Protecting Antiquities: A Role for Long-Term Leases?*

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140 countries have adopted bans on exports of antiquities, in part because these are seen as needed to protect cultural heritage for future generations. However, if enforcement is imperfect, export bans may be counterproductive, spurring the growth of a black market trade which can damage objects and obscure the archaeological record. We argue that allowing fixed-duration, long-term leases of antiquities or sales contracts with a pre-arranged repurchase option could achieve most of the goals of export bans while at the same time raising revenue for the source country and improving incentives for maintenance and revelation of antiquities in de facto private hands. While option contracts may be useful in the presence of credit constraints because they shift more revenue forward, leases are optimal mechanisms for resolving hold up and more robustly protect antiquities when officials in charge of cultural patrimony may be corrupt.

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Dull is the eye that will not weep to see
Thy walls defaced, thy mouldering shrines removed
By British hands, which it had best behoved
To guard those relics ne'er to be restored.
Curst be the hour when from their isle they roved,
And once again thy hapless bosom gored,
And snatch'd thy shrinking gods to northern climes abhorred!

- Byron, Childe Harold's Pilgrimage.

1 Introduction

From 1801 to 1812, Lord Elgin, the British ambassador to the Ottoman Empire, had workers remove and ship to England 75 meters of the original 160 meter Parthenon Frieze, structurally weakening the remainder of the Parthenon. Elgin claimed he received permission from Ottoman officials, but the Greek government has long sought their return, challenging the legitimacy of the permissions allegedly granted by Ottoman officials.

To avoid similar situations, most countries ban exports of certain antiquities. Beginning with restrictions imposed by the Vatican on the right of churches to sell off relics and art, export bans have spread to 140 countries around the world. 119 countries, including the United States and most of Europe, have ratified international treaties[1] designed to bolster enforcement of these export bans by committing to return all objects declared national property and illegally exported after the conventions' ratification dates.

However, illegal international trade continues, often with enormously destructive, potentially irreversible, consequences for cultural heritage. Mali and Nigeria provide examples of the scale of the problem. Ross (1995) estimates that over 50 percent of

[1]The UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer Of Ownership of Cultural Property and the 1995 UNIDROIT Convention on Stolen or Illegally Exported Cultural Objects.

archaeological sites in Mali have been severely damaged or destroyed by illegal looting. At least seven large museums in Nigeria have been the victims of major robberies in the last three decades, with estimated losses of up to $200-250 million from a single case (Akinade, 1999; Shyloon, 2000).

Indeed, in cases when enforcement power is limited, export bans may exacerbate the risk that antiquities will be destroyed. Income gaps across countries can create enormous pressure for smuggling, particularly in countries with weak rule of law and low incomes. By cutting those with de facto partial control over antiquities off from a major source of legitimate revenue, bans may weaken incentives to reveal or maintain antiquities in private hands, and may create incentives to loot them or remove them from state control altogether by selling them on the international black market. This illegal trade may be particularly damaging to cultural heritage because those engaging in this trade must work quickly and surreptitiously. Looters use fast methods of excavation such as dynamite, and pneumatic drills (Coggins, 1972; Bator, 1982; Prott & O'Keefe, 1990), work to keep site locations secret, and often obscure the origin of objects by intentionally damaging sites and breaking objects into fragments to pass international borders.

Under export bans, those in possession of artifacts of illegal or uncertain status, whether in the country of origin or in another country to which the objects have been transferred, have disincentives to reveal them by lending them to museums or to have them photographed and documented for scholarly inquiry. If those in possession of these artifacts do not have the means or interest to maintain the objects and are unable to sell them to those who do, the objects may be at risk of damage or destruction.

Since antiquities are irreplaceable, and potentially of great value to future generations, it may be appropriate to seek policies that robustly protect antiquities across a range of different circumstances. In particular, since antiquities from countries with

Figure 1: Before and after picture of an inscribed stone recovered in 1999. The Stele was part of the Bantaey Chhmar complex in Cambodia that was systematically looted in 1998-1999. Stolen objects included two 12 meter wall sections that were cut into blocks and intended for international sale. Original pictures taken by Luc Ionesco (1962) (EFEO collection) and Claudio Jacques (1999) (UNESCO collection).

limited state capacity are at the most risk, one might seek policies and institutions that can robustly protect antiquities even in circumstances where state officials may be corrupt, and where the state has limited enforcement power.

To help identify policies which could robustly perform well across a range of circumstances, we model both circumstances in which export bans would be preferable to free trade in antiquities, and circumstances in which export bans could be counterproductive, leading to destruction of cultural heritage. We argue that across a range of different circumstances, allowing limited-duration leases achieves most of the potential benefits of complete export bans, while mitigating the incentive problems that arise from export bans that can perversely increase risks to antiquities.

For many economists the default assumption might plausibly be that antiquities should be subject to free trade. In order to model leases as an alternative to an export ban, we consider a model in which such bans serve some role. In particular, we assume

that at least some citizens value having certain antiquities in the country of origin. At some level, there can be little doubt that at least some Greek citizens would prefer the Elgin Marbles to be in Greece, or that some U.S. citizens would react adversely to the sale of the Liberty Bell or the Statue of Liberty. We also assume the value citizens place on antiquities can change over time.

Even if the current use value of an object is currently less at home than abroad, a benevolent government may prefer not to sell the object outright in order to avoid potential difficulties in later recovering the object in potential future states of the world in which the object is valued more at home than abroad. A number of transaction frictions may prevent reacquisition. In particular, attempts by foreign owners to extract surplus may prevent efficient repurchase transactions *ex post*.

We consider two contracts that preserve long-term ownership rights for the home country and eliminate the repurchase hold-up problem: a lease contract and an "option" contract where an object is sold with an explicit option to repurchase the object at a *pre-arranged* price. In the absence of credit constraints, leases dominate both sale-and-repurchase and option contracts. With credit constraints, governments may prefer options to leases since they can relieve credit constraints by allowing objects to be used as collateral for borrowing. Both leases and options are also likely to mitigate other frictions that make repurchase difficult such as foreign tax policies that discourage re-exportation, endowment effects that make museums reluctant to give objects up once they have them, museum regulation, and legal costs.

After considering a benchmark model with a benevolent government, we consider an extension of the model in which there is a probability that government officials in any period may be corrupt. Corrupt officials can collude with foreign collectors to allow sales and divide the resulting rents. We show that in this case, a blanket ban on export of antiquities may be preferable to either free trade or allowing government officials

case by case discretion to allow exports.

However, over a broad range of probabilities that future officials will be corrupt, allowing leases will be preferable to either free trade or complete export bans. Leases prevent the expropriation of value from future generations while still granting freedom to optimally allocate usage rights today. Option contracts are less attractive in this environment since they generate upfront rents that can be expropriated.

Having considered two potential environments in which export bans might be preferable to free trade, and argued that allowing leases while banning sales could achieve most of the potential benefits of complete export bans, we then model a setting in which export bans are counterproductive, perversely increasing risks to antiquities. We argue that modifying export bans by allowing fixed-term leases could mitigate these risks. In particular, we consider an economy in which the government has limited enforcement capability, and banning legitimate exports induces those with de facto partial control over antiquities to sell objects on the black market or to stop maintaining the objects. In such a setting, allowing limited duration leases could generate rents for those with de facto control, helping preserve objects. Moreover, leases are an attractive way to provide de facto owners with the necessary rents, because they automatically tie the value of rents to the value of the object without requiring potentially corruptible agents to individually appraise objects. Such leases might also be used to locate objects previously smuggled abroad by granting short-term amnesty and public usage rights in exchange for future repatriation.

In summary, our results suggest that neither free trade nor export bans robustly protect cultural heritage. Under free trade, objects that generate tremendous psychic benefits for citizens may be exported and may be difficult to repatriate. Allowing officials the discretion to allow export of antiquities creates a risk that if the relevant official is corrupt or incompetent, antiquities may be permanently lost. The existing

international system of export bans and treaties committing receiving countries to return antiquities illegally exported after a certain date can be seen as an attempt to address these issues. Export bans may indeed protect antiquities if enforcement is strong and owners have adequate incentives to maintain options without the option of selling them to foreign collectors. However, in environments in which enforcement capability is limited and current de facto owners lack sufficient resources or incentives to maintain objects, export bans may lead to the destruction of objects. Legislation allowing fixed duration international leases, but not sales, can more robustly preserve antiquities than either free trade or export bans. Of course leases also generate the standard benefits associated with freedom to transact internationally — allowing the rest of the world to benefit from exposure to antiquities from the country of origin while raising revenue for that country.

The rest of the paper is organized as follows. Section Two sets up a simple benchmark model in which some citizens may derive an externality benefit from knowing that the antiquity is in the home country and this value can potentially change over time, providing a potential rationale for government regulation on antiquities. Section Three models transaction costs associated with sale and resale of commodities in such an environment, focusing on the potential for hold up by foreigners. Section Four models policy when there is a positive probability that future government officials will be corrupt. Section Five models the potential for export bans to be counterproductive if enforcement power is limited.

Section Six discusses various precedents and existing discussion of leases in the art world. It also addresses some practical issues around implementation of leases, noting for example, that lease transactions that do not involve exchanges of cash, but rather provision of assistance with archaeological excavation, preservation, and other cultural activities are less likely to raise repugnance concerns and may satisfy political economy

constraints. Section Six also discusses mechanisms for ensuring leaseholders exercise proper care of objects based on the legal and other institutions currently used for loans between museums. We argue it would be useful to have standardized contracts and the involvement of international organizations so as to ensure that programs are transparent, adequately safeguard antiquities, and attract as many legitimate bidders as possible.

2 The Benchmark Model

We first develop a benchmark model in which citizens may care about having objects in the country of origin. The extent to which citizens value maintaining antiquities relative to other priorities may vary over time. For example, citizens may become more educated over time, tastes for art may change, national identity may evolve, and income levels may change. In the short run, the flow consumption value of keeping the item at home is less than the short-run flow consumption value of renting the object to the highest value foreigners. However, if the object may later be valued more at home than abroad, and if transaction costs make it impossible to recover the object later at a price corresponding to the valuation at home, then selling the object may not be optimal.

For some intuition on why leases may be an attractive contract, consider an analogy to a faculty member going away on sabbatical for a year. If the faculty member places higher value than others on use of the house in the long term, but lower value than others during the sabbatical year, the faculty member would likely rent the house rather than selling it and then trying to repurchase it after the sabbatical. Similarly, a benevolent government that foresees that its citizens' might someday place high value on an antiquity might prefer leases over sales to reduce exposure to hold up and to minimize other transaction costs.

To get some intuition for when sales with options to repurchase at a predetermined price might be attractive when a country is credit constrained, consider an analogy to someone who has run out of cash on Tuesday and isn't paid until Friday, but owns a guitar. They might pawn the guitar to raise cash for immediate needs, planning to redeem it in a few days. Similarly, selling the object with an option to repurchase at a fixed price in the future can generate large up front revenue while maintaining many of the advantages of a lease.

