified case of hard paternalism.

As this brief overview suggests, linking necessity to a philosophical definition of coercion or exploitation is not especially fruitful. Following an idea by Richard Craswell, we suggest an alternative way of definition, based on “relative institutional competence” (Craswell 1993). Although the logic of judicial decisions would seem to require a definition before establishing whether any specific case qualifies as necessity, we proceed in the reverse direction. Craswell suggested that instead of waiting for philosophers to determine by abstract reasoning whether a contract term is (un)fair or a contract is concluded (in)voluntarily policy-makers should first look at the remedies which are desirable and available. Starting from the capacities and competences of the judiciary and the contracting parties, one should then infer back to the enforceability or otherwise of the contract (term) in question.

In particular, Craswell suggests adapting the property rule –liability rule framework (Calabresi – Melamed 1972) to contract formation problems in order to see whether and which remedies should be granted. A property rule protection of contractual consent would mean that the contract is either enforced or voided (unenforceable). A liability rule protection would mean that the judge replaces the unreasonable terms with reasonable ones. In this spirit, we suggest the following economic (incentive-based) definition of necessity, for the pragmatic purposes of contract regulation: the term necessity should refer to cases when price control is the optimal policy to minimize social costs, considering the incentive effects on the class of potential rescuers and victims.¹⁰

To be sure, as we will argue in the next section, relative institutional competence is not the single factor determining whether a contract should be considered as voluntarily concluded. Our pragmatic approach does not imply that legal or philosophical definitional endeavors are useless either. It might well be that as a matter of widely accepted legal doctrine and idea, in certain circumstances the regulation of necessity is governed by moral or political (distributive) concerns that trump efficiency considerations. What we insist on nevertheless is that there are good reasons that the techniques and the overall desirability of judicial price control should be also evaluated in terms of its efficiency.

⁹ For example, banning prostitution may eliminate an income-earning option of poor women. Even in a case of deprivation one can say that the choice to enter into prostitution does not reduce but rather increases the individual’s welfare, relative to other available options. “It is, of course, entirely legitimate to decry the absence of a richer menu of non-demeaning and self-fulfilling life choices in many of these contexts and to advocate public policies that would enlarge the choice set. However, amongst these policies, the prohibition of the problematic activity, standing alone, seems unlikely to increase [individuals]’s welfare, while clearly constraining their autonomy.” (Trebilcock, 1995: p. 374) While “prohibition will almost never have the effect of enlarging the available choice set,” there might be exceptional cases when it might help indirectly, by giving political impetus to legal reforms which in their turn lead to an enlarged set of opportunities in the long run (Trebilcock, 1995, p. 374). As an example, Trebilcock refers to British laws against child labour and the subsequent development of public schooling in the 19th century. In our context of necessity and rescue, similar dynamic efficiency considerations are explicitly discussed in (Esposito, 2002).

¹⁰ To be sure, this is not a „definition” in philosophical sense. Also, there might be cases when price regulation is reasonable but it would be anti-intuitive to call them „necessity”.

3. The model

In view of the difficulties of the philosophical definition of necessity, the starting point of our model is a stylized scenario with two players. The victim faces a potential loss and the rescuer can avoid this loss at lower costs than the victim. There are three decisions to be made in sequence. First, victim has to decide on *precaution*. Precaution includes all his *ex ante* activities in order to reduce the probability of necessity. Second, the rescuer decides on searching (*ex ante* investment in searching) and the rescue. She invests into *search* which includes all *ex ante* activities which are directed to find the victim. Third, once she has found the victim, the rescuer has to take steps to save him. This activity is called *rescue* in our model. In the first version of our model we assume risk neutrality of both parties.

