Endogenous Property Rights.*

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Abstract

Albeit the relevance of property rights is well known, their determinants are still poorly understood. When property is fully protected, some buyers with valuation higher than that of original owners are inefficiently excluded from trade due to transaction costs. When protection of property is weak, low-valuation buyers inefficiently expropriate original owners. The trade-off between these two misallocations implies that property rights will be stronger the more dispersed buyers' preferences are. This prediction survives when original owners have higher political influence on institutional design, and is consistent with novel data on the rules regulating adverse possession of personal and real property and government takings of real property in 125 jurisdictions.
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1 Introduction

Albeit overwhelming evidence shows that strong property rights foster investment and trade, only recently economists have begun to inquire into the determinants of this institution by looking at the trade-off between the dispersed coercive power in a state of anarchy and the predation by a central enforcement authority (Besley and Ghatak, 2010). This paper qualifies these contributions by incorporating into the economics literature the key insight proposed by a long tradition of legal scholarship (Calabresi and Melamed, 1972): partially insecure property rights can be efficient when transaction costs prevent consensual trade.

To characterize the basic trade-off between inefficient exclusion from trade and inefficient expropriation and link it to fundamental characteristics of society, we study a simple, yet general, framework. Society is equally split into a group of original owners whose valuation for a good is fixed and a group of potential buyers heterogeneous in their payoff from consuming the good. Potential buyers are randomly matched to original owners by an intermediation technology that allows each buyer to either obtain the good with the original owner's consent by paying her valuation plus a socially wasteful transaction cost, or expropriate it at no cost. We define property rights as the probability that an expropriated good is given back to the original owner. When property is fully protected, some buyers with valuation higher than that of original owners are inefficiently excluded from trade due to transaction costs. When protection of property is weak, low-valuation buyers inefficiently expropriate original owners. A rise in the heterogeneity of the buyers' preferences makes inefficient expropriation by low-valuation buyers weigh more heavily on social welfare than inefficient exclusion from trade and, hence, it is optimal to strengthen property rights. This prediction survives when property rights are not designed behind a "veil of ignorance" and original owners have higher political influence. In addition, the model's message continues to stand when potential buyers and original owners interact directly and so the good's price can be manipulated to avoid expropriation, when private expropriation is costly, and when transaction costs originate from either the market power of the intermediary or asymmetric information and when they are shaped by the original owners' investment activity.

Our model nicely applies to a wider range of economic interactions. First, the good can be

envisaged as an input producing a fixed value when transformed via the "old" technology in the hands of the original owners and an uncertain one when the "new" technology available to the potential buyers is applied. Second, the conflict between an original owner and a potential buyer can be reinterpreted as the one involving a creditor and a shareholder, who "tunnels" resources out of a firm (Johnson et al., 2000), or that arising between a buyer and a seller, who has the option of breaching the contract after the performance costs have changed. Finally, if expropriation is within the public sphere, the good can be conceived as having a fixed value if consumed by the citizens and an uncertain one if used by the state.

To evaluate the model's predictions, we require, first and foremost, a comparable sample of jurisdictions that vary in the relative extent of protection of the original owner's property rights. To construct such a sample, we approached legal experts and gathered data on the rules concerning the acquisition of ownership over personal and real property through adverse possession,[1] and those regulating the use of government takings to transfer real property from a private individual to another private individual. These data measure the extent of protection of property from "direct and indirect private takings", which are ubiquitous forms of expropriation that occur daily within the rule of law and, hence, are different from illegal expropriation through coercion by powerful individuals, which is much more uncommon but has been the focus of the existing literature (Besley and Ghatak, 2010).[2] Following Aghion, Alesina, and Trebbi (2004), we elect the jurisdiction's ethnic fractionalization as our main proxy of preference heterogeneity since it is related to the degree of genealogical distance among populations with a common ancestor and, thus, to the average differences in characteristics, like preferences, transmitted across generations. OLS estimates suggest that the protection of the original owners' property rights is the strongest where the extent of preference heterogeneity is the highest. This evidence is consistent with our model but could also be driven by omitted variables. To see this, it is useful to review the two main results of a growing body of research on "endogenous ethnic diversity". First, the majority of the world ethnic diversity has been produced during the agricultural revolution in response to an insufficient supply of public goods (Ahlerup and Olsson, 2012) or the availability of location-

[1]The civil law nomenclature for this legal institute is "acquisitive prescription."

[2]Some of these odd cases are reviewed by Besley and Ghatak (2010). On the contrary, the sectors affected by private takings account for 32% of the 2011 US GDP (Dari-Mattiacci, Guerriero, and Huang, 2012).

specific land endowments (Michalopoulos, 2012). Second, in the ex-European colonies, ethnic fractionalization has been shaped together with individual rights by the extraction strategy of the colonizer (Acemoglu, Johnson, and Robinson, 2001). These two pieces of evidence suggest that it is quite unlikely that our results could be driven by reverse causation but not that "relatively recent" historical events, like the colonial rule, are correlated with ethnic diversity and the design of property rights. Starting from this remark, we pursue a number of strategies to determine whether the correlations we uncover are, in fact, causal.

First, we control for two primary determinants of the type of institutions implemented during colonial rule: the deadliness of the disease environment and precolonial prosperity (Acemoglu, Johnson, and Robinson, 2002). We also consider other factors possibly affecting the design of property rights, like the level of non produced output, the quality of political institutions, and the jurisdiction's legal origins. We document that including these observable features leaves unchanged the gist of the empirical analysis. Notably, our findings survive when we switch to other proxies of preference heterogeneity as the linguistic or religious fractionalization. Second, we show that our results are pretty similar when we focus only on those jurisdictions where the majority of contemporary inhabitants can trace their ancestry in 1500 AD to the same area. This exercise implies that colonial rule is not driving alone the pattern we uncover in the data. Third, we use the recent insights from Altonji, Elder, and Taber (2005) to calculate how much greater the influence of unobservable factors would need to be, relative to observable factors, to completely explain away the relationship between ethnic fractionalization and property rights. We find that the influence of unobservable factors would have to be on average 59 times greater than that of observable factors. Hence, it is unlikely that our estimates can be fully attributed to unobserved heterogeneity. Finally, we build on social evolution theories to identify exogenous instruments for ethnic fractionalization. The IV estimates are qualitatively very similar to the OLS estimates and we tend to not reject that ethnic diversity is exogenous. Despite their prevalence, takings have not been included yet in the development literature and their legal importance, as captured by our measures, does not correlate with the proxy for expropriation through coercion currently available (Acemoglu and Johnson, 2005). Of course, this puzzling finding should solicit more research on the relation among different measures of property rights.