In the benchmark model, we consider a single antiquity, referred to as the object, which is initially in the hands of a social planner who must decide whether to keep it or sell it abroad. The *social planner* is benevolent and maximizes social welfare for its constituents.[2] At each time, $t \in \{0, 1, \ldots, \infty\}$, the government's constituents get utility from domestic antiquity "usage", x_t, and non-antiquity consumption, c_t.

Relative to the size of the total budget, the value of the object is assumed to be small. As such, we simplify the problem by assuming a linear tradeoff in each period between art usage and other consumption. Defining d_t as the sum of the *domestic* citizens' valuation for having the object in the country, social utility in each period defined as

$$u(c_t, x_t) = (1 + \gamma_t)c_t + d_t x_t, \tag{1}$$

where $1 + \gamma_t$ represents the marginal utility of consumption.

We allow the marginal utility of consumption to vary over time, as might be the case if countries face constraints on international borrowing. Initially, we abstract from credit constraints such that $\gamma_t = 0$ for all t. Later, we relax this assumption and consider the case where $\gamma_0 > \gamma_t$ for all t. Similarly, we allow the *domestic* taste for art, d_t, to be stochastic with the potential to change over time. Let d_t be bounded between

[2]Section 4 considers a situation in which government officials are not necessarily benevolent.

$\underline{d}$ and $\overline{d}$ and distributed according to the *home* country cdf $H_t(.)$ with associated pdf $h_t(.)$. d_t is unknown to the home country until period t so that any contracting before period t can only take into account the distribution of d_t, but not its actual realization.

All actors in our model share a common intertemporal discount rate of δ and can save on assets at interest rate R; however, the social planner might be credit constrained. We assume $\delta R = 1$ so that in the case of no credit constraints ($\gamma_t = 0$ for all t), the social planner would smooth consumption over time and keep the object in the country for domestic use in periods when d_t is greater than the income generated from moving it abroad. In section 3.3 we allow for credit constraints and consider the case where the home country prefers to collateralize objects and consume the proceeds today to better smooth intertemporal consumption.

There are $i \in \{1, \ldots, N\}$ foreign collectors who are potentially interested in using a legally procured object. Each foreign collector has a private per-period value for art consumption a^i bounded between $\underline{a}$ and $\overline{a}$ and distributed according to the time-invariant cdf $F(.)$ with associated pdf $f(.)$. We assume that foreign collectors have a linear utility function with per-period utility $v_t^i(c_t, z_t) = c_t + a^i z_t$, where $z_t \in \{0, 1\}$ is a binary variable that is 1 when the foreign collector legally keeps the object abroad. Without loss of generality, we assume that the buyers are ordered in ascending value. Thus a^N and a^{N-1} represent the highest and second highest values respectively.

Timing— Our model assumes an initial law-writing phase and a sequence of future periods each divided into a contracting and consumption stage. In the law-writing phase, the social planner can write laws constraining future domestic actors.[3] Initially, we assume that the social planner has a choice only between allowing free trade or imposing autarchy by passing an export ban which restricts foreign usage to zero. We

[3]While in principal there could be a law-writing phase in each period, we are interested in situations when the passing of laws binds future generations. The single law-writing phase is the most direct way to model this legislative inertia.

then expand the set of possible polices and allow for explicit restrictions on the types of contracts allowed in the market.

Subsequent to the initial law-writing phase, actors play an infinite sequence of periods each comprised of two stages: a contracting stage and a consumption stage:

1. **Contracting:** In the contracting stage, the owner of the object chooses whether to offer it to potential buyers. We make two key assumptions. First, we assume that the owner of the object determines the selling procedure, thereby maximizing his profits, subject to the laws imposed within their jurisdiction (for instance, using an optimal auction mechanism). Second, we assume that the owner of the object can commit to the selling procedure he selects and does not attempt to price discriminate intertemporally.[4]

2. **Consumption:** All players consume their valuations for the current period and play continues to the next period.

In section 5 we introduce an additional maintenance stage in which parties must also invest in maintenance in order to prevent the destruction of the object. As maintenance pushes policies toward free markets, we do not explicitly consider it in sections 3 and 4 since these sections explore reasons why restrictions on the market structure might make sense even when maintenance is guaranteed.

3 Transaction Costs

In the model above, if domestic valuation is less than foreign valuation today, but is greater in the future it might make sense for an object to leave in the short run and come back in the long run. However, a variety of transaction costs may make

[4]See section 3 for a brief discussion of commitment.

it difficult to repurchase the object in the future. For example, foreign tax regimes may encourage donations to domestic museums, and museum regulation may make it difficult or impossible to sell the object to the home country. Endowment effects, whereby buyers become attached to objects in their possession, could also lead to a gap between the sale price and the repurchase price. We focus on the role of asymmetric information in creating transaction costs since uncertainty over the future value of art may be important.

This section begins with a simplified version of our benchmark model which illustrates the hold-up problem inherent in selling the object knowing that one may wish to repurchase it later. We then show that leases can resolve the inefficiencies that exist in sales contracts and achieve the constrained optimum in the absence of credit constraints. Finally, we explore the relative efficiency of leases and options with credit constraints.

Starting with the analysis of sale and repurchase contracts, consider a special case of the model where initially the domestic taste for art is small so that $d_0 = \underline{d} < \underline{a}$. However, there is potential for the country to value art in the future. Let d_1 be drawn from a distribution with cdf $H_1(.)$ and assume that all exogenous variation is resolved at this point so that $d_t = d_1$ for $t \geq 1$. Further assume that $H_1(\underline{a}) > 0$ and $H_1(\bar{a}) < 1$. That is, there exist future states of the world in which the citizens in the home country do not value the object, and there also exists states of the world in which the domestic usage value is so high that the home country wishes to repatriate the object with certainty.

Foreign collectors' private values for art consumption $a^1, \ldots, a^N$ are independent and identically distributed (*iid*) with cdf $F(.)$ and associated pdf $f(.)$. We assume that foreign buyers are risk-neutral and do not face credit constraints. Under these characteristics, if an object is sold using an optimal auction for sellers, the winner of

the auction will be the foreign collector with the highest intrinsic valuation for the object a^N.

As all uncertainty is resolved after the first period, the special case of our model can be thought of as a two period allocation problem with valuations as follows:

$$\begin{array}{lcc} & \underline{\text{Period } 0} & \underline{\text{Period } t > 0} \\ \text{Domestic} & d_0 = \underline{d} & d_t \sim H_1(.) \\ \text{Foreign} & a_0^i \sim F(.) & a_t^i = a_0^i \end{array} \tag{2}$$

In period 0, all foreign collectors have greater value for object than the home country and thus the object should be moved abroad in a first-best world. In period 1, the home country learns its new domestic valuation and may value the object more than foreigners so the first best demands the object to be repatriated in some states of the world.

3.1 Sales Contracts with Future Repurchase

A consequence of selling an object to a foreign collector without specifying repurchase clauses is that the sale of the object also grants the foreign collector the right to choose the mechanism in future repurchase negotiations. To understand how the transfer of contracting power influences efficiency, we separate the analysis into its two contracting phases: a sale phase in which the home country auctions the object to the foreign buyers, and a repurchase phase in which the foreign collector who won the object in period 0 offers the object back to the home country in period 1. In order to analyze the contract, we first construct the optimal mechanism for the foreign collector attempting to sell the object back to the social planner in period 1. Using the expected revenue from this resale auction, we then return to period 0 to analyze the efficiency of the initial sale.

Phase 2: Repurchase Phase. For readability define the hazard rate of the distributions

$H_t(.)$ and $F(.)$ as

$$\psi_{H_t}(d_t) = \frac{h_t(d_t)}{1 - H_t(d_t)}, \psi_F(a) = \frac{f(a)}{1 - F(a)}. \tag{3}$$

We assume the problem is "regular" in a mechanism design sense so that both $\psi_{H_t}(d_t)$ and $\psi_F(a_0^i)$ are increasing functions.

The foreign collector in our problem has commitment power and thus selects the mechanism that maximizes his *ex-ante* expected utility.[5] To avoid the decrease in monopoly power associated with intertemporal price discrimination by durable goods monopolists (Coase, 1972), the foreign buyer commits to making a take-it-or-leave-it offer to sell the object back to the social planner (home country) exactly once in period 1. To find the profit maximizing resale offer for the foreign collector, we first solve the monopoly problem for each period $t \geq 1$,

$$P_t^M = \arg\max_{P_t} [P_t - a_t^N][1 - H_t(P_t)], \tag{4}$$

which yields the first order condition

$$P_t^M(a_t^N) = a_t^N + \frac{1}{\psi_{H_1}(P_t^M(a_t^N))}. \tag{5}$$

Since $a_t^N = a_0^N$ for $t \geq 1$, we have $P_t^M(a_0^N) = P_1^M(a_0^N)$ for $t \geq 1$. Aggregating over all future periods, the optimal resale price in period 1 is

$$P_1^R(a_0^N) \equiv \sum_{t=1}^{\infty} \delta^{t-1} P_t^M(a_t^N) = \frac{1}{1-\delta}\left[a_0^N + \frac{1}{\psi_{H_1}(P_1^M(a_0^N))}\right] \tag{6}$$

[5] As is well know in the literature on durable goods (e.g. Gul, Sonnenschein & Wilson (1986) and McAfee & Vincent (1997)), a lack of commitment in sequential bargaining or auction settings weakens the ability of the foreign buyer to make take-it-or-leave-it offers above their marginal valuation. In our model, less commitment by the foreign buyer increases overall efficiency since bargaining weakness reduces holdup. It is our view that foreign collectors have at least some commitment power due to either sequential rationality or high transaction costs.

which we note is greater than $\frac{a_0^N}{1-\delta}$ under the assumption that $H_1(\overline{a}) < 1$.

Phase 1: Sale Phase. Returning to the auction in stage 1, a foreign collector with value a^i incorporates the monopoly rents into his valuation when bidding in period 0. Thus, the value of an object to a foreign collector with value a^i is

$$V_0^i(a_0^i) = a_0^i + \delta \left[\left(1 - H_1(P_1^M(a_0^i))\right) P_1^R\left(a_0^i\right) + H_1(P_1^M(a_0^i)) \frac{a_0^i}{1-\delta} \right]. \tag{7}$$

Substituting for $P_1^R(a_0^N)$ from equation (6), this can be rewritten as

$$V_0^i(a_0^i) = \frac{a_0^i}{1-\delta} + \frac{\delta}{1-\delta} \frac{1 - H_1(P_1^M(a_0^i))}{\psi_{H_1}(P_1^M(a_0^i))}. \tag{8}$$

Note that since $H_1(\overline{a}) < 1$, there is some probability of resale to the home country and thus $V_0^i(a_0^i) > \frac{a_0^i}{1-\delta}$ for all N. Further, since all foreign collectors are free to set their second period prices as they see fit, it must be that $V_0^i(a_0^i)$ is weakly increasing in a_0^i. Thus V^i is a positive monotone transformation of a^i and preserves the order of valuations.

