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Salvaging Historic Shipwrecks

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Abstract

The salvage of historic shipwrecks involves a debate between profit-oriented salvagers, who wish to maximize profit, and archeologists, who wish to maximize historical value. We use a principal-agent model to derive the optimal reward scheme for salvagers, including a minimum duty of care in conducting the salvage operation. A review of U.S. and international law suggests that, while there is an emerging recognition of the need to devote greater care to salvaging those wrecks that are located, current doctrines provide inadequate incentives to locate historic wrecks in the first place.

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Salvaging Historic Shipwrecks

1. Introduction

The salvage of historic shipwrecks is a matter of hot debate between archeologists, who value wrecks largely for their historical value, and profit-motivated salvage companies, who care only about their market value (Bryant, 2001). Traditional admiralty law entitles salvagers to a share of the value of salvaged ships whose owners can be located (the law of salvage), and the full value of abandoned ships (the law of finds). While these doctrines provide some financial incentive for salvagers to locate and salvage wrecks, they do not provide efficient incentives for historic wrecks whose value is largely historical. In this case, salvage is essentially a public good best provided by the government. In this light, awarding ownership of historic shipwrecks in U.S. waters to the federal government (thereby superseding admiralty law) would to be a step in the direction of efficiency, provided that the government structures an efficient reward scheme for salvagers.

Shipwrecks in international waters are also governed by admiralty law, supplemented by the United Nations Convention on the Law of the Sea (UNCLOS III), which imposes a duty on salvagers to protect the historical character of wrecks. It has recently been proposed, however, that UNCLOS III be replaced by UNESCO's *Convention on the Protection of Underwater Cultural Heritage*, which abrogates admiralty law outside of the U.S. and advocates preservation of wrecks *in situ* (Bryant, 2001). While purporting to protect historic value, this convention, if adopted, would leave wrecks vulnerable to continuing decay. In addition, it would clearly reduce or eliminate any incentive to locate wrecks in the first place, thus rendering moot discussion

of the best way to preserve their historical character. Hence, it is unclear how the convention improves on existing law.

The purpose of this paper is to provide an economic analysis of the law of salvage, as applied specifically to the salvaging of historic shipwrecks. Ideally, salvage law should mimic the outcome of a bargain between the owner of a lost vessel and a salvager. This is the approach taken in Landes and Posner (1978) in their generalized model of rescue. However, the model in this paper emphasizes two aspects unique to the salvage of historic wrecks that make the market analogy inappropriate: first, the difficulty and expense of locating these wrecks, and second, the fact that much of their value is historic (non-monetary). The latter issue is especially problematic because it limits the ability of salvage law to provide efficient incentives both to locate and properly salvage historic wrecks. In order to highlight these incentive issues, we structure the model as a principal-agent problem, where society is the principal and the salvager is the agent. After developing the model in Section 2, Section 3 re-examines salvage law as it pertains to historic shipwrecks (both U.S. and international law) to see how closely it approximates the “optimal contract.” Finally, Section 4 concludes.

2. A Model of Salvaging Historic Shipwrecks

The model makes use of the following notation:

$p(y)$ = probability that wreck will be located;

y = dollar cost of effort to locate the wreck ($p > 0, p'' < 0$);

$S(x)$ = social value of the wreck (in dollars), once located;

$M(x)$ = market value of the wreck;

x = dollar cost of the investment in salvage once the wreck is located ($S' > 0, S'' < 0, M' > 0, M'' < 0$).

We assume that $S(x) \geq M(x)$ for all x , reflecting the fact that much of the value of the wreck may be historical or archeological and hence not marketable.¹ The difference $S(x) - M(x)$ reflects the dollar value of the knowledge gained from pure scientific and historical research, as opposed to the mere sale of the salvaged artifacts (the value of which is captured by $M(x)$).² Further, we assume $S' \geq M'$ for all x . It follows that a policy of awarding property rights in wrecks to the company locating it will not create efficient incentives. This is true, first, because salvage companies will underinvest in search effort (given $M(x) < S(x)$); and, second, because they will devote too little effort to salvaging those wrecks that they do find (given $M' < S'$). This suggests a role for the government in taking ownership of historic wrecks and offering a reward for their location and salvage. We therefore examine the choices of x and y in a principal-agent framework with the government as the principal and the salvage company as the agent.