First, we define the social optimum as the minimum of the social cost (SC).

$$(1) \quad SC = x + y + p \left[q_1 + \frac{1}{2} q_2 \right] - \left[-q_1 \right]$$

where

x is the precaution cost of the victim, y is the cost of search by rescuer, and c is cost of rescue in narrow sense; v is the value of the victim's loss when the rescue fails; Tr (transfer) is the price the victim pays to the rescuer in case of successful rescue. We define the three probabilities as follows:

p is the probability of the necessity which can be reduced by precaution at a decreasing rate ($\frac{\partial p}{\partial x} < 0$; $\frac{\partial^2 p}{\partial x^2} > 0$); q_1 is the probability of finding the victim which can be increased by the rescuer at a decreasing rate ($\frac{\partial q_1}{\partial y} > 0$ and $\frac{\partial^2 q_1}{\partial y^2} < 0$); and q_2 is the probability of successful rescue which can be increased

by at rescuer's cost at a decreasing rate ($\frac{\partial q_2}{\partial c} > 0$ and $\frac{\partial^2 q_2}{\partial c^2} < 0$). We assume that the optimal cost of rescue is lower than the potential loss ($c^* < v$).

The three cost components in (1) indicate the costs of the two *ex ante* activities x and y and the expected loss from necessity. The expected loss depends on the probability p ; then there are two potential outcomes: either the rescuer finds the victim (the expected cost is $q_1 + \frac{1}{2} q_2$) or not (the expected cost is $-q_1$). The probability of finding is q_1 . In the second case when the victim is not found, the loss is the full value v – occurring with probability $-q_1$. If the rescuer finds the victim she decides on rescue activity. She will pay c for the rescue cost, but the rescue will fail with probability $\frac{1}{2} q_2$ in which case v will be lost.

First, we calculate the socially optimal level of rescue activity once the victim has been found – it is at the minimum of $c + \frac{1}{2} q_2$:

$$(2) \quad c^* : \quad 1 = \frac{\partial q_2}{\partial c} v$$

As to the rescuer's decision, we distinguish three cases:

1. The rescue is a binary choice: there is only “one step” which the rescuer either takes or not. c can have only two values: $c = \frac{1}{2} c^*$. This step saves the victim with certainty: $q_2 = 1$. In this case the optimal solution can be induced by any price which is not less than the cost of rescue: $Tr \geq c^*$.

2. The rescue is also a binary choice but its success is uncertain: $q_2 < 1$. Here, due to the possibility of a failure (in which case no payment is due), the cost-based price is not enough to induce optimal rescue activity. Assuming that the rescuer is risk neutral, the price must be equal to or higher than the cost weighted by the chance of success:

$$Tr \geq c^*/q_2.$$

3. The rescue variable is continuous. In this case, the socially optimal level of rescue is defined by (2). The risk neutral rescuer will maximize her net expected revenue: $q_2 Tr - c$ and spend on rescue up to the point where

$$(3) \quad 1 = \frac{\partial q_2}{\partial c} Tr.$$

This leads to socially optimal decision if and only if the price is equal to the value of the entire loss ($Tr = v$).

After defining the optimal rescue activity, we consider the optimal level of the *precaution* (x). As (1) indicates, precaution and search activities are substitutes: the higher the one, the smaller the optimum of the other ($\frac{\partial x^*}{\partial y} < 0$ and $\frac{\partial y^*}{\partial x} < 0$). In

fact, this is an instance of the well-known paradox of compensation in the economic analysis of torts (see, e.g. Cooter, Ulen 2008: 261-267). The social optimum of both precaution and search cannot be simultaneously achieved, see *Appendix*, section 1.

Table 1 summarizes our results. The three activities precaution, search and rescue cannot be optimized simultaneously. If the price equals the full value of the rescue, this provides sufficient incentives for search and rescue. If the rescue is only a binary choice, a smaller price is enough to induce optimal decision on rescue but this will result in a suboptimal level of *ex ante* investment in search. On the other hand, precaution is optimal only if the price is equal to $\frac{c^*}{q_2}$. It is worth stressing that

contrary to suggestions in the previous literature (Shavell, 2007), the optimal price from the viewpoint of precaution is also higher than the costs. Thus, to reduce the rescuer's compensation to his costs provides insufficient incentives for the optimal level of search and rescue, except for the case of a very simple rescue situation (binary choice).