We now show that the inefficiently high price set in the resale phase leads to inefficiency in the sale phase regardless of the bidders' valuations. Consider the case when $N \to \infty$ such that $a_0^{N-1} = a_0^N = \overline{a}$. In this environment, the optimal auction will allocate the object to the highest value bidder at a price equal to $V(\overline{a})$ which is greater than $\frac{\overline{a}}{1-\delta}$. As the price is equal to the expected value of the object to the winning bidder, the foreign collectors' expected gain from winning the auction is zero and thus the home country is the recipient of all the rents associated with the object.

Next compare the (expected) domestic welfare generated in the sale and repurchase scheme to the first best outcome. In the first best case, the foreign collector's utility is always zero since the home country extracts all surplus. Maximizing domestic util-

ity subject to the foreign collector's IR constraint yields the (unconstrained) socially optimal repurchase price:

$$P_1^{FB} = \frac{a_0^N}{1-\delta}. \tag{9}$$

In a sale and repurchase scheme, $P_t^R > P_t^{FB}$ and thus there exist realizations of d_1 in which the object is misallocated to the foreign collector although it has a greater value at home. This will be the case any time $d_1 \in \left(a_0^N, P_1^M\right)$.

As can be seen, the monopoly power of the foreign collector in the repurchase phase creates inefficiencies in the initial sale auction. In order to extract rents from the domestic owner, the foreign collector chooses an inefficiently high price in the repurchase phase. Thus, while these rents are recaptured by the domestic owner in the sale phase, the allocation in the future is inefficient, which leads to a permanent loss of possible total welfare. As a result of these inefficiencies, forward looking social planners may restrict sales today until uncertainty regarding the future is resolved. This will be the case if the social planner is patient or the level of uncertainty is high.

3.2 Leases under Asymmetric Information

Leases diminish the effects of asymmetric information by leaving the choice of mechanism in both periods to the government, which can use auctions to reduce the asymmetric information about the foreign collectors' valuations. Consider a lease auction in which the government leases the object to the foreign collector in the first period but retains future ownership rights. We assume the government runs an optimal English auction in stage 1 in which the second highest bid price but not the winner's bid is revealed.[6]

[6] As is well known from the auction literature on sequential auctions, it is weakly welfare decreasing to use information about the value of the winning bidder in one auction for subsequent auctions. The government will want to use an auction mechanism which does not reveal the high bid because it will want to commit not to use information from one lease auction in subsequent lease auctions. See for

Given the price in the initial lease auction, the domestic owner knows the value of the second highest agent a^{N-1} and the density function of the highest bidder:

$$f^N(a) = \begin{cases} \frac{f(a)}{1-F(a^{N-1})} & a > a^{N-1}, \\ 0 & otherwise. \end{cases} \tag{10}$$

Maximizing profits for $t \geq 1$, the home country determines the optimal lease price in the second period by solving

$$P_t^* = \arg\max_{P_t} \quad [1 - F^N(P_t)]P_t + F^N(P_t)d_t. \tag{11}$$

The associated first order condition is

$$1 - F^N(P_t^*) + f^N(P_t^*)(d_t - P_t^*) = 0, \tag{12}$$

which yields[7]

$$P_t^* = d_t + \frac{1}{\psi_F(P_t^*)}. \tag{13}$$

Of course, the home country will never choose a price below a^{N-1} such that the optimal pricing rule becomes

$$P_t^L = max\left(P_t^*, a^{N-1}\right). \tag{14}$$

The optimal pricing rule from equation (14) is equivalent to running an English auction in each period with a reservation price dependent only on the home country's valuation and the initial distribution. As the number of bidders goes toward infinity, such a lease auction converges to the socially efficient price $P_t^L = max(d_t, a^N)$.

instance Hart & Tirole (1988).

[7]Note that $F^N(a) = \frac{F(a)-F(a^{N-1})}{1-F(a^{N-1})}$ For $a > a^{N-1}$.

Proposition 1 *The optimal allocation mechanism is to lease objects each period using an English auction with reservation price:*

$$P_t^* = d_t + \frac{1}{\psi_F(P_t^*)} \tag{15}$$

Proof: Proof is in the appendix.

As indicated in the proposition, the optimal lease contract generalizes readily to a more complicated environment where d_t grows over time.[8] Since the true valuation of the highest valued bidder stays private, there are no incentives for foreign collectors to strategically manipulate their bids. Also note that since contracting in future periods takes place once uncertainty regarding the home country's value is resolved, the reservation price in each period uses the true realization of current domestic valuation d_t. As is discussed in the next section and shown in the appendix, setting optimal reserves after uncertainty is resolved improves both the efficiency and expected rent generation of the mechanism relative to alternatives which conduct all contracting in period 0.

3.3 Credit Constraints and Option Contracts

In the environment discussed in the previous section where a country is poor today but has the potential to become rich in the future, the government is likely to be credit constrained. This section considers the case where domestic marginal utility of consumption varies over time. As described in the benchmark model, we assume

[8]That is $d_t = d_{t-1} + y_t(.)$ where $y_t(.)$ is bounded below at zero. As with Hart & Tirole (1988), if the value of the home country is decreasing in some periods, the home country may be tempted to use information from previous periods in current negotiations. This may lead the foreign collector to distort his value in cases where the home country is unable to commit to the mechanism for all future periods. Similar to Dewatripont (1989), increasing the lease length can limit renegotiation and increase efficiency when the domestic government lacks commitment power and d_t can both increase and decrease. As a lease can always mimic a sale contract by setting the number of periods to infinity, the broader set of contracts with leases will still weakly improve efficiency over sale and repurchase contracts even when commitment on the side of the home country is limited.

that the value of the object is small relative to the nation's budget, and the marginal utility of consumption in each period is $1 + \gamma_t$. Initially, the country is poor and credit constrained such that $\gamma_0 \geq \gamma_t$ for all t.[9] As such, the social planner prefers to (i) consume the value of the object in period 0 and (ii) prevent holdup in future periods.

An alternative to leases in this circumstance is to sell an object to the foreign buyer with an explicit option to repurchase the object in the future at a per-period strike price $s_t(P_t)$ which varies with the purchase price P_t. In the appendix, we show that one optimal option mechanism for the government in such an environment is to run an English auction with a strike price in each period equal to:

$$s_t(P_t) = \left[R^t P_t + \frac{\gamma_0 - \gamma_t}{(1+\gamma_0)(1+\gamma_t)} \frac{H_t(\hat{s}_t)}{\psi_{H_t}(\hat{s}_t)} \right], \tag{16}$$

where P_t is the winning bid for period t, R is the interest rate, and $\hat{s}_t = (1+\gamma_t)s_t$.

As can be seen by studying equation (16), the strike price is composed of two parts: the first term, which corresponds to the efficient allocation of the object in future periods, and the second term, which sets the strike price above the purchase price, thereby increasing the expected bids of the foreign collectors but potentially generating inefficient allocations in the future.

When there are no credit constraints, $\gamma_0 = \gamma_t$ and thus $s_t = R^t P_t$. As the home country does not care about the timing of payments, it sets the option strike price to efficiently allocate the object in future periods, thereby minimizing future allocation inefficiencies.

When a country is credit constrained, however, $\gamma_0 > \gamma_t$ and the strike price for repurchase is greater than the price paid. Raising the strike price above the bid price

[9] It is worth noting that γ_t will also likely to be stochastic and negatively correlated with d_t. To keep things simple and highlight the main intuition, we show the deterministic version of the model. The main intuition in this section holds as long as $\gamma_0 > \mathbb{E}[\gamma_t]$.

creates some states of the world in which the object stays in the hands of the foreign collector inefficiently. At the same time, however, an increase of the strike price over the winning bid increases the value of the contract to the foreign collector. This second effect increases bids and leads to greater revenue in period 0 but a larger expected repayment in the future. As credit constraints get extreme, for instance when $\gamma_0 \to \infty$, the optimal strike price is set such that the value of the object for a bidder of type i is exactly equal to $V(a^i)$ and the strike price is equal to $P_1^R(a_0^{N-1})$. Thus, as $N \to \infty$, the option contract can mimic both the lease and sale auction through the selection of the strike price s_t.

A second property of the optimal option contract is that the reservation price must be set prior to the home country learning its future valuation. In the absence of credit constraints, the optimal reservation price is implicity described by the following equation:

$$P_t^{Res} = \delta^t \left[\mathbb{E}(d_t | d_t < R^t P_t^{Res}) + \frac{1}{\psi_F(P_t^{Res})} \right]. \tag{17}$$

Comparing this expression to (15), it becomes apparent that the reservation price is analogous to that of the lease auction, with the difference being that the auction takes place in period 0 prior to the revelation of d_t. Conditioning on the expected value of d_t decreases the efficiency of the auction, an inefficiency which is greatest when domestic valuations are most uncertain. Conditioning also may lead to additional problems with commitment, since after high realizations of d_t, the home country would like to exercise the option and offer the object to the winner at a higher reserve price.

Like the lease contract, the optimal option contract eliminates the hold-up problem of the sales contract with future repurchase by settling all negotiations *ex ante*. A careful comparison of equations (15) to (16) and (17) provides intuition concerning the environments in which the lease or option contract is likely to be preferred. When there

are no credit constraints, the home country does not benefit from shifting payments to earlier periods as achieved by an option contract. Since the option's reservation price must be established with less information about the future, an option contract will have an inefficient reserve price relative to the lease auction if there is uncertainty regarding future domestic valuation of an object.

When there are credit constraints, however, the option contract may dominate leases since it allows countries to consume more than the objects per-period value immediately. This will unambiguously be the case if the government knows its future valuation and thus can set its reserve prices optimally. These results are formally described in Proposition 2:

Proposition 2 *When future valuations of the home country are unknown to all parties and there are no credit constraints, a lease auction maximizes social welfare of the home country. When future valuations of the home country are known but private information and credit constraints bind, an auction that sells the object with an option to repurchase maximizes social welfare of the home country.*

Proof: Proof is in the appendix.

While we have discussed leases and options in the context of efficiency, it is worth noting that the implementation of option contracts may be more difficult than lease contracts. To construct the optimal strike price, the home country must have a good sense not only of its future credit constraints, but on the distribution of future valuations. If option contracts prove intractable from an implementation standpoint, credit constraints can also be satisfied by a lease with an extended term length. Such leases are likely to generate revenue similar to an option contract while reducing the complexity of the auction. However, allowing for very long leases opens the door for corruption,

a problem which we view as critical to managing cultural heritage. We will discuss this issue in the next section.

4 Robustness to Risks of Corruption

In this section and the next, we consider two factors that may create particular risks to antiquities in settings with limited state capacity — corruption and weak law enforcement. In this section we argue that corruption risk may make bright line export bans attractive relative to discretionary regulation where export decisions are made on a case by case basis if such laws constrain future corrupt officials from appropriating the value of the object. If the only available policy instrument is a law imposing autarchy and banning international transactions, a benevolent government may choose to pass such a law in order to constrain future corrupt officials at the cost of restricting honest ones from authorizing welfare enhancing trades. However, for reasonable parameter values, less draconian export restrictions that allow one-period leases are superior to both free trade and complete export bans. Options contracts are not attractive in this environment as they generate large upfront rents that are vulnerable to corruption.