As a benchmark for deriving the optimal reward scheme, we note that the efficient choices of x and y maximize the expected social value of the wreck:

$$p(y)[S(x) - x] - y. \tag{1}$$

Since x is chosen once the wreck is found, x^* maximizes $S(x) - x$ and hence is defined by the first order condition

$$S'(x) - 1 = 0. \tag{2}$$

¹ Throckmorton (1990) suggests a method for assigning a dollar value to archeological knowledge.

² In this sense, salvage of an historic shipwreck has many of the characteristics of academic research in general.

The optimal choice of y is then found by maximizing (1) evaluated at x^* , which yields the first order condition for y^* :

$$p'(y)[S(x^*)-x^*] - 1 = 0. \quad (3)$$

Now consider a general reward scheme that specifies a payment schedule conditioned on the outcome of the search for a wreck--specifically, R_S is the reward for success and R_F is the reward for failure (where $R_F < 0$ is allowed)--and a minimum effort, x (for example, the number of days), that must be devoted to the salvage operation.³ In deriving this scheme, we assume that the principal can monitor the salvage company's choice of x but not its search effort y . We therefore write the principal's problem as follows:

$$\max_{R_S, R_F, x} p(y)[S(x)-R_S] - (1-p(y))R_F \quad \text{subject to:} \quad (4)$$

$$y = \operatorname{argmax} p(y)(R_S-x) + (1-p(y))R_F - y \quad (5)$$

$$p(y)(R_S-x) + (1-p(y))R_F - y \geq \pi_0. \quad (6)$$

Constraint (5) (the incentive compatibility constraint) reflects the principal's inability to observe y , while (6) (the participation constraint) ensures that the salvage company (the agent) is willing to participate in the contract.

Consider first the incentive compatibility constraint. The first-order condition implied by (5) is

$$p'(y)(R_S-R_F-x) - 1 = 0, \quad (7)$$

which implicitly defines the search function $\hat{y}(R_S, R_F, x)$. Differentiating (7) yields

$$\frac{\partial \hat{y}}{\partial R_S} = \frac{-p'}{p''(R_S - R_F - x)} > 0, \quad (8)$$

³ Since the constraint will be binding, the minimum and actual values of x will coincide.

$$\frac{\partial \hat{y}}{\partial R_F} = \frac{\partial \hat{y}}{\partial x} = \frac{p'}{p''(R_S - R_F - x)} < 0. \quad (9)$$

Thus, a larger reward for success elicits greater search effort, while a larger reward (or smaller fine) for failure and a larger required investment in salvage once the wreck is found both reduce search effort.

One way to proceed in deriving the optimal contract is to eliminate (5) by maximizing (4) subject to (6) with $y = \hat{y}(R_S, R_F, x)$. The resulting first-order conditions for R_S , R_F , and x (after substituting from (7)) are

$$-p(1-\lambda) + p'(S-R_S+R_F)(\partial \hat{y} / \partial R_S) = 0 \quad (10)$$

$$-(1-p)(1-\lambda) + p'(S-R_S+R_F)(\partial \hat{y} / \partial R_F) = 0 \quad (11)$$

$$p(S'-\lambda) + p'(S-R_S-R_F)(\partial \hat{y} / \partial x) = 0, \quad (12)$$

where λ is the multiplier on (6). Using (8) and (9), we can combine (10) and (11) to show that $\lambda=1$, which implies that the participation constraint is binding. It follows that the optimal contract satisfies

$$R_S = R_F + S \quad (13)$$

and

$$S'(x) - 1 = 0. \quad (14)$$

Comparing (14) and (2) implies that $x=x^*$, while substituting (13) into (7) implies that $y=y^*$. Thus, the optimal contract specifies both an efficient level of search and an efficient level of salvage once a wreck is found. This reflects the well-known result that the principal's optimal contract implements the first-best outcome when the agent is risk-neutral (Mas-Colell, Whinston, and Green, 1995, p. 482). Finally, we can solve (13) and (6) (written as an equality) simultaneously to obtain explicit expressions for R_S and R_F :

$$R_S = \pi_0 + y^* - p(y^*)[S(x^*) - x^*] + S(x^*) \quad (15)$$

$$R_F = \pi_0 + y^* - p(y^*)[S(x^*) - x^*]. \quad (16)$$

Figure 1 shows the locus of points defined by (13) (given $x=x^*$) in (R_S, R_F) space. All points on this locus induce $y=y^*$, while points below it induce $y<y^*$ and points above it induce $y>y^*$. As shown, the principal's optimal contract lies on this locus and hence induces efficient search effort. However, there are two impediments to the implementation of this contract in practice. First, note that the optimal value of R_F is negative, implying that the salvage company must pay a "fine" for failure. In contrast, R_F will probably be constrained to equal zero (as under the law of salvage), or at least to be non-negative.⁴ If the reward scheme is limited to a payment for success (points on the vertical axis), then the optimal contract will be second-best; that is, it will involve an inefficient level of search (i.e., $y<y^*$).⁵ This can be seen in Figure 1, which shows that if $R_F=0$, the salvage company can only be induced to choose $y=y^*$ if $R_S=S(x^*)$ —that is, if it is awarded the full social value of the wreck. Clearly, this will not be consistent with the principal's optimal contract.