The present study is strictly related to three bodies of research. The first one looks at the increasing importance of human capital as compared to natural resources and, in general, at the role of falling income inequality in producing efficient political institutions safeguarding individuals from illegal expropriation by the state (Cervellati, Fortunato, and Sunde, 2008). In contrast, in our model a wider heterogeneity in the willingness to consume within a group of "outsiders" weakens the property rights of a group of "insiders" initially holding consumption goods. A second strand of literature focuses on the relative importance of protecting property rights and enforcing contracts at the macro level (Acemoglu and Johnson, 2005), whereas we examine the determinants of the trade-off between these two institutional strategies created by the possibility of transferring value without consent (see also Dari-Mattiacci, Guerriero, and Huang, 2012). In this respect, our paper can be considered as an inquiry into the classic choice between property rules and liability rules when preferences or technological abilities are disperse (Calabresi and Melamed, 1972).[3] Finally, a third body of literature sees the legal system as a response to the risk that the majority of market participants are coerced by a minority of more powerful special interests (Glaeser and Shleifer, 2003), similarly powerful untrustworthy agents (Aghion et al., 2010), or the state (Besley and Ghatak, 2010). We broaden the scope of these contributions by considering the problem of legal direct and indirect non-consensual transfers between two private parties.

The rest of the paper is organized as follows. Section 2 describes the legal variation in the property rights protection to inform the setup of the model discussed in section 3. Section 4 assesses how robust the model's prediction is to alternative assumptions. Section 5 tests such a prediction and section 6 concludes. The appendix gathers proofs, figures, and tables.

2 The Legal Protection of Property Rights

While all legal systems punish theft and provide remedies for dispossessed owners, the protection of property against private expropriation is not absolute. Under many circumstances indeed, private parties are allowed to take private property with or without paying

[3]With the term "liability rule" we refer to a broad class of legal rules allowing transfer without consent and obliging the taker to pay a weakly positive compensation to the owner (Bar-Gill and Persico, 2012). Hasen and McAdams (1997) also link transaction costs to legalized theft. Yet, they do not consider preference heterogeneity and conclude that partially insecure property rights cannot be an equilibrium.

compensation to the owner in situations of sizeable transaction costs (Bouckaert and De Geest, 1995). Two are the main cases of legalized private expropriation.

The first is adverse possession of personal and real property, that is, "movable" and "immovable" goods, respectively, in civil law parlance. Adverse possession is a form of acquisition of property rights such that a possessor becomes the legal owner of a good by virtue of the passing of time and recurring other conditions such as open, continuous, and notorious possession. By means of adverse possession, property can be effectively transferred without the owner's consent. Different legal systems balance the interests of the owner and the possessor differently. In the United States adverse possession of personal property is not admitted, so that the possessor never acquires ownership. Instead, a possessor in good-faith acquires ownership after 10 years in Germany (Sec. 937 BGB) and after 3 years in France (Art. 2276 CC). In our empirical exercise, we use the number of years necessary to acquire ownership through adverse possession in good-faith as an inverse measure of the protection of property rights so that Germany displays higher protection than France. The case of adverse possession of real property is more involved, since the transfer of immovable goods involves some form of registration, which has different effects across legal systems. To account for this heterogeneity, we construct a composite index capturing the legal treatment of non-consensual transfers and explicitly incorporating the role of registration.

While adverse possession allows for direct expropriation, expropriation can also be indirect and in particular mediated by the state (Bell, 2009). Differently from adverse possession, under this scenario a monetary compensation is paid to the owner. Even if all jurisdictions allow the state to seize private property under eminent domain for some form of public interest (Fischel, 1995), legal systems differ in the extent to which the transfer of private property from a private party to another private party qualifies as public use. This problem has been recently discussed by the USA Supreme Court in the Kelo case (see Kelo v. City of New London, 545 U.S. 469, 2005). The Court decided that it was admissible for a city to take private property to transfer it to a firm, which was going to use it for a redevelopment plan that would have spurred economic growth in the community. This specific use was found to satisfy the "public use" requirement of the Fifth Amendment. Our data indicate whether the transfer of property from a private individual to another private individual through public

expropriation is generally allowed in a jurisdiction and hence measure the extent to which private property is protected against indirect private takings. In the following, we present a model studying how fundamental characteristics of a society, that is, the extent of preference heterogeneity and the importance of transaction costs, affect the design of property rights.

3 Theory

We consider a society regulating property rights over a good x consumed by either original owners or potential buyers. The two groups have mass one. While original owners value x at $v > 0$, a share $\Delta/2$ of potential buyers value the good at $\underline{\lambda} > 0$, a share $\Delta/2$ of them value x at $\overline{\lambda} > v > \underline{\lambda}$, and the remaining potential buyers have valuation λ uniformly distributed over the support $\left[\underline{\lambda}, \overline{\lambda}\right]$ with $l \equiv \overline{\lambda} - \underline{\lambda}$ and $\lambda_m \equiv \left(\overline{\lambda} + \underline{\lambda}\right)/2$. Thus, provided that $\Delta \in (0, 1)$, a rise in Δ implies a mean-preserving spread of the λ distribution. We employ the uniform distribution to obtain closed form solutions, but in the appendix we show that the model's message remains true when we consider more general probability density functions.

As suggested by Besley and Ghatak (2010), x captures economic value in general. In the case of private expropriation, it can also represent an input producing an output of market value v when the "old" technology in the hands of the original owners is used and value λ when instead the "new" technology available to a generic potential buyer is employed. In addition, the conflict between an original owner and a potential buyer can be reinterpreted as the one involving a creditor and a shareholder, who "tunnels" resources out of a firm, or that arising between a buyer and a seller, who has the option of breaching the contract after the performance costs have changed. If instead expropriation is within the public sphere, x can be seen as a good whose valuation is v for the citizens and the uncertain λ for the state. For concreteness, we focus in the following on the consumption good interpretation.