To focus directly on the role of corruption, we consider a special case of the previous environment in which there are no transaction frictions and where objects may be bought from and sold to foreign buyers at a constant per-period price P.[10] We continue to assume that the value to citizens of having the object at home d_t, which is stochastic and may vary over time; we further restrict attention to the case where valuations are drawn *iid* from a single time invariant cdf $H(.)$.

In the initial law writing phase, a law can be created binding all future officials who will each have influence over objects for one period. We first consider the case in

[10] We abstract from the issues discussed in the previous section, where the price paid for antiquities depended on the possibility that the object may be resold in the future.

which the social planner can only decide between allowing free markets or completely prohibiting any overseas transfer of the object. We then consider cases in which the social planner has the additional option to restrict foreign transactions to single period leases. Subsequent to the initial law writing phase, and including the contracting stage in period 0, decisions are made by a sequence of officials. Each official has probability $1 - \epsilon$ of being *honest* and acting as a benevolent social planner and a probability of ϵ of being *corrupt* and maximizing their own consumption with no regard for current or future generations; we assume that the types of officials are uncorrelated over time.

Corrupt officials have access to some portion of the proceeds of sales and leases via kickbacks and thus always choose to move objects abroad or into private hands for the maximum amount of time legally possible. In effect a corrupt official can act in collusion with a foreign buyer to expropriate the cultural patrimony of the country.[11] For clarity, we study the stark case in which corrupt officials have access to the entire revenue from a transaction and thus consume all the proceeds from the exchange. If markets are free, a corrupt official sells the object and consumes all future rents. Under an export ban, the corrupt official keeps the object for private use for the period he is in office such that the country cannot benefit from it. Finally, if foreign transactions are restricted to single period leases, the corrupt official leases the object abroad and consumes the proceeds.

An *honest official* who has no constraints on her action may act in one of two ways. If the potential for future corruption is small, she allows an object to be used by the foreign collector in any time period when $d_t < P$ and keeps the object local otherwise. As there are no credit constraints, this is most easily accomplished through a one-period lease. Alternatively, if the potential for corruption is large, an honest official may wish

[11]The problem is thus in some ways analogous to that studied by Pogge (2001) and Kremer & Jayachandran (2006).

to sell an object today and distribute the earnings during his tenure to prevent corrupt officials from expropriating this value in the future. Under a complete prohibition on international transfers of antiquities, honest officials simply keep the object at home for domestic use.

Under *free markets*, honest officials sell the object abroad if the price for selling the object today is greater than the expected value of optimally allocating the object until the first corrupt official arrives:

$$\frac{P}{1-\delta} > \sum_{t=0}^{\infty} \delta^t (1-\epsilon)^{t+1} \mathbb{E}_d \left[\max(P, d_t)\right]. \tag{18}$$

Note that for ϵ close to zero, this will never be the case. However, if the chance that future officials are corrupt becomes sufficiently large, honest officials will sell the object preemptively. In the absence of preemptive sales by honest officials, the expected net present value of population welfare derived from each object under free trade is:

$$NPV^{FT} = \sum_{t=0}^{\infty} \delta^t (1-\epsilon)^{t+1} \mathbb{E}_d \left[\max(P, d_t)\right]. \tag{19}$$

Under an *export ban*, the object always stays in the country resulting in a value of $\mathbb{E}[d_t]$ in each period that an honest official is in power. The expected net present value of population welfare derived from each object is

$$NPV^{EB} = \sum_{t=0}^{\infty} \delta^t (1-\epsilon) \mathbb{E}_d \left[d_t\right]. \tag{20}$$

As can be seen by comparing equations (19) and (20), export bans act as a blunt tool to constrain corrupt future officials from acting in a malevolent way. To reduce the ability of future corrupt leaders to steal funds, the government also limits the ability of good officials to make welfare improving trades. This reduces the expected value in

a given period to $\mathbb{E}_d(d)$ from the higher expected value of $\mathbb{E}_d\left[\max(P, d_t)\right]$. Vice versa, the lack of control over the actions of corrupt officials leads to a lower probability that an object will be preserved for the enjoyment of future generations. Thus, under free trade, the valuation of future periods is discounted by $(1-\epsilon)^{t+1}$ as opposed to $(1-\epsilon)$ as in the case of an export ban.

Leases are a way of balancing concerns about corruption with efficiency considerations. In particular, short-term leases can restrict the long-term damage by corrupt officials[12] while still giving benevolent ones the ability to make Pareto-improving short-term trades. To see this, consider the expected net present value of population welfare derive from each object when only one-period leases are permitted:

$$NPV^L = \sum_{t=0}^{\infty} \delta^t (1-\epsilon)\mathbb{E}_d\left[\max(P, d_t)\right] \tag{21}$$

Comparing this expression to equation (20), it becomes apparent that allowing one-period leases but no sales dominates passing complete export bans as long as P exceeds d_t in some state of the world.[13] Furthermore, comparing (21) to (19) reveals that one-period leases dominate free-trade as long as $\epsilon > 0$. It follows:

Proposition 3 *If the only law available to a benevolent social planner is an export ban or free trade, and $P < \mathbb{E}[d_t]$, then as $\delta \to 1$, there exist probabilities $\underline{\epsilon}$ and $\overline{\epsilon}$ such that if $\epsilon \in (\underline{\epsilon}, \overline{\epsilon})$ the social planner chooses an export ban. Leases dominate both export bans and free trade as long as $\epsilon > 0$ and there exist some states of the world for which $d_t > P$.*

Proof: Proof is in the appendix.

[12]Recall that the foreign collector is in charge of negotiation on objects sold abroad. Since there is no asymmetric information, the home country gains nothing from recovering objects that were sold by a corrupt official.

[13]Leases also dominate preemptive sale as long as NPV^L is greater than $\frac{P}{1-\delta}$.

Note that in order for leases to reduce the negative effects of corruption, commitment must be made both to the type of contracts allowed and to the way in which objects are auctioned. A maximum possible lease length would need to be set to prevent leases from being so long as to approximate sales.[14] Section 6 discusses a series of safeguards that could be implemented to reduce the scope for corruption in the lease contracts.

5 Limited enforcement capacity and incentives to reveal and maintain objects

As discussed in the introduction, in many countries black market trade in antiquities continues despite export bans. This suggests it is important to consider the case where governments have limited enforcement power, and where others may have de-facto partial control of objects.

In most countries, both excavated and unexcavated archaeological objects legally belong to the state. However, since individuals often possess the objects or have private knowledge of the location of unexcavated archaeological sites, it is important to design mechanisms which robustly safeguard cultural property when it is in the hands of private individuals both inside and outside the nation's borders.[15] This section considers the case where the government has *de jure* rights to objects but unlike in the previous

[14]Similarly, limits would be needed on the reserve price and the strike price under option contracts if such contracts were to be used. Such contracts would need additional oversight to ensure that revenue is not expropriated.

[15]Antiquities law is complicated by the fact that looted antiquities generally do not have an owner and are undocumented. While most countries have laws which make it a crime to transport, receive, or sell foreign goods known to be stolen, smugglers intentionally obfuscate the origin of objects to limit repatriation claims. Artifact-rich countries have responded to the problem of undocumented artifacts by passing laws which declare antiquities as state property. This has allowed for legal recourse using the laws of the importing country such as the National Stolen Property Act (1976) of the United States. See Bator (1982) for a broader legal discussion.

section, the government does not have possession of the objects and may not even know about the existence of particular objects. *De facto* owners must be given incentives to both maintain the objects and reveal their existence.[16]

In addition to the moral hazard problem in which *de facto* owners must be given incentives to both maintain the objects and reveal their existence, there may also be an adverse selection problem, which in turn allows corruption in purchase programs. We argue that granting lease rights for a set number of years can provide incentives for preservation and may also be less vulnerable to corruption than offering cash for objects or information on archeological sites. This implies that even if the externality for domestic usage is large, we may not want complete export bans, but instead may want to allow leases to encourage individuals to preserve and reveal their objects.

Our modeling focuses on the case of objects that are in private hands but inside the country. At the end of the section, we discuss how a minor modification of the lease system proposed in this section can be used to generate incentives for individuals outside the country to reveal objects in exchange for eventual repatriation.

5.1 Primitives

The intrinsic and cultural value of antiquities is highly heterogeneous, with only a handful of museum quality pieces typically found in an archaeological expedition. To allow for this, we consider an extension of the baseline model with high (H) and low (L) quality objects which are distributed randomly across a large number of domestic citizens. *De facto* owners have no value for their objects and would prefer to sell their objects at the highest possible price, but are subject to the enforcement policy within their jurisdiction. Greater enforcement, e: (i) reduces the probability $\alpha(e)$ that a *de*

[16]This section of our paper is related to Borodkin (1995) and Bator (1982) who write from a legal perspective, and advocate the use of markets to reduce looting in developing countries.

facto owner has access to an intermediary or smuggler, (ii) reduces the proportion $\pi^q(e)$, $q \in \{L, H\}$, of the maximum foreign sale price captured by the *de facto* owner in the event of a sale to an smuggler and (iii) increases the probability $\beta(e)$ that an object which has not been sold is detected and confiscated.

Preserving art requires expenditure M at the beginning of each period to *maintain* the object. We consider M to be a reduced form parameter that includes the cost of preventing damage and theft by looters. For convenience, rather than modeling a continuous and stochastic relationship between effort and damage, we assume that M is binary and that if it is not paid, the object is immediately destroyed. We further assume that $a^N > M$ so at least one foreign collector exists who maintains the object if he or she owns it. The government knows the proportion p of high quality objects and the externality to its constituents from domestic use. It has *de jure* rights to all objects but lacks information on the location of objects and on whether the objects are of high or low quality. A bureaucrat can estimate objects' values and generate a report, but some proportion b of bureaucrats are corrupt and may alter reports to the government in exchange for a bribe B.

The ordering of actions in each period is as follows. A *de facto* owner holding an object must pay M in order to prevent the object from being destroyed. If the object is preserved, the *de facto* owners decide whether to publicly disclose their objects or wait for a potential smuggler. If the government sets up a system to reward public disclosure, publicly disclosed objects are randomly assigned to bureaucrats for assessment. If a *de facto* owner is assigned to a corrupt bureaucrat, the *de facto* owner chooses whether to offer a bribe to certify that an object is of a particular quality. The bureaucrats then generate their reports and the governments incentive mechanism is implemented.

If the de facto owner does not disclose an object, with probability $\alpha(e)$ the *de facto* owner is matched with an intermediary or smuggler and has the option of selling the

object to him at a proportion of its value $\pi^q(e)$. We assume that smuggled objects are hidden by foreign collectors and thus cannot be resold back to the government under the export ban policy, but that the government is free to buy objects revealed under a free market policy at the market price. Finally, with probability $\beta(e)$ the government can detect the remaining objects and either excavate or confiscate them.