Table 1. The incentive effect of different price levels on rescue, search, and precaution

	Rescue (c)			Searching investment (y)	Precaution (x)
	Binary + certain escape	Binary + chance to failure	Many options		
$Tr > v$	OPTIMAL (c^*)	OPTIMAL (c^*)	Supraoptimal	Supraoptimal	Supraoptimal
$Tr = v$	OPTIMAL (c^*)	OPTIMAL (c^*)	OPTIMAL (c^*)	OPTIMAL (y^*)	Supraoptimal
$v > Tr > \frac{c^*}{q_2}$	OPTIMAL (c^*)	OPTIMAL (c^*)	Suboptimal	Suboptimal	Supraoptimal
$Tr = \frac{c^*}{q_2}$	OPTIMAL (c^*)	OPTIMAL (c^*)	Suboptimal	Suboptimal	OPTIMAL (x^*)

$\frac{c^*}{q_2} \rightarrow TR \geq c^*$	OPTIMAL (c^*)	Suboptimal	Suboptimal	Suboptimal	Suboptimal
$c^* > TR$	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal

As the incentives of victim and rescuer are in conflict, there is no first best optimum. A second best optimum can be calculated, see *Appendix*, section 2.

Here we focus on two cases: the court either enforces the contract as agreed upon or it reduces the price to what it considers a reasonable or fair price level. The case of enforcement will be assessed as if the price were equal to the value of the loss. Although this is a rough approximation,¹¹ it is not implausible. In serious necessity, the price of the rescue can be almost as high as the victim's willingness to pay, because of the extreme bargaining power of the rescuer. If the contracts are enforced and the price equals the full value, this leads to excess costs ($EC_{TR=v}$), i.e. social losses coming from supraoptimal precaution of the victim. On the other hand, if the rescue price is reduced to what the court considers the reasonable or fair level, there is another type of excess costs ($EC_{TR=c^*/q_2}$), indicating the social losses from the suboptimal search and rescue

level. If the regulator's objective is to minimise social losses and the policy alternatives are enforcement and price reduction, it should compare two imperfect situations: one with excessive precaution and another with suboptimal search and rescue and opt for the policy with lower excess costs.

4. Extensions

In our basic model we make three simplifying assumptions. First, search is a purposive activity; the rescuer invests in finding the victim. Formally, the probability of finding is a function of *ex ante* investment (y). Second, necessity is foreseeable for a reasonable victim and he also knows that by increasing precaution he can reduce the probability of a necessity situation occurring. Third, both the victim and the rescuer are risk-neutral and maximize their expected net benefits. Here we discuss how our results change when each of these assumptions are relaxed in turn.

Accidental rescue. If the rescuer finds the victim only accidentally, her incentives for search disappear. In this case, the optimal level of transfer is determined only by rescue and precaution. This provides clear results in case of binary choice, when the optimal amount is the costs weighted by the chance of success: $Tr = \frac{c^*}{q_2}$. To note again, even in this case, the transfer exceeds the cost of rescue, contrary to the view suggested by the cost-based price models.

Unforeseen necessity. If the necessity situation is not foreseen by the victim, the payment for rescue has no effect on his level of precaution. If the necessity is an unforeseen event, the subjective probability estimate of the victim is zero. This leads to zero precaution ($x=0$) as an individual optimum, independently of the amount of the transfer. Consequently, the optimal price depends on the incentives for search and rescue only and it will be equal to the entire value of the loss. To be sure, it is

¹¹ In real world rescue situations the price might be lower for many reasons, including reputational considerations, altruism or social norms (Esposito, 2002).

questionable whether this assumption is realistic in its pure form. It might be argued that a reasonable victim comes to such an unforeseen necessity situation at most once. Either he is rescued (for the price of his whole wealth) and learns from this experience or he does not survive. These results are summarised in Table 2.