To capture the institutions discussed in section 2, we envision a simple, yet general, exchange economy. Potential buyers are randomly matched to original owners by an intermediation technology that allows each buyer to either obtain x with the original owner's consent by paying v plus a positive transaction cost $\alpha < \min\{v, l - v\}$ or expropriate it at no cost.[4] An expropriated x is returned back to its original owner with probability γ,

[4]We discuss how restrictive the assumptions concerning α are in footnotes 7 and 9.

which thus summarizes the extent of legal protection of the original owner's property rights, i.e., the strength of the remedies in his hands, the length of time the buyer needs to wait before acquiring property rights by adverse possession, and the probability of public enforcement.[5] The transaction cost α has no social value and summarizes inefficiencies like the cost of enforcing a proper delivery or borrowing v, or the mark-up accruing to an intermediary outside society. While section 3.2 analyzes more general market structures—i.e., such that α has a social value or originates from a "market for lemon" failure—and discusses the case of heterogeneous original owners (see footnote 13), section 4 clarifies that the model's message is unaffected when original owners and potential buyers can interact directly and so bargain over the selling price and when private expropriation entails a cost for the potential buyers.

At time t_0, γ is chosen to maximize social welfare which is the sum of original owners' and potential buyers' utilities. At t_1, agents learn who they are and, in particular, their valuation. Next at t_2, original owners are randomly matched to potential buyers, who via the intermediation technology can either acquire x at $v + \alpha$ or expropriate their match.[6] Finally at t_3, with probability γ an expropriated good is given back to its original owner.

In interpreting the generality of the foregoing, several remarks should be heeded. First, the model's testable prediction will stand should institutions be designed in t_0 by those agents that are more likely to know their identity when the veil of ignorance is pierced (see section 3.3). Second, since time inconsistency in investment is a key issue when property rights are designed, we prove that the gist of our theory is robust to the introduction of an investment step between t_1 and t_2 (see section 4). Third, as above-mentioned, the model can be usefully applied to the comparison between property rules and liability rules. We characterize this extension relating our model to the existing literature in section 4.

3.1 Socially Optimal Property Rights

Potential buyers buy if their valuation λ net of the purchasing costs $v + \alpha$ is greater than the expected payoff from expropriation $(1 - \gamma)\lambda$, which is the case if $\lambda \geq \hat{\lambda} \equiv \frac{v+\alpha}{\gamma}$. Hence, when selecting the optimal γ^*, society will maximizes the following social welfare function

[5] One example fitting our setup is that of an intermediary selling at a very low price a stolen or embezzled good to a buyer in good-faith; another illustrative case is the squatting of a piece of land or a house.

[6] Provided that only one good can be consumed, our results continue to hold even when those x that are purchased can be expropriated before consumption since all those willing to expropriate already do it.

$$\left(\overline{\lambda}-\alpha\right)\frac{\Delta}{2}+\left(1-\Delta\right)\int_{\hat{\lambda}}^{\overline{\lambda}}\frac{\lambda-\alpha}{l}d\lambda+\left(1-\Delta\right)\int_{\underline{\lambda}}^{\hat{\lambda}}\frac{\left(1-\gamma\right)\lambda+\gamma v}{l}d\lambda+\frac{\left(1-\gamma\right)\underline{\lambda}+\gamma v}{2}\Delta \quad (1)$$

if $\gamma^{*}\in\left(\frac{v+\alpha}{\overline{\lambda}},1\right]$ and $\left(1-\Delta\right)\int_{\underline{\lambda}}^{\overline{\lambda}}\frac{(1-\gamma)\lambda+\gamma v}{l}d\lambda+\left[\left(1-\gamma\right)\lambda_{m}+\gamma v\right]\Delta$ otherwise.[7] An incomplete protection of the original owners' property rights—i.e., $\gamma<1$—has three effects: 1. it saves α at the cost of misallocating x with probability γ for all the matches for which $v+\alpha<\lambda\leq\hat{\lambda}$; 2. it avoids misallocation with probability $1-\gamma$ for all the matches for which $v<\lambda\leq v+\alpha$ by efficiently expanding in these cases the consumption set of potential buyers; 3. it misallocates x with probability $1-\gamma$ for all the matches for which $\lambda\leq v$. While the last effect is always negative, the sum of the first two is positive provided that α is sufficiently high.[8] Of course, all buyers with "moderate" valuation—i.e., for whom $\lambda\leq\hat{\lambda}$—prefer $\gamma^{*}<1$. The necessary and sufficient first order condition for an interior solution is given by

$$-2\frac{d\hat{\lambda}}{d\gamma}\left(\gamma^{*}\hat{\lambda}-\gamma^{*}v-\alpha\right)-\left(\hat{\lambda}^{2}-\underline{\lambda}^{2}\right)+2v\left(\hat{\lambda}-\underline{\lambda}\right)+\frac{\left(v-\underline{\lambda}\right)l\Delta}{1-\Delta}=0\leftrightarrow \quad (2)$$

$$\left(\gamma^{*}\right)^{2}=\left(v^{2}-\alpha^{2}\right)\left[v\underline{\lambda}+\left(v-\underline{\lambda}\right)\left(\underline{\lambda}-\tfrac{l\Delta}{1-\Delta}\right)\right]^{-1},$$

for $\gamma^{*}\in\left(\frac{v+\alpha}{\overline{\lambda}},1\right]$. The first term in the first line of equation (2) implies that a rise in property rights has always a positive marginal effect, whereas its infra-marginal effect $\left(1-\Delta\right)\int_{\underline{\lambda}}^{\hat{\lambda}}\frac{v-\lambda}{l}d\lambda+\Delta\left(v-\underline{\lambda}\right)$ can be negative only when $v<\lambda_{m}$. Hence, for $v\geq\lambda_{m}$ optimal property rights are complete. For $v<\lambda_{m}$ instead, a $\gamma^{*}<1$ is possible and equals either the expression in the second line of equation (2) or 0 depending on which of the two values maximizes the social welfare.[9] The former case is more likely the higher Δ is under our restrictions on α.[10] An interior γ^{*} weakly rises with the original owner's valuation v and the heterogeneity of the potential buyers' preferences Δ (figure 1). A rise in v has the infra-

[7] The assumption $\alpha<v$ assures that problem (1) is strictly concave. Should it fail, the corner solution will be 1 (0) if social welfare is higher at 1 (0) or $\left(\overline{\lambda}-\alpha+v\right)l\Delta+\left(1-\Delta\right)\left[\overline{\lambda}^{2}+\left(v+\alpha\right)^{2}-2\left(\alpha\overline{\lambda}+v\underline{\lambda}\right)\right]>\overline{\lambda}+\underline{\lambda}$ (otherwise). This last inequality is easier to satisfy the higher the extent of preference heterogeneity Δ whenever $\left(\alpha+v\right)\left(\overline{\lambda}+\underline{\lambda}-\alpha-v\right)>\underline{\lambda}\overline{\lambda}$ or $\alpha<\overline{\lambda}-v$, which is always true under our assumptions.