It is important to note, however, that even in the second-best contract, the principal will instruct the salvage company to invest in the efficient level of salvage once a wreck is located (i.e., to set $x=x^*$). To see this formally, note that combining (10) and (12) (with $R_F=0$) yields (14) for any value of λ . This result makes sense once we recognize that the salvage company's net reward for locating a wreck is $R_S - x$. Thus, the principal can set $x=x^*$ to achieve efficient salvage (thereby maximizing the value of the

⁴ For example, the agent may require a minimum return in all states (Cooper, 1984).

⁵ The optimal contract will also be second-best if the agent is risk averse (Holmstrom, 1979).

treasure to be divided) and then simply adjust R_S to achieve the desired incentive for search.

As noted, the second-best contract involves setting $R_S \leq S(x^*)$ (given $R_F=0$), but even this scheme may not be feasible for historic wrecks because there is no guarantee that the optimal reward will be less than the monetary value of the wreck, M . To illustrate, the darkened segment of the vertical axis in Figure 1 shows the set of contracts for which $R_S \leq M(x^*)$, and this segment may or may not include the second best contract. This suggests that a reward scheme based on assigning full or partial property rights in a wreck to the finder (as under salvage law) will not only fall short of the first-best outcome, it may even fail to achieve the second-best outcome. Further, sale of the salvaged treasure for the highest prices (i.e., maximization of M) under such a scheme may involve dispersal of the artifacts, which will compromise the archeological value of the find.

These results suggest that a market approach to the structuring of salvage law may be inappropriate for historic shipwrecks. Instead, awarding ownership to the government—in effect treating historic wrecks like public goods--may be the best way to provide efficient incentives for their location and salvage.

3. Application of the Analysis to the Law of Salvage

In this section, we examine the law governing salvage of historic shipwrecks in light of the foregoing analysis. We first consider U.S. law and then turn to international law.

3.1. U.S. Law

Traditionally, the salvage of historic shipwrecks in U.S. waters has been governed by the ancient doctrines of admiralty law. The relevant doctrines are the law of salvage and the law of finds.⁶ Under the law of salvage, the wreck remains the property of the owner, but salvagers are legally entitled to a court-determined award, usually specified as a percentage of the value of the property rescued.⁷ The law of salvage is therefore most applicable to modern shipwrecks whose owner is known and where most of the value is monetary. The law of finds, in contrast, applies to the salvage of abandoned ships, and hence is the more relevant doctrine for most historic wrecks. Under the law of finds, the locator of a wreck becomes the sole owner once he makes certain affirmative efforts toward actually taking possession of the wreck. (Mere location is not sufficient to acquire title.)

By awarding property rights in a wreck to the finder, admiralty law provides financial incentives for the salvage of property lost at sea, but it has been criticized for failing to adequately protect the archeological value of historic wrecks. This shortcoming prompted Congress to enact the *Abandoned Shipwreck Act* (ASA) of 1987,⁸ which noted that, in addition to their monetary worth, “shipwrecks offer recreational and educational opportunities to sport divers and other interested groups, as well as irreplaceable State resources for tourism, biological sanctuaries, and historical research.” This reflects the assumption in the model that the social value of historic wrecks exceeds their monetary value (i.e., $S(x) \geq M(x)$).

⁶ Strictly speaking, the law of finds originated in the common law rather than admiralty law, but it is now also considered a maritime concept (Bryant, 2001, p. 119).

⁷ The size of the salvage award depends on several factors: the degree of marine peril; the value of the property recovered; the risks incurred by the salvagers; their promptness, skill, and energy; the value of the equipment used in the salvage operation; and the amount of labor expended (Bryant, 2001, pp. 122-123).

⁸ 43 U.S.C. §§ 2101-2106.