Table 2. Optimal price for special cases

	Cases of rescue decision (c)		
	Binary; escape certain	Binary; chance of failure	Many options
Basic model	$v \geq TR \geq c^*$	$v \geq TR \geq c^*/q_2$	$v \geq TR \geq c^*/q_2$
Accidental rescue	$Tr = c^*/q_2$	$Tr = c^*/q_2$	$v \geq TR \geq c^*/q_2$
Unforeseen necessity	$Tr = v$	$Tr = v$	$Tr = v$

Victim's risk-aversion. While one can also imagine a risk-averse rescuer, we only discuss here the more plausible case when the party in necessity is risk averse. For a risk-averse victim the *ex ante* cost of an uncertain loss exceeds its expected value. As we discuss in section 3 of the *Appendix*, under certain circumstances this may (but does not need to) have the consequence that in the choice of socially optimal policy options risk aversion tips the balance towards price control for cases when otherwise enforcement would have been superior.

5. Policy implications and open questions

Our model suggests that there is no contract price which would lead to socially optimal amount of precaution, search and rescue simultaneously. Mathematically, one can calculate an optimum of second best. However, doing this calculation is not a realistic task for a real world court or even for a real world administrative body. There are too many variables to take into account and the necessary amount of information would be almost always lacking. In our world of second (or third) best we suggest nevertheless that courts should choose between the two policies indicated. This choice, in turn, should depend on a number of further considerations which we briefly discuss now. The court should choose between two options. The first is to enforce the contract “as written” (as agreed upon). As a rough approximation, this would mean that contracts with a price close to the entire value at risk should be upheld ($Tr = v$). The alternative is to reduce the price of the rescue to a “fair amount”, namely $Tr = c^*/q_2$.

Let us stress here again the main differences between our model and the existing law and economics literature. Based on the results summarized in Table 2, policy implications are straightforward in some cases. Enforcement is optimal for unforeseeable necessity, while price control is optimal when rescue is either a binary choice or accidental. In all other cases, policy implications are less clear. For those cases we suggest that the policy choice should take into account which party is the superior risk bearer.

If the incentives for search and rescue are more important than those for precaution, the price control should be more lenient. This would be in accord with more general results in the economic analysis of contract law (Posner, Rosenfield, 1977; Triantis, 2000: pp. 108–112) suggesting that for contingencies not regulated in a contract the risk should be

allocated to the least-cost risk avoider. When it is not reasonable to prevent the risk but insurance can be bought, risk should be allocated to the cheapest insurer; finally, when insurance is not available, to the *superior risk bearer*.

There are at least two further considerations which are relevant for this policy choice: enforcement costs and the availability of preliminary contracting schemes. As to the first, even putting aside the task of calculating complicated mathematical formulas like (8) and (9), one has good reasons to be skeptical about the capacity of real world courts to implement the price control policy we suggest. Of course, the difficulties are not equally serious in every context. Enforcing the agreement does not require extra judicial resources but price control requires the estimation of c^* and q_2^* . Although we do not think that judicial costs alone should be decisive on how to regulate the contract (in this respect, we do not follow Craswell's backward induction method), a reasonable pragmatic rule could be that when the optimal transfer is close to the full value (taking enforcement costs into account), price control should not be available.

The availability of private contracting schemes and non-judicial public solutions in actual necessity contexts indicate that judicial price control is not the only way to tackle with the holdup problem.¹² In many areas we actually find that private parties arrange for insurance-like solutions *ex ante* (option contracts) and/or they establish a professional rescue service for a fixed (self- or government-regulated) price. In a theoretical world of zero transaction costs, all necessity cases would be regulated by affected parties in advance, i.e. through preliminary contracts. In other words, necessity cases only arise if, for some reason related to transaction costs, victim and rescuer meet on spot the first time. Realistically, preliminary contracts or other private arrangements are not always available or cost-effective. But when such solutions are in place, one can be relatively more confident that these schemes reflect a superior combination of incentives, risk-bearing and price than what courts would be able to calibrate. In other words, judicial intervention is only justified if such a preliminary contractual solution would be prohibitively costly or otherwise impractical.