[8] In particular, $\alpha^{2}>\left(1-\gamma\right)v^{2}$. $\gamma^{*}<1$ whenever $\alpha>v-\underline{\lambda}$, which is possible given our assumptions.

[9] This is due to the fact that for $v<\lambda_{m}$ and $\gamma^{*}\leq\frac{v+\alpha}{\overline{\lambda}}$, the derivative of the social welfare with respect to γ equals $\left(1-\Delta\right)\left[-\overline{\lambda}^{2}+\underline{\lambda}^{2}+2v\left(\overline{\lambda}-\underline{\lambda}\right)\right]l^{-1}+2\left(v-\lambda_{m}\right)\Delta=2\left(v-\lambda_{m}\right)<0$.

[10] This is true if $2\lambda_{m}\left(\gamma^{*}v+\alpha\right)+\left(v^{2}-\alpha^{2}\right)/\gamma^{*}>\gamma^{*}\overline{\lambda}\underline{\lambda}+2v\left(v+\alpha\right)$. If this inequality is easier to satisfy the higher (lower) γ^{*} is, a sufficient condition such that it is true is $\alpha<l-v$ ($\alpha<\overline{\lambda}-v$).

marginal effect of boosting the original owner's payoff when his property rights are enforced and the marginal effect of raising $\hat{\lambda}$: both effects call for a higher γ^*. If instead Δ grows bigger, the welfare returns from the expropriation of the buyers for which $v < \lambda \leq \hat{\lambda}$ fall and the welfare costs from the expropriation by low-valuation buyers rise. Thus, γ^* has to increase. The role of the aggregate uncertainty l is similar.[11] Finally, γ^* falls with transaction costs α when interior (figure 1). The following proposition summarizes this discussion:

Proposition: *The optimal strength of property rights γ^* weakly increases (falls) with the original owner's valuation v, the aggregate uncertainty on the potential buyers' valuation l, and the heterogeneity of the potential buyers' preferences Δ (transaction costs α).*

This result is deeply related to those contributions showing a positive relation between defensive patenting and the dispersion of the technological base on which a new product builds (see Hall and Harhoff, 2012).[12] In addition, it resembles the findings of the literature linking optimal taxation and preference heterogeneity (Saez, 2002; Diamond and Spinnewijn, 2012). Yet, the "tax" γ is levied on original owners only and only some time redistributes value from higher to lower valuation agents. Finally, our main proposition spurs important insights for the transaction costs theories of the firm. Greater transaction costs call for a higher degree of vertical integration because of asset specificities (Williamson, 2010), but they also shape the upstream suppliers' property rights and, therefore, the hold-up risk (see also Hart and Moore, 1990). As a consequence, the direct and indirect effects of transaction costs should be fully considered in empirical analyses concerning the boundaries of the firm.

3.2 Endogenous Transaction Costs

More general market structures.—Consider the case in which the intermediation technology is in the hands of the original owners and transaction costs originate from the mark-up they apply on v. At the cost of a more cumbersome algebra and provided that v is sufficiently

[11] Following Aghion, Alesina, and Trebbi (2004), we can introduce in the model a very simple form of risk aversion by envisioning that agents gaining less than their utility under the certain scenario of full property rights incur also a loss u. Since ex ante all potential buyers prefer $\gamma < 1$ and all original owners $\gamma = 1$, a rise in risk aversion is isomorphic to a rise in v and thus induces a higher γ^*. The rationale for this result is that insecure property rights can be seen as a randomization of the agent's consumption patterns for $\underline{\lambda} \leq \lambda \leq \hat{\lambda}$.

[12] Similarly, Bar-Gill (2008) claims that the extent of consumer protection should be stronger to discourage the exploitation of buyers with heterogeneous cognitive abilities by rational producers.

high, the analysis will be similar should the intermediation technology be in the hands of a third group part of society. We assume that $\alpha = \beta\delta$, where β is a mark-up selected between t_1 and t_2 and δ an inverse measure of market competitiveness. β^* is chosen to maximize expected profits plus the expected payoff from consuming x when handed back or

$$(v+\beta\delta)\frac{\Delta}{2}+(1-\Delta)\frac{(v+\beta\delta)\left(\overline{\lambda}-\hat{\lambda}\right)}{l}+(1-\Delta)\gamma v\frac{\left(\hat{\lambda}-\underline{\lambda}\right)}{l}+\gamma v\frac{\Delta}{2}, \tag{3}$$

for $\frac{v+\beta\delta}{\gamma}=\hat{\lambda}<\overline{\lambda}$ and γv otherwise. Hence, β^* can be positive only in the former case when the interior solution is $\beta^*\delta=\frac{\gamma l\Delta}{4(1-\Delta)}+\frac{\gamma\overline{\lambda}}{2}-\frac{v(2-\gamma)}{2}$. If positive, β^* trades off the profits from those x that are purchased and the losses from those x that are instead expropriated so that it falls with both the degree of market competitiveness and the probability of legal expropriation $1-\gamma$. As a result, stronger property rights lower a potential buyer's payoff from buying x by increasing β^* and decrease the expected payoff from expropriating. Because of the optimality of the original owners' choice and the uniformity of preferences these two effects cancel out and so $\frac{d\hat{\lambda}}{d\gamma}=0$. Since α is now a transfer, the optimal γ maximizes

$$\overline{\lambda}\frac{\Delta}{2}+(1-\Delta)\int_{\hat{\lambda}}^{\overline{\lambda}}\frac{\lambda}{l}d\lambda+(1-\Delta)\int_{\underline{\lambda}}^{\hat{\lambda}}\frac{(1-\gamma)\lambda+\gamma v}{l}d\lambda+\frac{(1-\gamma)\underline{\lambda}+\gamma v}{2}\Delta, \tag{4}$$

whose derivative with respect to γ for $\hat{\lambda}<\overline{\lambda}$ is $(1-\Delta)\left[-\hat{\lambda}^2+\underline{\lambda}^2+2v\left(\hat{\lambda}-\underline{\lambda}\right)\right]l^{-1}+(v-\underline{\lambda})\Delta$. Thus, γ^* equals 1 (equals 0) if this derivative is positive (negative) since now social welfare under complete property rights is higher than it was in equation (1) and in turn bigger than it would be for $\gamma^*=0$. The former is the case if Δ is sufficiently high.[13]