Significantly, the ASA explicitly abrogates admiralty law for *abandoned* shipwrecks in U.S. waters.⁹ For these wrecks, title vests with the U.S. government, which then transfers it to the state in whose waters, or on whose submerged land, the wreck lies. Salvagers are thereby barred from asserting claims under the law of finds for wrecks covered by the ASA; instead, they must obtain a state-issued permit to proceed with salvage. This preemption of admiralty law reflects the view of Congress that states can better manage the salvage of historically important wrecks, “a view surely supported by archeologists” (Bryant, 2001, p. 128).

As the model showed, government control of salvage is also potentially desirable from an economic perspective because it allows an efficient approach both to the protection of the historical integrity of wrecks by establishing appropriate guidelines for salvage (i.e., by requiring that $x=x^*$); and to the location of wrecks by offering adequate awards to finders. (Indeed, nothing prevents states from implementing the first or second-best contracts described above.) In practice, however, the permit system varies by state, and in some states, does not exist at all. These failings of the ASA, as it is currently structured, probably make it inferior to admiralty law in terms of economic incentives to locate historic wrecks. And until a wreck is located, guidelines for its salvage are irrelevant.

⁹ “The law of salvage and the law of finds shall not apply to abandoned shipwrecks to which section 2105 of the title applies” (43 U.S.C. § 2106 (a)). In determining whether a ship is abandoned, courts consider several factors, including the time that has passed since the wreck was lost, the steps taken by the original owner to recover it, and whether the owner has given up all hope of recovery (Bryant, 2001, p. 119). Ships not judged to be abandoned are still covered by the law of salvage, which has given rise to considerable litigation over the status of certain wrecks. See, for example, *California v. Deep Sea Research*, 523 U.S. 491 (1998), which concerned the wreck of the historically important *Brother Jonathan*, found in the waters off California. The finder, Deep Sea Research, claimed rights to the cargo under the law of salvage, but California claimed title under the ASA.

Wrecks not judged to be abandoned continue to be covered by admiralty law-- specifically, the law of salvage. Although salvage law provides some incentives to locate wrecks, as noted, it fails to provide for the protection of the archeological value of historic wrecks. Recently, however, admiralty courts have begun to address this deficiency by recognizing an “Archeological Duty of Care,” which ties salvage awards to salvagers’ efforts to preserve archeological data and artifacts associated with historically valuable wrecks (Bryant, 2001, pp. 138-144). For example, in *Marex Int’l, Inc. v. The Unidentified, Wrecked and Abandoned Vessel*, the court stated that, in order to claim an award, finders and salvagers must “document to the court’s satisfaction the shipwreck’s archeological ‘provenance data’ ...by mapping or recording the location, depth and proximity of each artifact recovered in relation to other artifacts.”¹⁰ In contrast, in *Klein v. The Unidentified Wrecked and Abandoned Vessel*,¹¹ the court denied a salvage award to a salvager who had made no effort to protect the archeological value of the wreck.

This development in salvage law is consistent with the fact that salvagers will generally underinvest in salvage effort, even if awarded exclusive rights to a wreck, absent a legal duty of care. It further suggests that, considering incentives both to locate and salvage historic wrecks, salvage law may now be superior to the ASA from an economic perspective, as both are currently structured.

3.2. International Law

Salvage of historic shipwrecks in international waters is currently governed by the United Nations Convention on the Law of the Sea (UNCLOS III), which specifies that

¹⁰ 952 F.Supp. 825, 829 (S.D. Ga. 1997). Also see *Cobb Coin Co. v. The Unidentified, Wrecked and Abandoned Sailing Vessel*, 549 F.Supp. 540 (S.D. Fla. 1982); and *Columbus-Am. Discovery Group v. Atl. Mut. Ins. Co.*, 974 F.2d 450 (4th Cir. 1992).

¹¹ 758 F.2d 1511 (11th Cir. 1985).

member countries recognize a “duty to protect objects of an archeological and historic nature found at sea” (Article 303(1)). The convention does not, however, abrogate admiralty law, thereby leaving in place the financial incentives (embodied in the laws of salvage and finds) to locate wrecks.¹² In this sense, current international law resembles U.S. law for wrecks not covered by the ASA.

The recently proposed UNESCO *Convention on the Protection of the Underwater Cultural Heritage* (adopted in November, 2001), if ratified, would supercede UNCLOS III. While the *Convention* heavily favors archeological values, it appears to discount salvage value completely. (For example, it would abrogate admiralty law in international waters.) This is evident from the first two rules abstracted from the annex to the document:

Rule 1. The protection of underwater cultural heritage through *in situ* preservation shall be considered as the first option. Accordingly, activities directed at underwater cultural heritage shall be authorized in a manner consistent with the protection of that heritage and subject to that requirement may be authorized for the purpose of making a significant contribution to protection of knowledge or enhancement of underwater cultural heritage.