A reasonable policy seems to be to assess the different institutional solutions and distinguish case-groups where courts should both rely on private contractual mechanisms and encourage potential victims to participate. Amongst the various methods to incentivize potential victims to use non-judicial solutions, one is that when an *ex-ante* arrangement would have been reasonably available for the victim but he did not participate, courts do *not* reduce the contract price or, what amounts to the same, they do not consider the case a "necessity" case.

Before formulating a self-confident recommendation along these lines, one would need much more empirical data about how the various private and public rescue schemes operate. Probably the most developed and most well-known example is maritime rescue (Lennox-King 2007). Currently, most maritime rescue cases are governed by standard form contracts (the so-called Lloyd Open Form) which provide that the reward for rescue operations is determined by arbitrators based in London once the rescue had been

¹² "Holdup (and the related need for legal intervention in contracts) may be viewed as a consequence of parties' inability to contract at an earlier time." (Shavell 2007: 349)

successfully completed.¹³ One way to develop our argument further would be to analyse such rescue schemes from a comparative institutional perspective.

Appendix

1. The social optimum of both precaution and search cannot be simultaneously achieved.

For the victim, his privately optimal level of the precaution, at a given level of searching activity, is defined by the minimum of

$$x + p \left(\left[-q_1 q_2 y \right] + q_1 q_2 Tr \right)$$

Its first order condition, $x^*(y)$ is

$$(4) \quad 1 = \frac{\partial p}{\partial x} \left(\left[-q_1 q_2 y \right] + q_1 q_2 Tr \right)$$

Rewriting (1) we get

$$(1') \quad x + y + p \left(\left[-q_1 g_2(y^*) \right] + q_1 c^* \right)$$

Here, the first order condition is

$$(5) \quad 1 = \frac{\partial p}{\partial x} \left(\left[-q_1 q_2 y \right] + q_1 c^* \right)$$

The first term of the sum in bracket ($\left[-q_1 q_2 y \right]$) is the expected loss if the rescue fails. The second one ($q_1 q_2 c^*$) is the optimal cost in case of successful action. Comparing (1')

and (4), the optimal level of transfer is $Tr = \frac{c^*}{q_2}$.

Obviously, this amount is less than the rescuer's optimum in the third case above, when she had many options *after* finding the victim.

From (1), the social optimum of the *search* (*ex ante* investment) at a given level of precaution ($y^*(x)$) is determined by

$$(6) \quad 1 = -\frac{\partial q_1}{\partial y} p \left[-q_2 v \right] - \frac{\partial q_1}{\partial y} p \left[2v - c \right]$$

The private optimum is the maximum of $p q_1 \left[2 \left(Tr - c \right) \right] y$ where the first term is the expected revenue if the rescuer finds the victim and the second one is the certain cost of the search. The first order condition is

$$(7) \quad 1 = \frac{\partial q_1}{\partial y} p \left[2 \left(Tr - c \right) \right]$$

The optimum level of the transfer is $Tr = v$.

2. As the incentives of victim and rescuer are in conflict, there is no first best optimum. The optimum is a second best situation when social loss is minimal. This implies a price (transfer) level which minimizes the following expression:

$$\left(Tr - x^* \right) + \left(Tr - y^* \right) + p \left(\left[-q_1 g_2(y^*) \right] + q_1 c^* \right) - p \left(\left[-q_1 g_2(y^*) \right] + q_1 c^* \right)$$

The first two terms indicate the extra precaution and search costs, respectively. The next two represent the difference between the optimal and the actual expected loss. The actual loss is calculated for the case when each decision is optimal at the actual price level Tr . This optimum can be calculated mathematically under various assumptions

¹³ When a particular rescue is not governed by a standard or individually negotiated contract, in Anglo-American jurisdictions it is subject to the law of salvage, a doctrinal body of rules in admiralty law which regulates, among other issues with vague standards whether and how the rescuer should be rewarded.

about the form of the cost and probability functions. Here we simply discuss the effects of two policies in terms of their “excess costs”.