Market for lemons.—As noticed by Hasen and McAdams (1997), "because the thief does not know which goods are lemons, he does not adversely select lemons for sale." Here, we qualify this intuition showing that in our setup partially insecure property rights can solve "lemons"-type market failures. To see this in the simplest way, we maintain that the original owners have private information on their valuation v, which is drawn from an uniform distribution with support $\left[\underline{\lambda},\overline{\lambda}\right]$ and correlated to that of potential buyers.[14] In particular,

[13]Since $\hat{\lambda}=\frac{l\Delta}{4(1-\Delta)}+\frac{\overline{\lambda}}{2}+\frac{v}{2}$, a sufficient condition turns out to be $12\left(\overline{\lambda}-v\right)(v-\underline{\lambda})>\frac{l^2\Delta(2-\Delta)}{(1-\Delta)^2}$.

[14]This is a key case of heterogeneous owners' preferences. When instead low-valuation owners are matched to

$\Delta/2$ potential buyers have valuation θv with $\theta > 2$, $1-\Delta$ of them value the good at $v+\mu$ with $0 < \mu < (\theta-1)v$, and the remainder at v/θ. While θ gauges the polarization of the potential buyers' preferences, μ covers in the present set-up the same role of α and measures the misallocation due to the asymmetry in information. The price on the official market is exogenously fixed at p so that a buyer infers that the expected value of x is $p/2$ since the owner sells only if $v \leq p$. Provided that $p > 2\mu$, while high-valuation potential buyers obtain always the good on the official market, middle and low-valuation ones expropriate whenever property rights are imperfect. This time, society maximizes the following objective function

$$\theta\left(\underline{\lambda}+\overline{\lambda}\right)\tfrac{\Delta}{4}+\left[(1-\gamma)\left(\tfrac{\underline{\lambda}+\overline{\lambda}}{2}+\mu\right)+\tfrac{\gamma\left(\underline{\lambda}+\overline{\lambda}\right)}{2}\right](1-\Delta)+\left[(1-\gamma)\tfrac{\underline{\lambda}+\overline{\lambda}}{2\theta}+\tfrac{\gamma\left(\underline{\lambda}+\overline{\lambda}\right)}{2}\right]\tfrac{\Delta}{2},$$

which implies that γ^* is equal to 1 if $-\mu(1-\Delta)+\left(\underline{\lambda}+\overline{\lambda}\right)\frac{\theta-1}{\theta}\frac{\Delta}{4} \geq 0$ and 0 otherwise. The last inequality is easier to satisfy the higher Δ is and the smaller μ is. Therefore, a higher extent of preference heterogeneity Δ is conducive to stronger property rights γ^*, whereas wider misallocations due to asymmetric information—i.e., μ—reduces them.

3.3 The Political Economy of Property Rights Protection

Thus far, we have examined the case of a perfect veil of ignorance, behind which everybody is identical. In reality this veil has large holes in it as the high pitched bargaining and conflicts occurring at the constitutional table suggest. To evaluate the positive side of property rights formation we follow Alesina, Aghion, and Trebbi (2004) and consider a situation in which the minority who chooses γ also knows his future role in the economy. A natural choice for this group of "insiders" is given by the one formed by the original owners and the buyers with the highest valuation. We maintain that these special interests can exclude the rest of society from institutional design so that property rights now solve the problem

$$\left(\overline{\lambda}-\alpha\right)\tfrac{\Delta}{2}+(1-\Delta)\int_{\hat{\lambda}}^{\overline{\lambda}}\tfrac{\lambda-\alpha}{l}d\lambda+(1-\Delta)\int_{\underline{\lambda}+\epsilon}^{\hat{\lambda}}\tfrac{(1-\gamma)\lambda+\gamma v}{l}d\lambda+\gamma v\left(\tfrac{\Delta}{2}+\tfrac{\epsilon}{l}\right).$$

Comparing this last expression with equation (1) implies that γ^* will still weakly rise with Δ but this time it will be inefficiently high because designed by "insiders" who do not face preference or technological uncertainty, e.g., Zamindari system of land taxation in India allowing landowners to expropriate from the tenants who are often more productive (Besley

high-valuation buyers at the cost α under complete information, the model's prediction stands if $l > 2\alpha$.

and Ghatak, 2010). This last claim will be overturned when the excluded potential buyers have the highest valuation, i.e., $\lambda \in \left[\overline{\lambda} - \epsilon, \overline{\lambda}\right]$. Yet, even in this case, the relation linking γ^* with preference heterogeneity will be positive under slightly different conditions on α accounting for the identity of the potential buyers excluded from the constitutional table.

4 Robustness to Alternative Assumptions

Private sales.—The case of private sales differs from our basic setup because the original owner can bargain with a matched potential buyer at the prospect of a taking. To analyze this scenario, we assume that a potential buyer has a third option once directly matched with an original owner. She can accept a take-or-leave offer $p_C < v$ allowing her to enjoy the good for sure at the extra cost $\xi < \gamma\lambda - \alpha - v$ representing, for instance, the expected punishment inflicted for coercing the original owner. To be individually rational for both the original owner and the potential buyer, p_C has to be such that $\gamma v \leq p_C \leq \gamma\lambda - \alpha - \xi$. This immediately implies that the original owners will set $p_C = \gamma\lambda - \alpha - \xi$, the potential buyers with $\lambda \geq \hat{\lambda} \equiv \frac{v+\alpha}{\gamma}$ will purchase the good at $v + \alpha$, those having a valuation $v + \frac{\alpha+\xi}{\gamma} \equiv \hat{\lambda}_C \leq \lambda < \hat{\lambda}$ will accept the take-or-leave offer and pay $p_C + \alpha$, and the remainder will expropriate the good. If $\hat{\lambda}_C \leq \hat{\lambda}$ and $\gamma^* > \frac{v+\alpha}{\overline{\lambda}}$, society maximizes the following objective function $\frac{(\overline{\lambda}-\alpha)\Delta}{2} + (1-\Delta)\int_{\hat{\lambda}}^{\overline{\lambda}} \frac{\lambda-\alpha}{l} d\lambda + (1-\Delta)\int_{\hat{\lambda}_C}^{\hat{\lambda}} \frac{\lambda-\alpha-\xi}{l} d\lambda + (1-\Delta)\int_{\underline{\lambda}}^{\hat{\lambda}_C} \frac{(1-\gamma)\lambda+\gamma v}{l} d\lambda + \frac{(1-\gamma)\underline{\lambda}+\gamma v}{2}\Delta$,