To simplify the contracting environment, we further specialize the model to remove all uncertainty regarding efficient future ownership by assuming that the domestic externality is constant over time. Suppressing the time subscript, high- and low-value objects that are discovered and transferred to the government generate a domestic externality $\frac{1}{1-\delta}d^H$ and $\frac{1}{1-\delta}d^L$, respectively, which *de facto* owners do not take into account. For excavated objects, this externality includes the amenity value of having the object in the country of origin, its curatorial value to domestic museums, and information on the location of active looting. We further simplify the problem by assuming the number of potential foreign buyers $N \to \infty$. This ensures that the foreign market prices are $\frac{\overline{a}^q - \delta M}{1-\delta}$ for $q \in \{L, H\}$ which are fixed and constant over time.

Note that empirically, the proportion of money received by the de-facto owner for selling an object to the black market ($\pi^q(e)$) is typically very small. For illegally traded objects, most of the proceeds from trade are paid to intermediaries.[17] Further, illegally traded objects also sell for less than their maximal value because of limitations on the ability to display the object, the difficulty of resale, and the danger of detection and prosecution.

[17]For example, Christie's Auction House estimates that the original holder of artifacts typically receive 2 percent of the objects' final sales prices. See Beech (2003).

5.2 Bans on Exports and the Free Market

Under an *export ban*, *de facto* owners will invest in maintenance only if the expected return is higher than the maintenance cost, or $\alpha(e)\pi^q(e)\frac{\overline{a}^q-\delta M}{1-\delta} > M$. If the owner maintains the object the government detects with probability $\beta(e)$ each period, and receives an expected net present value of

$$S^{Ban}(e) = \frac{(1-\alpha(e))\beta(e)}{1-\delta[(1-\alpha(e))(1-\beta(e))]}\frac{d^q-\delta M}{1-\delta} \tag{22}$$

per object. The proportion $\alpha(e)[1-(1-\alpha(e))(1-\beta(e))]^{-1}$ of objects are lost to smuggling. Increasing $\beta(e)$, the probability of detection, through tougher enforcement will increase what the government recovers, but there is a limit to what the government can recover. If enforcement is toughened and $\alpha(e)\pi^q(e)\frac{\overline{a}^q\delta M}{1-\delta}$ falls below M, individuals lose their incentive to protect and maintain objects, leading to their destruction. As it is inherently difficult to hold individuals directly accountable for actions to unknown objects and $\pi^q(e)$ is likely to be very small, a policy based purely on enforcement (as opposed to one with rewards for revelation of objects) may generate less incentives for protection and ultimately lead to inefficient social outcomes.

One can also examine the consequences of allowing complete free trade. In the absolute best case for free trade, the government would allow objects to be sold and then buy objects back at the market price. If $d^q > \overline{a}^q$, the government will purchase all objects of quality q that are put up for auction, leading to a net social utility gain of

$$S^{Free} = \frac{d^q-\overline{a}^q}{1-\delta} \tag{23}$$

per object. As $\overline{a}^q > M$, all objects are preserved under this scheme.[18] However, the

[18]Note that we are implicitly assuming the government views the transfer of income to *de facto* owners as pure waste. Relaxing this assumption pushes policy toward free markets where *de facto*

additional payments made in recovering objects may lead the government to prefer export bans and enforcement.

5.3 Antiquity Purchases and Leases

The preceding discussion suggests that augmenting an export ban policy with explicit incentives for revealing the location of objects may improve social welfare. Payments for revelation may not only resolve the information asymmetry and limit the impact of corruption but also provide incentives for *de facto* owners to maintain their objects in the first place. We consider two types of incentive programs: purchase programs which pay cash incentives based on the quality of the good and lease programs which allow *de facto* owners to lease objects abroad for a number of periods in exchange for revealing its location. We show that the cash programs are vulnerable to corruption and that the lease system is more efficient than both the cash program and the export bans considered in the last section.

Consider first a purchase program which pays cash incentives based on the quality of the good. As the potential values of objects are unknown *ex ante* and must be estimated by bureaucrats, the process of using these cash incentives to pay for revealed objects is vulnerable to corruption.

We consider two cases of purchase programs which vary in the cost of corruption. In the first case, $d^q > \overline{a}^q$ for $q \in \{H, L\}$ and the government would like to retain all objects. We view this case as the environment envisioned by cultural nationalists and others who view the value of domestic usage as very high. Second, we consider the case where $d^H > \overline{a}^H$ but where $d^L = 0$ and $\overline{a}^L = M$. In this case, low-quality objects can be thought of as forgeries which can be produced at cost by citizens in the domestic country.

owners' revenue is highest.

Starting with the case where the government would like to retain all objects, let V^q represent the potential outside option of a *de facto* owner holding an object of quality q and note that in any equilibrium where bribes exist, $B \in [0, V^H - V^L]$ depending on the bargaining power of the bureaucrat relative to the *de facto* owner.[19] The individual rationality constraint for *de facto* owners holding high- or low-quality objects demand that their expected transfers (net of the bribe) weakly exceed the value of their respective outside option. Defining T^H and T^L as the transfers made to *de facto* owners whose objects are reported as high and low respectively, individual rationality requires

$$T^H \geq V^H, \tag{25}$$

$$(1-b)T^L + b(T^H - B) \geq V^L. \tag{26}$$

In the optimal purchase program, both constraints will hold with equality. Thus, rearranging equation (26) yields

$$T^L = V^L - \frac{b}{1-b}\left(V^H - V^L - B\right), \tag{27}$$

which is strictly less than V^L. The reduction in T_L is due to the possibility of a holder of an object matching with a corrupt bureaucrat and receiving a positive surplus.

The expected cost for procuring each object is

$$[p + (1-p)b]T^H + (1-p)(1-b)T^L, \tag{28}$$

[19] A *de facto* owner has two potential outside options. First, he or she can choose not to maintain the object. To prevent this from being optimal, the purchase program must pay a minimum of M. Second, the owner must prefer revealing the object over waiting for a smuggler. Assuming that the decision to reveal an object occurs directly after paying maintenance costs, the owner's outside option value is

$$V^q = \max\left\{M, \frac{1}{1-\delta[(1-\alpha(e))(1-\beta(e))]}\left[\alpha(e)\pi^q(e)\frac{\overline{a}^q - \delta M}{1-\delta} - (1-\alpha(e))(1-\beta(e))\delta M\right]\right\} \tag{24}$$

for $q \in \{H, L\}$, respectively.

where p is the proportion of high quality objects. Plugging in (26) and (27) yields an expected cost per item of

$$pV^H + (1-p)V^L + (1-p)bB. \tag{29}$$

Compared to the case without corruption, a purchase program requires additional transfers of $(1-p)bB$ to be paid to bureaucrats which ultimately must be paid by the government. These transfers are likely to be perceived as waste by the government and in any case will be costly if taxation involves a deadweight loss.[20]

Let us now consider the second case in which the government only wants high-quality objects and where low-quality objects are interpreted as forgeries with no domestic value. In this case, the social planner only wants to retain high-quality objects but, due to corruption, also ends up purchasing a proportion $(1-p)b$ of forgeries which negatively affect welfare. In this environment, the cost of the program is

$$[p + (1-p)b]V^H \tag{30}$$

while the gross value of the high-quality objects is only:

$$p\left(\frac{D^H - \delta M}{1-\delta} - V^H\right). \tag{31}$$

As can be seen by comparing these two equations, when p is small relative to $(1-p)$, the cost of this program may be very large relative to its benefit. This will be the case, for instance, if forgeries are generated endogenously and V^H is high relative to the cost of forgeries.

[20]Corrupt bureaucrats could, of course, also charge bribes to individuals with high-quality objects to truthfully reveal quality. In this case the information rents for high types must be increased by bB and the rents to the low types can be decreased by $\frac{b}{1-b}bB$. The total transfers for the project increase by pbB.

At its core, the problem of the purchase program is one of discretion. By lacking an external price signal upon which valuations can be assessed, bureaucrats generate distortions both in cost and allocation. The advantage of a lease program is that the information rents generated by an object can be linked directly to its value without relying on the discretion of bureaucrats.

Proposition 4 *Let τ as the smallest integer such that*

$$\sum_{t=0}^{\tau} \delta^t (\overline{a}^H - \delta M) \geq V^H. \tag{32}$$

Then, a lease program that allows for leases of length greater or equal to τ in exchange for future ownership rights is sufficient for generating maintenance and revelation incentives.

As can be seen by noting that V^H is a function of the enforcement technology, the length of the lease τ necessary depends on the value that a smuggler can provide to an individual relative to the market price for legally transferred leases. This will be related both to the ability of the country to police illegal markets and to the relative worth of legal leases versus illegal sales. Comparing the outcome of leases, cash programs, free markets and bans leads to the following proposition:

Proposition 5 *There exists a $\delta \in (0, 1)$ such that leases dominate free markets, export bans and cash incentive programs for all enforcement technologies.*

It is worth noting that lotteries or taxes on sales could also allow the value of objects to be split without a government process and could create incentives for de facto owners to reveal objects, but under lotteries the parties bear more risk. Further, as was argued in section 3, lease arrangements that give ownership rights to the state may also achieve

preferable intertemporal allocations since transaction costs for recovering sold objects may be large.

Taxes are also vulnerable to corrupt deals with side payments in which the official price is less than the actual value of the object. This can lead to a movement of objects abroad which would optimally stay at home. In the current case where all objects should optimally be retained at home, the tax system may also not generate enough incentives for maintenance and requires positive monetary payments by the government for repatriation.

5.4 Using Leases to Identify and Secure Previously Smuggled Objects

In recent years, public institutions have reduced their appetite for illicit objects. However, a large stock of objects are in the hands of private de facto owners outside the country of origin. There currently remains limited ways that illegally exported objects can reenter the public domain and (potentially) be repatriated by the country of origin. This has the potential to permanently destroy antiquities, particularly in cases where objects are bequeathed to a future generation who does not share the taste of the original collector.

Granting the de facto owner a lease is equivalent to a partial amnesty program in which those revealing objects are granted temporary use rights. Illegally moved objects typically are not in the hands of the highest valued collector and the need to keep them secret reduces their value relative to a legal object. By allowing individuals with objects of murky provenance to lease their objects in exchange for repatriation rights, collectors can be induced to identify objects and repatriate them in the future.

A partial-amnesty program based on leases and repatriation has three advantages.

First, it can mitigate the costs of litigation that can arise from disputed ownership and shield the foreign buyer from liability. This has clear advantages for public institutions who have objects of uncertain provenance in their collection. Both the Getty and the Metropolitan Museum of Art recently repatriated portions of their Italian collection back to Italy in exchange for long-term loans of Italian art with similar value. In the case of the Metropolitan Museum of Art, this agreement ended a legal battle which had been fought for almost 30 years (Kennedy & Eakin, 2006).

Second, a partial-amnesty program could lead to the identification and registration of a large number of objects currently hidden. One of the issues in the regulation and policing of antiquities is a lack of information which can be used to identify looted objects. By reducing the pool of unidentified objects, it is more difficult for individuals to forge the provenance of looted objects. Identifying objects also increases scholarly access and allows governments to secure objects with cultural significance that it might otherwise not have known about. Finally, partial-amnesty programs avoid issues of repayment and thus may be more politically feasible than programs in which the government is paid to leave things abroad. A program in which foreign owners pay for amnesty must assign a price to the object which may be seen as "commodifying" the object. As discussed in Benabou & Tirole (2007), the in-kind nature of leases are likely to have smaller behavioral and social effects than programs that use cash.