Rule 2. The commercial exploitation of underwater cultural heritage for trade or speculation or its irretrievable dispersal is fundamentally incompatible with the protection and proper management of underwater cultural heritage. Underwater cultural heritage shall not be traded, sold, bought, or bartered as commercial goods.

¹² Article 303(3) of the United Nations Law of the Sea states that “nothing in this article affects the rights of identifiable owners, the law of salvage or other rules of admiralty, or laws and practices with respect to cultural exchanges.”

The practical effect of these rules, if implemented, is that most historic wrecks in international waters will remain undiscovered because of the lack of financial incentives to expend the necessary resources. And even for wrecks that have been located, it is debatable whether preserving them *in situ* is consistent with the stated objective of the *Convention* since they will remain inaccessible to most scholars (not to mention the interested public) and are subject to further decay.

What then accounts for the extreme nature of the *Convention*? One explanation is that the archeological value of historic wrecks will increase over time if left unsalvaged. Archeologists often leave land-based sites only partially excavated so that future researchers using improved methods can learn more about the site. However, this argument is only consistent with the maximization of the social value of shipwrecks if the expected rate of improvement in salvage technology exceeds the rate of decay of the site.

Another, more likely, explanation is that the *Convention* is politically motivated and is aimed at promoting the interests of Third World countries at the expense of developed countries. Developed countries disproportionately possess the latest underwater exploration technologies and the funds needed to utilize them. Thus, they stand to profit most from commercial exploitation of shipwrecks outside of their territorial waters.

4. Conclusion

This paper has applied economic analysis to the problem of salvaging historic shipwrecks. Compared to modern wrecks, historic wrecks present two problems: the difficulty of locating them, and the fact that much of their value is non-monetary. As a result, we argued that the traditional law of salvage does not generally provide adequate

incentives for profit-motivated salvagers either to find or adequately salvage these wrecks. This leaves scope for the government to take ownership of wrecks and structure an efficient reward scheme. For wrecks in U.S. waters, passage of the Abandoned Shipwreck Act of 1987, which abrogated admiralty law for abandoned wrecks, appeared to be a step in that direction. As currently implemented, however, the ASA, if anything, seems to offer inferior incentives for locating wrecks compared to admiralty law. Moreover, admiralty courts have begun to impose due standards of care for the salvage of historic wrecks not covered by the ASA in accordance with their historic value. This suggests that, when incentives for both location and salvage are taken into account, admiralty law may be superior to the ASA in terms of economic efficiency.

As for international law, admiralty principles still dictate salvage awards, while UNCLOS III establishes a duty of care for salvaging historic wrecks (though enforcement measures are largely absent). However, a recently proposed U.N. Convention on historic wrecks, which abrogates admiralty law and advocates *in situ* preservation, would likely worsen matters by removing any incentive for salvagers to locate these wrecks and by preventing even responsible salvage efforts of those that are located.

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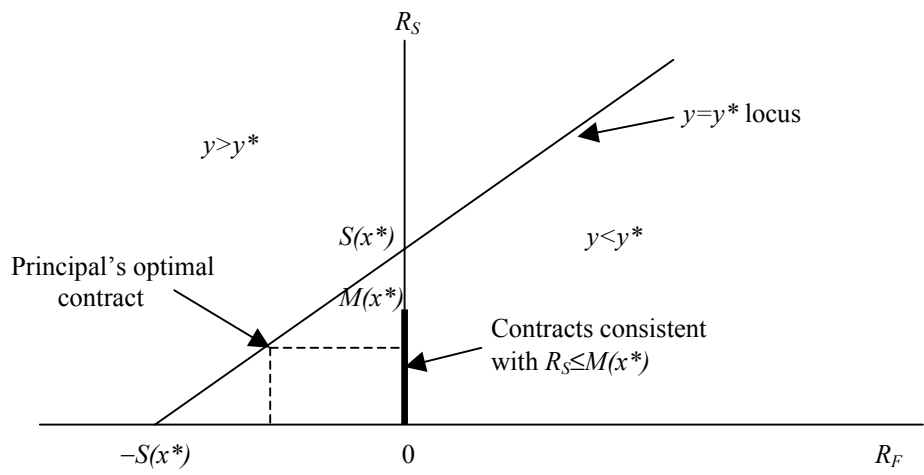


Figure 1.