whose necessary and sufficient first order condition for an interior solution is $\frac{2\xi v - \alpha^2 - \xi^2}{\gamma^2} + (v - \underline{\lambda})\left(v - \underline{\lambda} + \frac{l\Delta}{1-\Delta}\right)$. Since the supply of private takings is smaller than that of the basic model and some legal transactions also entail the social loss ξ, γ^* is optimally lowered to encourage private expropriation and thus save social costs. Moreover, optimal property rights are still increasing in the extent of preference heterogeneity. This last remark leaves unchanged the gist of the model and it is even more reassuring because, for $\xi > v(1-\gamma)$, the design of property rights is the same as in section 3.1 since $\hat{\lambda}_C > \hat{\lambda}$.

Costly expropriation.—Buying in good-faith a stolen or embezzled good comes at a price, which is positive even if usually lower than that charged for goods with proper title (Dari-Mattiacci, Guerriero, and Huang, 2012). Similarly, to successfully occupy a piece of land or a house an agent needs to overcome the original owner's protection effort. Here, we embed

the socially wasteful expenses borne by a potential buyer who opts for expropriation in the cost $c > 0$. If $\underline{\lambda} > c(1-\gamma)^{-1}$, the lowest-valuation buyers will still expropriate x and the model's results will be unaffected.[15] If $\underline{\lambda} < c(1-\gamma)^{-1} < \hat{\lambda} \equiv \frac{v+\alpha-c}{\gamma}$, γ^* maximizes

$$\frac{(\overline{\lambda}-\alpha)\Delta}{2} + (1-\Delta)\int_{\hat{\lambda}}^{\overline{\lambda}} \frac{\lambda-\alpha}{l} d\lambda + (1-\Delta)\int_{\frac{c}{1-\gamma}}^{\hat{\lambda}} \frac{(1-\gamma)\lambda+\gamma v-c}{l} d\lambda + \left[\frac{1-\Delta}{l}\left(\frac{c}{1-\gamma} - \underline{\lambda}\right) + \frac{\Delta}{2}\right] v$$

when $\gamma^* \in \left(\frac{v+\alpha-c}{\overline{\lambda}}, 1\right]$ and $(1-\Delta)\int_{\frac{c}{1-\gamma}}^{\overline{\lambda}} \frac{(1-\gamma)\lambda+\gamma v-c}{l} d\lambda + \frac{(1-\Delta)cv}{l(1-\gamma)} + \frac{\left[(1-\gamma)\overline{\lambda}+\gamma v-c\right]\Delta}{2}$ otherwise. A glance to the new social welfare would suffice to clarify that, for $\hat{\lambda} < \overline{\lambda}$, γ^* does not depend any more on Δ. However, when $\hat{\lambda} \geq \overline{\lambda}$, society's problem becomes convex and its solution is either $\frac{v+\alpha-c}{\overline{\lambda}}$ or 0. The condition assuring that the former is more likely than the latter is easier to satisfy the higher Δ is, provided that v is not too different from $\overline{\lambda}$. Under this scenario indeed, the welfare brought by the middle-valuation buyers' takings is higher than that coming from the high-valuation buyers' takings so that, as the former weighs less, γ^* has to rise. This observation leaves intact the model's message and our testable prediction.

Investment.—The standard "security" argument in favour of property rights claims that expropriation creates a disincentive to commit effort or invest in technology (Besley and Ghatak, 2010). To understand how this basic intuition fits our model, we allow the original owners to appropriate a share ρ of the transaction cost α by investing $\rho^2/2$. For instance, they could finance in exchange for a low interest rate the potential buyers' purchases or set up a technology allowing potential buyers to customize x and reduce asset specificities. This investment choice decreases socially inefficient transaction cots but does not affect the size of α and so has no marginal effects.[16] The optimal ρ^* maximizes the following function

$$(v+\rho\alpha)\frac{\Delta}{2} + \frac{(v+\rho\alpha)(1-\Delta)\left(\overline{\lambda}-\hat{\lambda}\right)}{l} + \gamma v\frac{(1-\Delta)\left(\hat{\lambda}-\underline{\lambda}\right)}{l} + \gamma v\frac{\Delta}{2} - \frac{\rho^2}{2}, \qquad (5)$$

and equals when interior $\alpha\Delta/2 + \alpha(1-\Delta)\left(\overline{\lambda}-\hat{\lambda}\right)l^{-1} \leq 1$ for $\hat{\lambda} < \overline{\lambda}$ and 0 otherwise. Insecure property rights depress investment and society considers the severity of dynamic inconsistency at the constitutional table. When $\hat{\lambda} < \overline{\lambda}$, γ^* maximizes the following function

$$\frac{\overline{\lambda}-(1-\rho)\alpha}{2}\Delta + (1-\Delta)\int_{\hat{\lambda}}^{\overline{\lambda}} \frac{\lambda-(1-\rho)\alpha}{l} d\lambda + (1-\Delta)\int_{\underline{\lambda}}^{\hat{\lambda}} \frac{(1-\gamma)\lambda+\gamma v}{l} d\lambda + \frac{(1-\gamma)\underline{\lambda}+\gamma v}{2}\Delta - \frac{\rho^2}{2},$$

[15] Since the lowest value that γ can assume is $\frac{v+\alpha-c}{\overline{\lambda}}$, a sufficient condition for $\underline{\lambda} > \frac{c}{1-\gamma}$ is that $c < \frac{(\overline{\lambda}-v-\alpha)\underline{\lambda}}{l}$.

[16] The condition assuring the concavity of society's problem is now laxer: $v+\alpha^2\Delta > \alpha$. The model's prediction will stand should we consider different investment technologies affecting, for instance, the λ distribution.

whose first order condition equals that in equation (2) except for the investment inducement term $-\alpha^2 \frac{\Delta(1-\Delta)}{l} \frac{d\hat{\lambda}}{d\gamma}$. An interior γ^* is given this time by the square root of $\frac{(v+\alpha)\left(v+\alpha^2\Delta-\alpha\right)}{v\underline{\lambda}+(v-\underline{\lambda})\left(\underline{\lambda}-\frac{l\Delta}{1-\Delta}\right)}$, is higher than that prevailing without investment, and rises once again with Δ.