In case of full enforcement of rescue contracts the price equals the value of the loss. Here the excess costs refer to the social loss coming from supraoptimal precaution:

$$(8) EC_{TR=v} = (c_{TR} - x^*) \left[p(q_1 + q_2) - q_1 q_2 \right] + q_1 c^*$$

The first term of this expression, extra precaution cost is positive while the second is negative because $p > q_1 q_2$. As the first (positive) term is larger than the absolute value of second (negative) term, the excess loss is positive.

If the price is regulated on a cost basis, another type of excess cost arises from suboptimal search and rescue.

$$(9) EC_{TR=c^*/q_2} = (c_{TR} - y^*) \left[p(q_1 + q_2) - q_1 q_2 \right] + \left[p(q_1 + q_2) - q_1 q_2 \right] c^*$$

Here the first term which indicates the savings from the low searching cost is negative. The second term, the extra loss caused by the low searching and rescue efforts is positive. The second term is larger than the savings as the optimum is the cost minimizing solution.

Note that if the rescue involves a simple binary choice and there is only one potential step, the previous formula reduces to the following expression where the effects of suboptimal rescue are absent:

$$(9') EC_{TR=c^*/q_2} = (c_{TR} - y^*) \left[p(q_1 + q_2) - q_1 q_2 \right] + \left[p(q_1 + q_2) - q_1 q_2 \right] c^*$$

A social cost minimising regulator should compare (8) with (9) (or (9')). If $EC_{TR=v} < EC_{TR=c^*/q_2}$, enforcement of the contract should be preferred. If $EC_{TR=v} > EC_{TR=c^*/q_2}$, price reduction is the better decision.

3. Victim’s risk aversion. A risk-averse decision-maker can be modelled as considering two factors: the expected loss (EL) and its variance (VAR). For him, the ex ante cost of the necessity is a function of these two factors: $EC_{exante} = EC(EL, VAR)$. The first order optimum according to precaution is

$$(10) \frac{\partial EC_{exante}}{\partial x} = \frac{\partial EC_{exante}}{\partial EL} \frac{\partial EL}{\partial p} \frac{\partial p}{\partial x} + \frac{\partial EC_{exante}}{\partial VAR} \frac{\partial VAR}{\partial p} \frac{\partial p}{\partial x}$$

The first term indicates the ex ante cost for a risk neutral person, the second term represents risk-aversion. In our model, both the expected loss and the variance depend on precaution because the precaution reduces the probability of the necessity: $\frac{\partial p}{\partial x} < 0$.

Both the higher expected loss and the higher variance of the loss increase the ex ante cost (reduce the benefit) of the risk-averse decision-maker: $\frac{\partial EC_{exante}}{\partial EL} > 0$ and $\frac{\partial EC_{exante}}{\partial VAR} > 0$. On the other hand, a reduction in the probability of necessity clearly reduces expected loss.

A higher level of precaution also reduces the variance if the probability of the necessity is sufficiently low. More precisely:

$$VAR = (1-p) \left[q_1 q_2 Tr + (-q_1 q_2) \right]^2 + p q_1 q_2 \left[q_1 q_2 Tr + (-q_1 q_2) \right]^2 + p \left[(-q_1 q_2) \right]^2$$

Its differential is $\frac{\partial VAR}{\partial p} = -2p \left[q_1 q_2 Tr + (-q_1 q_2) \right]^2 + q_1 q_2 Tr^2 + \left[(-q_1 q_2) \right]^2$, which implies that

the lower probability reduces variance if $p < \frac{q_1 q_2 Tr^2 + \left[(-q_1 q_2) \right]^2}{2 \left[q_1 q_2 Tr + (-q_1 q_2) \right]^2}$. If

the reduction of the probability reduces the variance, then the precaution has higher marginal benefit for the victim because an additional unit reduces not only the expected loss, but the variance as well.

While the reduction in probability reduces variance (which is the case when the victim is risk-averse *and* the probability is low), the victim will set higher precaution at any given price. This, naturally, modifies the relative loss in the cases of enforcement and price reduction. The excess cost in case of enforcement in the expression (8) above will increase as with risk-aversion x_{Tr} will be higher. This may (but does not need to) have the consequence that in the policy choice between enforcement and price control, risk aversion will tip the balance towards the latter.

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