As with any program which allows for amnesty, a repatriation for lease program has the potential of exacerbating looting if countries cannot avoid the temptation of offering amnesty on objects looted today and offered in the future. The extent to which such time inconsistency is a problem likely varies by the type of object under dispute and the ratio of objects looted relative to the number of objects still in the ground. For objects which have been outside the home country for a long time but have disputed ownership claims, it is likely that the time inconsistency problems are quite small.

Likewise, for objects still within the country of origin which have provenance but are subject to export bans, we see little problem with the program. On the other hand, offering amnesty on objects that have recently been excavated has clear issues. We believe that in cases in which looting is still ongoing, amnesty programs are likely to exacerbate looting. In these cases, offering leases in exchange for excavation rights and antiquity protection is likely better at securing sites and preserving heritage.

6 Precedents and Implementation Issues

Previous sections have considered leases in the abstract. In this section, we first discuss two examples that suggest leases are legally, administratively, and politically feasible. We then discuss a number of implementation issues including renter-side moral hazard regarding care of the object, mechanisms to mitigate its effects, ways to limit corruption, and interaction between market design and institutions.

There are already precedents for lease arrangements. The Menil collection in Houston negotiated a long-term lease of two 13th century Byzantine frescoes with the Church of Cyprus. These frescoes were recovered in 1987 from sources with disputed claims. The Menil Foundation restored the frescoes as part of the lease requirements and displayed them from 1992 to 2012 in a way that paid tribute to their origins. They were returned to Cypress in March 2012.

This example suggests that in some circumstances it may be easier to implement programs in which the borrowing party provides in-kind payments rather than cash payments. This may be because relinquishing cultural heritage in exchange for cash could be seen as repugnant or because it might signal something about the characteristics of the relevant government officials.[21]. Alternatively, cultural officials in the

[21]See Roth (2007) and Benabou & Tirole (2007)

source country may have de facto veto rights and may prefer in-kind transactions than cash transactions because the proceeds of cash transactions may go outside of their ministries.

In contexts in which ownership is not in dispute, but archaeological work needs to be done to excavate the objects, foreign entities could provide financial assistance in conducting excavations in return for rights to hold a subset of objects that are excavated for a fixed number of years. This idea is in some ways similar to early 20th century agreements in which foreign expeditions worked in the country for a share in the excavated objects. Iraq, for instance, had a policy where half of the duplicate objects from an expedition would be allowed to leave with the excavating party but all unique items went to the central museum (Bernhardsson, 2003). A lease policy has some similarities but allows for the repatriation of all objects to the source country in the long run. In other contexts, foreign institutions could obtain rights to hold an object for a certain number of years on condition that they assist the home country in developing proper facilities for care of the objects after the end of the lease period.

While in-kind transfers may be easiest to implement, there is precedents for leases to be used in exchange for cash. The King Tut exhibit, which circulated in the United States and London from 2005-2008, provides a clear precedent. Egypt charged a flat fee of $5 million per city and required insurance payments of roughly $1 million per city (Boehn, 2005).

Both the Menil Collection and King Tut exhibit sheds light on the ways to control renter-side moral hazard. In common law countries, museum loan programs are considered bailments where one party gives possession of the object to another for safe keeping. Museum contracts augment the common law by specifying the arbitration process for damaged goods and providing requirements for care.[22] In the King Tut case,

[22]Simpson (2008) provides further details into the contracts used in museum exchange and lending

the lease agreements specified transportation, display, and storage conditions. Based on the success of traveling exhibits and the extensive level of museum to museum lending which currently exists, our sense is that these issues could be adequately addressed contractually, as long as the legal system in the receiving country is sufficiently well functioning.

One positive sign regarding the feasibility of leases markets is provided by discussion of using leases in the simplest cases in the art disciplines themselves. Lease contracts have been briefly mentioned in press by Butcher & Gill (1990), Asgari (1993)[23], and Gerstenblith (2001) who proposed leases between museums to decrease demand for new pieces from foreign countries.

Establishing a set of standard contracts and procedures for auctions to be conducted in an open and transparent manner could limit the potential for corruption that might arise if action procedures were decided on a case by case basis by potentially corrupt officials. On the contracting side, a standard contract would include maintenance and care agreements, specify insurance and bond requirements, standardize lease lengths, and develop a protocol for arbitration in the event of damage. To prevent collusion and corruption during the auction, standardized rules would be needed for the auction. This would include standardized procedures allowing qualified bidders to verify the condition and quality of goods prior to auction. Qualified bidders would need to meet some minimal level of trustworthiness along with demonstrating the financial resources to provide the proper level of insurance and care.

The lease length should be long enough to provide information rents to private individuals and to make transaction costs worthwhile, but short enough to limit rent extraction from future generations by corrupt officials. If transaction costs are sub-

programs.

[23] As quoted in Erdem (1993), Asgari argues that ten year leases may be used between major museums to reduce incentives to purchase illicit artifacts.

stantial, relatively longer leases may be desirable. While the optimal lease length will depend on the needs of the country, the lease length of 20 years used in the Menil collection appears to be a reasonable precedent.

We have assumed that the per-period valuation of foreign collectors does not change with the type of contract that they enter into. However, there may be a value to ownership separate from the discounted sum of use value. For example, a potential lessee might anticipate being subject to an endowment effect in which they would experience disutility from losing an object during their lifetime. Tying the lease to the lifetime of the lessee might be valuable in this circumstance and would also mitigate concerns about the maintenance of property bequeathed to heirs who do not share the same tastes as the original collector.

It might be desirable for an international organization to facilitate a lease system by serving as a standard intermediary. An international organization is more robust to regime change in the source and renting countries and is likely to have an easier time committing to follow standard policies. The participation of an established international organization could also provide legitimacy and address concerns that officials in source countries proposing such arrangements were pursuing this approach out of corrupt motives. To reduce costs and increase the number of international bidders, an international organization could also work with an established auction house to run the auctions. Amending the laws of receiving countries to allow source countries to seize objects transferred outside legitimate agreed upon procedures would reduce incentives of collectors to contract corruptly outside such procedures. The international organization running the lease market could limit lease auctions to items with clear title and exclude objects believed to be inappropriately obtained.

7 Conclusion

Allowing antiquities to be exported only under time-limited leases offers an opportunity to robustly protect antiquities in a range of environments. Under three of the potential rationales for export bans we consider — the difficulty of repurchasing objects once sold, the possibility that corrupt officials will expropriate the value of the national patrimony, and the need to provide incentives to those in de facto control of antiquities — leases perform better than both discretionary free trade and export bans. Leases also appear to be legally, administratively, and politically feasible.

We have shown that relative to pure free trade, both leases and option contracts protect against the possibility that hold up or transaction costs will prevent the efficient repatriation of cultural heritage. Option contracts may be useful in environments where countries are credit constrained, while leases are optimal mechanisms for resolving hold up in environments without credit constraints and more robustly protect antiquities when officials in charge of cultural patrimony may be corrupt.

Unlike complete export bans, allowing time-limited leases could create incentives for those with de facto control over objects to reveal and maintain them rather than turning to the black market with potentially disastrous consequences for cultural patrimony. Relative to cash programs, using leases to generate incentives for individuals to reveal objects is less vulnerable to corruption. Leases might also be used as the basis for partial-amnesty program that could lead to the identification, registration, and repatriation of a large number of objects currently hidden abroad.

8 Appendix

8.1 Optimal Option Contract

In this section we construct the optimal option mechanism for a credit constrained government. The construction is taken in two parts. Part 1 starts from a Vickrey Clarke Groves (VCG) mechanism and determines the maximum price that could be charged in an alternative direct mechanism which invokes truth telling but uses a different option strike price rule. By varying the strike price rules, the constructed pairs of sale price and strike price trace out the entire set of possible allocations which are incentive compatible and allocate the object either to the highest valued foreign collector or the seller. Given this set of possible allocation rules, Part 2 determines the optimal direct mechanism from this set and then constructs the corresponding indirect mechanism that uses the bidding procedures of the English auction.

Lemma 1 *Let (p, s) be a purchase and strike price from an efficient VCG mechanism where an object is sold in period 0 at price p, but where the home country has the option to repurchase the object in period t at price $s = R^t p$. Then, an alternative direct mechanism where the contract (p', s') is awarded to the buyer with the highest valuation is also incentive compatible if $s' > s$ and*

$$p' = [1 - H_t(s')]\delta^t s' + H_t(s')p. \tag{33}$$

Proof. In the original direct mechanism, the winner is exactly compensated for any payments that he makes in any situation that he does not win the object. Thus it is a weakly dominant strategy for each buyer type to truthfully bid their present discounted value. Under these conditions, $p = \delta^t a^{N-1}$ and $\delta^t a^N \geq p$. For incentive compatibility to hold in the alternative direct mechanism, it must be the case that for any a^N, the present discounted value of the new contract is at least as good as the present discounted value of the old contract. This occurs if:

$$[1 - H_t(s')][\delta^t s' - p'] + H_t(s')[\delta^t a^N - p'] \geq [1 - H_t(s)][\delta^t s - p] + H_t(s)[\delta^t a^N - p]. \tag{34}$$

For truth telling to be an optimal, it also must be the case that no individual has an incentive to overstate their value. Thus, equation (34) must hold with strict equality when $a^N = a^{N-1}$.

Since $\delta R = 1$, The first term on the RHS is zero. Rewriting the equation with this term removed yields:

$$p' \leq [1 - H_t(s')]\delta^t s' + H_t(s)p + [H_t(s') - H_t(s)]\delta^t a^N. \tag{35}$$

Each of the RHS terms is positive for $s' > s$ with the last term increasing in a^N. For $\delta^t a^N = \delta^t a^{N-1} = p$, equality occurs when:

$$p' = [1 - H_t(s')]\delta^t s' + H_t(s')p. \tag{36}$$

For types with $\delta^t a^N > p$, $H_t(s')p \leq H_t(s)p + [H_t(s') - H_t(s)]\delta^t a^N$ and thus for the case in which $a^N > a^{N-1}$, incentive compatibility holds with strict preference at the new contract price p' for all types with $a^N > a^{N-1}$. These two conditions ensure truth telling remains a weakly dominant strategy in the alternative direct mechanism which offers contracts (p', s'). Note that the payment rules between (p', s') and (p, s) can differ since the allocation rule between the winning buyer and the seller change in response to s. ■

Proposition 6 *When the government's utility function is linear and the buyers' valuations are independent and identically distributed, one optimal mechanism which restricts all contracting to period 0 is to sell future ownerships via an English auction with an option to repurchase in period t at an option* strike *price*

$$s_t(p_t) = \left[R^t p_t + \frac{\gamma_0 - \gamma_t}{(1+\gamma_0)(1+\gamma_t)} \frac{H_t(\hat{s}_t)}{\psi_{H_t}(\hat{s}_t)}\right], \tag{37}$$

where $\hat{s}_t = (1+\gamma_t)s_t$. *The reservation price for the auction is:*

$$P_t^{Res} = \frac{\delta^t}{1+\gamma_0}\left[H_t(\hat{s}_t)\left[E(d_t|d_t < \hat{s}_t) + \frac{1}{\psi_F(a(P_t^{Res}))}\right] + [1 - H_t(\hat{s}_t)](1+\gamma_t)s_t(P_t^{Res})\right] \tag{38}$$

where

$$a(P_t^{Res}) = R^t P_t^{Res} - \frac{\gamma_0 - \gamma_t}{(1+\gamma_0)(1+\gamma_t)} \frac{1 - H_t(\hat{s}_t)}{\psi_{H_t}(\hat{s}_t)}. \tag{39}$$

Proof. Consider the class of direct mechanisms which invoke truth telling. By the envelope theorem, all incentive compatible mechanisms with the same allocation rule must have the same payment rule up to a constant. Lemma 1 provides a class of allocation rules between the highest valued buyer and the seller for $s \in [Rp, \infty]$ which are incentive compatible. This class of allocation rules exhausts the set of possible allocations which 1) allocates ownership rights to either the highest valued buyer or the seller, 2) limits all contracting to period 0, and 3) has the seller's allocation monotonically increasing in own valuation.