Property rules versus liability rules.—After expropriation, a potential buyer has to hand back the good with probability γ—i.e., when the property rule is applied—and can keep it by paying damages d to the original owner otherwise, i.e., when the liability rule is applied.[17] Following Kaplow and Shavell (1996), we assume that there are frictions in the evaluation of d, which equals $\underline{\lambda}$ with probability ϕ and v otherwise. The parameter ϕ gauges either the asymmetry in information faced by the judiciary (Kaplow and Shavell, 1996) or her willingness to pander to potential buyers (Guerriero, 2012), who buy if $\lambda \geq \hat{\lambda} \equiv \frac{v+\alpha-(1-\gamma)d}{\gamma}$ with $d = \phi\underline{\lambda} + (1-\phi)\, v$ and expropriate otherwise. Hence, society maximizes the function

$$\frac{\overline{\lambda}-\alpha}{2(1-\Delta)}\Delta + \int_{\hat{\lambda}}^{\overline{\lambda}} \frac{\lambda-\alpha}{l} d\lambda + \int_{v}^{\hat{\lambda}} \frac{(1-\gamma)\lambda+\gamma v}{l} d\lambda + \int_{\underline{\lambda}}^{v} \frac{(1-\gamma)\phi\lambda+[(1-\gamma)(1-\phi)+\gamma]v}{l} d\lambda + \frac{(1-\gamma)\phi\underline{\lambda}+[(1-\gamma)(1-\phi)+\gamma]v}{2(1-\Delta)}\Delta$$

if $\hat{\lambda} < \overline{\lambda}$. Provided that $(v-d)^2 > \alpha^2$, society's problem is still concave and an interior γ^* is implicitly and uniquely defined by $\frac{v^2-\alpha^2+d(d-2v)\left(1-\gamma^2\right)}{\gamma^2} + \phi\,(v-\underline{\lambda})^2 - v^2 + \frac{\phi(v-\underline{\lambda})l\Delta}{(1-\Delta)} = 0$.

Again, a higher preference heterogeneity narrows the scope of welfare increasing transfers without consent and pushes towards stronger property rights. Also, liability rules are more likely the higher transaction costs and/or damages are. In fact, a low d, as chosen for instance by a pro-buyer judge, encourages inefficient use of liability rules for $\lambda \leq v$.

5 Evidence

We focus our empirical exercise on key question of what institutions are more appropriate for more or less fragmented societies (see also Aghion, Alesina, and Trebbi, 2004). Our model implies that a rise in preference heterogeneity will lead to a stronger protection of property rights because it reduces the mass of middle-valuation buyers inefficiently excluded from trade because of transaction costs. This intuition is true whether or not constitution writers choose under the veil of ignorance and leads to the following prediction:

[17] This set up captures also the case of a state paying compensation after expropriation. A key extension to our model is to study property rights selection in anticipation of later bargaining (Segal and Whinston, 2012).

Prediction: *The strength of property rights will rise with preference heterogeneity.*

To test this prediction we need, first and foremost, meaningful proxies for the relative extent of protection of the original owner's property rights and preference heterogeneity.

5.1 Measuring Property Rights and Preference Heterogeneity

Starting with personal property, we focus on the number of years after which a good-faith possessor of a movable good acquires ownership, *AP-Movable* (see for a similar choice Dari-Mattiacci, Guerriero, and Huang, 2012). The longer this term of years, the stronger the protection afforded to the original owner.[18] To construct this and the following dependent variables, we sent questionnaires to members of Lex Mundi and HG.org, i.e., the most prestigious associations of law firms (see Djankov et al., 2003), contributors to the World Bank doing business project, and law scholars. *AP-Movable* is available for our entire dataset, which covers 126 jurisdictions between 1981 and 2011. The lack of any significant reform over this period and the unavailability of our main proxy of preference heterogeneity for Puerto Rico leaves us with a cross section of 125 jurisdictions (see table 1). Table 2 reports the definition, sources, and summary statics of all the variables we use in this section.

Turning to real property, we employ *AP-Immovable*, which equals: the number of years necessary for adverse possession of immovable goods with good-faith but without title if the adverse possessor prevails against a good-faith buyer from the original owner or registration is compulsory for adverse possession; 30 if registration is not compulsory for adverse possession and the good-faith buyer from the original owner prevails on the adverse possessor or if ownership of the adverse possessor is not legally recognized.[19] Differently from *AP-Movable*, *AP-Immovable* is built having in mind a particular scenario, i.e., the conflict between a good-faith possessor of real property without title and a third party buying from the original owner after the term for adverse possession is expired. This legal case emphasizes the most the adverse possessor's claim since enforceability against third parties is the key feature of property rights on immovable goods (Bouckaert and De Geest, 1995). When the possessor

[18] If the law prescribes that the good-faith buyer can never acquire property rights we assign the variable a value of thirty, which is the maximum observed elsewhere in the sample. Switching to seventy years or to the life expectancy at birth of the jurisdiction does not qualitatively affect the results of the empirical exercise.

[19] In the background, we assume that a good-faith possessor will always register the good if registration is compulsory to acquire property via adverse possession.

prevails, the protection of the original owner and, in turn, of the buyer will be weaker.

Finally, for what concerns public expropriation, we gauge the scope of indirect private takings via the dummy *Government-Takings*. This is equal to 1 if the state can take private real property only for public use but not to transfer it to a private entity for private for-profit use. Therefore, *Government-Takings* equals 0 when the state can use public takings to deliberatively favor a subgroup of the population to the detriment of another.

The maps in figure 2 visualize the large variation in our three proxies of property rights protection over our sample. For instance, the average general term for adverse possession of a movable good by any good-faith possessor is 11.212 years with a standard deviation of 11.781 years, which summarizes the existence of a variety of solution ranging from the full protection of the owner in United States to the full protection of the good-faith possessor in Italy. To draw our maps, we have divided the range of each variable into four equal intervals, but in the statistical analysis we always use the continuously measured variables.