The home country seeks to maximize its welfare subject to satisfying the incentive compatibility constraints of the buyers. For a given reserve price s, the home country will exercise the option if $d_t > s(1+\gamma_t)$. Letting $\hat{s} = s(1+\gamma_t)$, it thus maximizes:

$$max_s(1+\gamma_0)p(s) + [1 - H_t(\hat{s})]\delta^t[E(d_t|d_t > \hat{s}) - \hat{s}] \tag{40}$$

where

$$p(s) = \delta^t \big[[1 - H_t(\hat{s})]s + H_t(\hat{s})a^{N-1}\big]. \tag{41}$$

The equation for $p(s)$ uses the results from Lemma 1, substituting in for p with $\delta^t a^{N-1}$, the price paid in the original VCG mechanism.

Taking the FOC with respect to s yields:[24]

$$\frac{\partial L}{\partial s} : \big[-s+a^{N-1}\big]h_t(\hat{s})(1+\gamma_t)(1+\gamma_0)+[1-H_t(\hat{s})](1+\gamma_0)-[1-H_t(\hat{s})](1+\gamma_t) = 0. \tag{42}$$

Simplifying yields:

$$s = a^{N-1} + \frac{\gamma_0 - \gamma_t}{(1+\gamma_0)(1+\gamma_t)} \frac{1}{\psi_{H_t}(\hat{s})}. \tag{43}$$

Equation (43) provides important intuition as to the effect that credit constraints have on the mechanism chosen by the seller. Without credit constraints, $s = a^{N-1}$ and the home country optimally selects the mechanism which is efficient from an ex-ante standpoint. Increases in the price paid in period 0 does not adequately compensate the home country for potential inefficiencies in the future and thus there is no wedge between the sale price today and the present discounted strike price. Further, if d_1 is known, the optimal option is identical to a lease auction in both reservation price and strike price.

When there are credit constraints, however, revenue received today is more valuable than money used in repurchasing the object in the future. To increase payments today, the home country introduces inefficiencies in the strike price to generate additional funds. The relative markup of the strike price over the purchase price is increasing in the size of the credit constraint and in the amount of distortion that these rents generate in the allocation of the object in the future.

To determine the optimal reservation price, the next step is to determine the bidder type who has the same virtual valuation as the seller taking into consideration the payments that can be used to reduce credit constraints in the first period. This is akin to solving a monopoly problem which compares the gains from trading with a threshold type a^c against the virtual valuations paid out to all types with valuations greater than a^c. The home country solves:

$$\max_{a^c,s} \quad \underbrace{[1 - F(a^c)]}_{\substack{\textit{Probability of} \\ \textit{Initial Sale}}} \big[p(s,a^c)(1+\gamma_0)+\underbrace{(1 - H_t(\hat{s}))}_{\substack{\textit{Probability} \\ \textit{of Exercise}}} \underbrace{\delta^t[E(d_t|d_t > \hat{s}) - \hat{s}]}_{\substack{\textit{Expected Value Conditional} \\ \textit{on Option Exercise}}} \big]+F(a^c)\delta^t[E(d_t)], \tag{44}$$

where

$$p(s,a^c) = \delta^t \big[[1 - H_t(\hat{s})]s + H_t(\hat{s})a^c\big]. \tag{45}$$

[24]Note that $\frac{\partial}{\partial \hat{s}} E(d_t|d_t > \hat{s}) = \frac{\partial}{\partial \hat{s}} \frac{1}{1-H(\hat{s})} \int_{\hat{s}}^{\infty} xh(x)dx = \frac{h(\hat{s})}{1-H(\hat{s})}[E(d_t|d_t > \hat{s}) - \hat{s}]$. Thus $\frac{\partial}{\partial s}[1 - H(\hat{s})][E(d_t|d_t > \hat{s}) - \hat{s}] = -[1 - H(\hat{s})](1+\gamma_t)$.

Adding $E(d_t) - E(d_t)$ to the end of this maximum and noting that

$$E(d_t) = E(d_t|d_t < \hat{s})H(\hat{s}) + E(d_t|d_t > \hat{s})[1 - H(\hat{s})], \tag{46}$$

the maximum simplifies to:

$$\max_{a^c,s} \quad \delta^t[1 - F(a^c)]\big[[H(s)][-E(d_t|d_t < \hat{s}) + \hat{s}] + p(s, a^c)(1 + \gamma_0) - \hat{s}] + \delta^t E(d_t). \tag{47}$$

The last term is independent of both choice variables and can be removed. δ^t is also constant across terms and can be excluded. Taking these simplifications and expanding $p(s, a^c)$ yields:

$$\max_{a^c,s} \quad [1-F(a^c)]\Big[[H(\hat{s})][-E(d_t|d_t < \hat{s})+\hat{s}]+[1-H_s(\hat{s})]s(1+\gamma_0)+H_t(\hat{s})a^c(1+\gamma_0)-\hat{s}\Big]. \tag{48}$$

This can be further reduced to:

$$\max_{a^c,s} \quad [1 - F(a^c)]\Big[[H(\hat{s})][\hat{s} - E(d_t|d_t < \hat{s})] - H_t(\hat{s})(1 + \gamma_0)[s - a^c] + s(\gamma_0 - \gamma_t)\Big]. \tag{49}$$

Taking the FOC with respect to the option price s and a^c yields:

$$\begin{aligned}
&\tfrac{\partial L}{\partial s} : [1 - F(a^c)]\big[(1 + \gamma_t)H(\hat{s}) - h(\hat{s})(1 + \gamma_t)(1 + \gamma_0)[s - a^c] \\
&\qquad\qquad -(1 + \gamma_0)H(\hat{s}) + [\gamma_0 - \gamma_t]\big] = 0, \\
&\tfrac{\partial L}{\partial a^c} : -f(a^c)\big[H(\hat{s})[\hat{s} - E(d_t|d_t < \hat{s})] - H_t(\hat{s})(1 + \gamma_0)[s - a^c] + s(\gamma_0 - \gamma_t)\big] \\
&\qquad\qquad +[1 - F(a^c)]H_t(\hat{s}) = 0.
\end{aligned} \tag{50}$$

Simplifying the second equation yields

$$a^c = \frac{E(d_t|d_t < \hat{s})}{1 + \gamma_0} - \frac{1 - H_t(\hat{s})}{H_t(\hat{s})}\frac{\gamma_0 - \gamma_t}{1 + \gamma_0}s(F^c) + \frac{1}{\psi_F(a^c)}\frac{1}{1 + \gamma_0}, \tag{51}$$

where $s(a^c)$ is the optimal strike price for a buyer of type a^c. This optimal strike price is found from the first equation of (50) and is identical to the one found in equation (43):

$$s(a^c) = a^c + \frac{\gamma_0 - \gamma_t}{(1 + \gamma_0)(1 + \gamma_t)}\frac{1}{\psi_{H_t}(\hat{s})}. \tag{52}$$

For intuition, substituting of the optimal strike price into equation (51) yields:

$$a^c = \frac{1}{1 + \gamma_0}\left[\frac{H_t(\hat{s})}{H_t(\hat{s}) + z}\left[E(d_t|d_t < \hat{s}) + \frac{1}{\psi_F(a^c)}\right] - \frac{z}{H_t(\hat{s}) + z}\left[\frac{\gamma_0 - \gamma_t}{(1 + \gamma_0)(1 + \gamma_t)}\frac{1}{\psi_{H_t}(\hat{s})}\right]\right], \tag{53}$$

where

$$z = [1 - H_t(\hat{s})]\frac{\gamma_0 - \gamma_t}{1 + \gamma_0} \tag{54}$$

is a measure of the countries credit constraint. As expected, a home country who is faced with credit constraints is reluctant to set a high reserve price since such reserves increase the probability that the home country will be unable to sell the object. As period 0 credit constraints grow large, the home country solely values the revenue that it can gain in the first period. In the limit as $\gamma_0 \to \infty$, $lim_{\gamma_0 \to \infty} a^c = \underline{a}$ and $s(a^{N-1}) = a^{N-1} + \frac{1}{\psi_{H_t}(\hat{s})}$. This result is similar to a sale auction in which the foreign collector has bargaining power in the second period.

As credit constraints grow small, the home country sets the strike price such that there is no hold-up problem in the second period and excludes buyers whose virtual valuations are expected to be zero. When $\gamma_0 = \gamma_t = 0$ and d_t is known, the option contract and lease contracts are identical except for the timing of payments. Further, when there are no credit constraints but d_t is unknown, the optimal reservation price in a second price auction is:

$$P^{Res} = E(d_t | d_t < P^{Res}) + \frac{1}{\psi_F(P^{Res})}. \tag{55}$$

Note that the reservation price is based on $E(d_t | d_t < P^{Res})$ since d_t is unknown. In contrast to the optimal lease auction, the option auction is inefficient since the auction is done prior to learning the sellers true valuation in the future.

While there are in principle many indirect mechanisms with the same allocation rules as the one considered here, the English auction has the advantage of the valuation of the highest bidder not being revealed in each period. Since the second price auction and English auction are identical in the IPV setting considered here, we next construct the second price auction which corresponds to the optimal direct mechanism shown above. With credit constraints, the strike price of the option will be above the valuation of the object for the foreign buyer. Thus, foreign buyers will bid above their type. Given a strike price $s(\beta(a^{N-1}))$ that is based on the final bid price $\beta(a^{N-1})$, a foreign buyer will bid:

$$\beta(a^{N-1}) = \delta^t \big[[1 - H_t(\hat{s})] s(\beta(a^{N-1})) + H_t(\hat{s}) a^{N-1} \big]. \tag{56}$$

Reverse engineering, the type corresponding to a bid of $\beta(a^{N-1})$ in a second price auction with strike price rule $s(\beta(a^{N-1}))$ is:

$$a^{N-1}(\beta(a^{N-1}), s(\beta(a^{N-1}))) = \frac{R^t \beta(a^{N-1})}{H_t(\hat{s})} - \frac{[1 - H_t(\hat{s})]}{H_t(\hat{s})} s(\beta(a^{N-1})). \tag{57}$$

In order for the strike price to be optimal, it must be that:

$$s(\beta(a^{N-1})) = a^{N-1}(\beta(a^{N-1}), s(\beta(a^{N-1}))) + \frac{\gamma_0 - \gamma_t}{(1+\gamma_0)(1+\gamma_t)} \frac{1}{\psi_{H_t}(\hat{s})}. \tag{58}$$

Substituting equation (57) into (58) yields the optimal strike price for the second price auction:

$$s(\beta(a^{N-1})) = R^t\beta(a^{N-1}) + \frac{\gamma_0 - \gamma_t}{(1+\gamma_0)(1+\gamma_t)}\frac{H_t(\hat{s})}{\psi_{H_t}(\hat{s})}. \tag{59}$$

The optimal reserve price is found in an analogous manner by finding the price at which a bidder of type a^c will drop out of the auction. This price is equal to

$$\beta(a^c) = \delta^t\big[[1 - H_t(\hat{s})]s(\beta(a^c)) + H_t(\hat{s})a^c\big], \tag{60}$$

where a^c can be substituted with equation (53) above. Note that since the strike price is strictly above the bid when credit constraints are present, the reservation price is strictly above that of the lease auction. However, as we saw in the direct mechanism, the actual type for which this bid corresponds is strictly below the threshold type in the original auction. Thus, even though at first glance the option contract appears less efficient, credit constraints are actually improving first period efficiency while decreasing efficiency in the second period. ■

8.2 Proofs from Main Text

<u>Proposition 1:</u> This result stems directly from Myerson's optimal mechanism (Myerson, 1981). Let $\phi(a^i) = a^i + \frac{1}{\psi_F(a^i)}$ be the virtual valuation for buyer i. The optimal mechanism (Q, T) is an allocation rule Q and payment rule T such that:

$$\begin{aligned} Q_i &= \begin{cases} 1 & if\, \phi(a^i) > \max_{j\neq i}\phi(a^j)\ and\ \phi(a^i) > \phi(d_1) \\ 0 & otherwise \end{cases}, \\ T_i &= max\{\phi^{-1}(d_1), max_{j\neq i}a^j\}. \end{aligned} \tag{61}$$

An English auction with reservation price $P = d_1 + \frac{1}{\psi_F(P)}$ has the same allocation rule as the optimal auction and thus by the revenue equivalence theorem is optimal. It also does not disclose the true valuation of the highest bidder in each period preventing this information from being used in future auctions.

<u>Proposition 2:</u> With no credit constraints, the marginal utility of money is constant over time and thus the country is indifferent to the periods in which the contract generates payment. Leases with an English auction are surplus maximizing for the home country. Since the reservation prices for the option contract differs, the option contract cannot be optimal. The difference between the optimal lease and the optimal option is that under options, contracting is done before the home country knows its valuation d_t. This can generate situations in which the option price results in no trade in future periods even though, upon realization of d_t, trade would be optimal.

When credit constraints exist but the future valuations of the objects are known, the reservation price of the option contract can replicate those of the lease auction

perfectly. Further, since $\gamma_0 > \gamma_t$ for all t, the option contract dominates the lease auction by guaranteeing that all payments are received in period 0.

<u>Proposition 3:</u> Under free markets, a generation $t > 0$ that is reached without a corrupt official that is served by a benevolent official gets expected value

$$max[P, E[d_t]] = [1 - H(P)][E(d_t|d_t \geq P)] + H(P)P, \tag{62}$$

where H is the cdf of possible home valuations and we have suppressed the time subscripts. The NPV of an object with a free market is thus:

$$\frac{1-\epsilon}{1-\delta(1-\epsilon)}\big[[1 - H(P)][E(d_t|d_t \geq P)] + H(P)P\big]. \tag{63}$$

The NPV of an export ban is

$$\frac{1-\epsilon}{1-\delta}[E(d_t)]. \tag{64}$$

The home country prefers an export ban if equation (63) is less than equation (64). This condition is equivalent to requiring that

$$P \leq E(d_t|d_t \leq P) + \frac{\delta\epsilon}{1-\delta}\frac{E(d_t)}{H(P)}. \tag{65}$$

At $\epsilon = 0$, the RHS of (65) is $E(d_t|d_t \leq P)$ which is less than P for $H(P) > 0$. Thus, with no corruption, free trade is optimal. As $\delta \to 1$, for $\epsilon \in (0, 1)$ the right hand side of (65) goes to infinity implying that an export ban is always optimal. Thus, there exists an arbitrarily small $\underline{\epsilon}$ such that an export ban is superior to free trade with no preemption. Intuitively, the more patient a country is, the more it values the losses that occur if an object is stolen. As $\delta \to 1$ the losses that occur if an object is ever stolen weighs heavily in making a decision. This leads to a larger set of ϵ for which an export ban is optimal.

Under free trade, the period zero official also has the option to sell an object in order to preempt future corrupt officials from doing the same. Preemption generates a total surplus of $\frac{P}{1-\delta}$. As $\epsilon \to 1$, the value of an export ban evaluated at the point of contracting converges to $E[d_0] < \frac{P}{1-\delta}$. Since $P < E[d_t]$, there exists a positive ϵ for which an export ban is better than preemption. Thus, as $\delta \to 1$, there exists an $\overline{\epsilon}$ such that for $\epsilon < \overline{\epsilon}$, an export ban is preferred to preemption. Since $\underline{\epsilon}$ is arbitrarily close to zero, $\underline{\epsilon} < \overline{\epsilon}$ and thus there exists a range of corruption levels for which an export ban is preferred.

<u>Proposition 4:</u> There exists one buyer such that $a^N > M$. Further, for any enforcement scheme, the expected return to not revealing the object is less than

$$\frac{1}{1-\delta}[\overline{a}^q - \delta M] = \lim_{\tau\to\infty} \delta[\overline{a}^q - \delta M]. \tag{66}$$

It follows that there exists at least one τ where revelation dominates all other strategies of the *de facto* owner.

<u>Proposition 5:</u> As $\delta \to 1$, the losses of total surplus associated with a lease contract for an antiquity of quality q is V^q. In order to show that it dominates the other three contracts, it is sufficient to show that the losses associated with the other contracts are greater. The comparison to the cash program is straight forward - the cash program must also pay V^q on average but has additional rents lost to corruption. For the sales contract, note that

$$Loss_{Leases} = \frac{1}{1-\delta}\frac{\alpha(e)\pi^q(e)[\overline{a}^q - \delta M]}{1-\delta[(1-\alpha(e))(1-\beta(e))]}, \tag{67}$$

while the sales contract has a loss of:

$$Loss_{Sale} = \frac{1}{1-\delta}[\overline{a}^q - \delta M]. \tag{68}$$

It follows that if $\frac{\alpha(e)}{1-\delta[(1-\alpha(e))(1-\beta(e))]} < 1$ the lease contract is superior. This can be shown to be true by taking the first order condition with respect to $\alpha(e)$, noting it is increasing over the domain of $\alpha(e) \in [0,1]$ and noting that at $\alpha(e) = 1$, the expression is equal to one.

For the export ban, the loss is given by:

$$Loss_{Ban} = \frac{1}{1-\delta}\frac{\alpha(e)[d^q - \delta M]}{1-\delta[(1-\alpha(e))(1-\beta(e))]}. \tag{69}$$

By assumption it is optimal to keep the object at home and thus $d^q > \overline{a}^q$. Since $\pi^q(e) < 1$, it follows that the loss on the export ban is greater than on the lease auction.

References

Akinade, O. (1999), 'Illicit traffic in cultural property in Nigeria: Aftermaths and antidotes', *African Study Monographs* **20**(2), 99–107.

Asgari, N. (1993), 'Speech', Quoted in Suna Erdem, New Trojan War Highlights Pillage of Turkey's Past, Reuters, Oct. 13, 1993, available in LEXIS, News Library, CURNWS File.

Bator, P. (1982), 'An essay on the international trade of art', *Stanford Law Review* **34**(2), 275–384.

Beech, H. (2003), 'Spirited away', Time, Oct. 20.

Benabou, R. & Tirole, J. (2007), Identity, dignity and taboos: Beliefs as assets, CEPR Discussion Papers 6123.

Bernhardsson, M. T. (2003), *Reclaiming a Plundered Past Archaeology and Nation Building in Modern Iraq*, University of Texas Press, Texas.

Boehn, M. (2005), 'New blockbusters: Traveling exhibits.', NPR: Talk of the Nation, June 1st.

Borodkin, L. (1995), 'The economics of antiquities looting and a propsosed legal alternative.', *Columbia Law Review* **95**(2), 377–417.

Butcher, K. & Gill, D. (1990), 'Mischievous pastime or historical science', *Antiquity* **64**, 946–50.

Coase, R. (1972), 'Durability and monopoly', *Journal of Law and Economics* **15**, 143–149.

Coggins, C. (1972), 'Archeology and the art market.', *Science* **175**(4019), 262–266.

Dewatripont, M. (1989), 'Renegotiation and information revelation over time: The case of optimal labor contracts.', *Quarterly Journal of Economics* **104**, 589–619.

Erdem, S. (1993), 'A new trojan war.', Reuters, Oct. 13.

Gerstenblith, P. (2001), 'The public interest in the restitution of cultural objects (symposium, ownership and protection of heritage: Cultural property rights for the 21st century)', *Connecticut Journal of International Law* **16**, 197–246.

Gul, Sonnenschein & Wilson (1986), 'Foundations of dynamic monopoly and the coase conjecture.', *Journal of Economic Theory* **39**, 155–190.

Hart, O. & Tirole, J. (1988), 'Contract renegotiation and coasian dynamics.', *Review of Economic Studies* **55**, 509–540.

Kennedy, R. & Eakin, H. (2006), 'The met, ending 30-year stance, is set to yield prized vase to italy.', The New York Times, February 3rd.

Kremer, M. & Jayachandran, S. (2006), 'Odious debt.', *American Economic Review* **96**(1), 82–92.

McAfee, P. & Vincent, D. (1997), 'Sequentially optimal auctions.', *Games and Economic Behavior* **18**(1), 246–376.

Myerson, R. (1981), 'Optimal auction design', *Mathematics of Operations Research* **6**, 58–73.

Pogge, T. (2001), 'Achieving democracy.', *Ethics and International Affairs* **15**(1), 3–23.

Prott, L. & O'Keefe, P. (1990), *Law and Cultural Heritage.*, Professional Books Limitied, England.

Ross, D. (1995), 'Disturbing history: Protecting mali's cultural heritage.', *African Arts* **28**(4), 1–10.

Roth, A. E. (2007), 'Repugnance as a constraint on markets.', *Journal of Economic Perspectives* **21**(3), 37–58.

Shyloon, F. (2000), The recovery of cultural objects by african states through the UNESCO and UNIDROIT conventions and the role of arbitration., UNIDROIT Paper 2a-2000, Uniform Law Review / Revue de droit uniforme.

Simpson, S. (2008), *Collections Law: Legal Issues for Australian Archives, Galleries, Libraries and Museums.*, Powderhouse Museum, Australia.