For what concern our proxy for Δ, a long stream of contributions in population genetics clarifies that the degree of genealogical relatedness of different populations over time is a general metric for average differences in characteristics, such as moral values and preferences, transmitted across generations (Cavalli-Sforza, Menozzi, and Piazza, 1994). In this perspective, the strong link between ethnic roots and genetic pools makes the ethnic fractionalization within a jurisdiction a natural proxy for the extent of preference heterogeneity. Consistent with this choice, Lieberman and McClendon (2013) use on Afrobarometer survey data from 18 Sub-Saharan countries to show that preferences vary across ethnic groups. Ethnicity shapes not only the propensity to commit crimes but also how salient respondents perceive education, electricity, farming, health, and unemployment policies. The estimates discussed below are mostly based on the probability that two individuals randomly drawn from the overall population belong to different ethnic groups, *Ethnic* (Alesina et al., 2003). Lower ethnic cohesion corresponds to higher values of *Ethnic*, which ranges between 0 and 1. The bottom right map of figure 2 displays the wide variation of *Ethnic* over our sample.

5.2 Estimating Equation and Basic Results

A comparison of the four maps in figure 2 offers a visual test of our empirical prediction.

Consistent with our model, countries characterized by a stronger preference heterogeneity also present a stronger protection of the original owner's property rights. In the following, we document that this pattern remains true when we switch to multivariate analysis and possibly turn to other proxies of preference heterogeneity like the language or religious fractionalization (Alesina et al., 2003) or a synthetic index of ethnolinguistic fractionalization (Fearon and Laitin, 2003). Building on our model, our baseline estimating equation is

$$y_j = \alpha + \beta x_j + \gamma' \mathbf{Z}_j + \epsilon_j, \tag{6}$$

where y_j is one of our measures of property rights for jurisdiction j, x_j is *Ethnic*, and $\mathbf{Z}_j$ gathers a series of other covariates that we introduce below and include in equation 6 in sub-groups to avoid multicollinearity. The key implication to be tested is that $\beta > 0$.

Column (1) of tables 3 to 5 displays the OLS estimates of equation (6) when we do not include any extra control variables and the dependent variable is respectively *AP-Movable*, *AP-Immovable*, and *Government-Takings*. A one-standard-deviation rise in *Ethnic*, i.e., 0.24, is associated with a 2.52 (1.55)-year increase in the general term for adverse possession (*AP-Immovable*) in column (1) of table 3 (4) and to a 0.14 increase in the expected value of *Government-Takings* in column (1) of table 5. All these coefficients are significant at 10 % or better and imply that jurisdictions endowed with higher preference heterogeneity afford a stronger protection to the original owners' property rights whether the good in question is movable or immovable or the private taking is direct or mediated by the state.

5.3 Identifying Causal Relationships

The positive correlation between *Ethnic* and our measures of property rights that is documented in the previous section is consistent with the main testable prediction of our model. However, the correlation could also be explained by omitted variables. As discussed above, empirical works building on the "primordial" theory of social evolution document that the majority of the world ethnic diversity has been produced during the agricultural revolution (Ahlerup and Olsson, 2012), whereas those in line with the "constructive" theory see the European colonizers' attempt to "divide and rule" the natives as a main determinant of ethnic diversity (Michalopoulos, 2012). Hence, even if it is quite unlikely that our results

could be driven by reverse causation, there could be more recent historical events, like the colonial rule, that have shaped at the same time ethnic fractionalization and the legal and political institutions conducive to stronger property rights (Acemoglu and Johnson, 2005).[20]

We pursue four strategies to assess whether the correlations documented so far are causal. First, we control for the potential impact of colonial rule and other determinants of property rights. Second, we focus on the jurisdictions where the majority of contemporary inhabitants belong to the native populations. Third, we use selection on observable variables to assess the likelihood that our estimates are being driven by unobserved heterogeneity. Finally, we turn to an IV estimator using the primordial drivers of ethnic diversity as instruments.

5.3.1 Controlling for Observables

The most important potentially omitted factors in equation (6) belong to three categories: those shifting the extraction strategy of European colonizers, those shaping property rights through channels other than misallocation, and those affecting preference heterogeneity. Starting from the former, Acemoglu, Johnson, and Robinson (2001, 2002) propose that the colonizers invested in "institutions of private property" where the disease environment allowed a more prosperous settlement and in less populated regions where coercion of the natives was a suboptimal option. Therefore, if the colonizers have invested in institutions supporting property rights and have preserved ethnic diversity where precolonial pathogen-load and development were lower, we could falsely attribute the effect of colonial rule to *Ethnic*. Accordingly, we insert in $\mathbf{Z}_j$ either the historical prevalence of seven different diseases developed by Murray and Schaller (2010)—*Pathogen-Load*—or the natural logarithm of the population density in 1500 estimated by McEvedy and Jones (1978), *Urbanization-1500*.

Turning to the other shifters of property rights, Dari-Mattiacci, Guerriero, and Huang (2012) study the balance between protection of property rights and reliance on contracts as a function of the intermediaries' incentives to expropriate original owners and in particular of their norms of respect and trust. To summarize both aspects, we focus on the first principal component of the level of generalized trust and the importance of respect obtained from individual answers to the World Value Surveys and European Value Study run before 2008

[20] Another more subtle form of endogeneity could be driven by the inability of heterogeneous communities to agree on the production of public goods like enforcement capacity (Alesina, Baqir, and Easterly, 1999).

(Inglehart et al. 2010), *Culture*.[21] The relation between property rights and *Culture* should be positive since, in a society where intermediaries are more honest, most transactions will be consensual and there is less scope for ex post re-allocation of value.[22] A second driver of property rights is put forward by a legacy of findings suggesting that a higher level of non-produced output leads to more expropriation because the disincentive-on-effort effect of expropriation is smaller (Besley and Ghatak, 2010). To account for the resource course, we look at the level of crude oil proved reserves in billion barrels per capita, *Reserves*. A third possible determinant of property rights protection has been proposed by a growing theoretical literature claiming that sufficiently high resource or income inequality, by fostering inter-groups conflicts and making redistribution costly, inevitably leads to some form of autocracy and, in turn, legalized expropriation (Cervellati, Fortunato, and Sunde, 2008; but see for a different view, Boranbay and Guerriero, 2013). We include in the specification directly the strength of the constraints on the executive from the POLITY IV data set averaged over all the available years before 2010—*Democracy*.[23] Our conclusions however will be qualitatively similar should we consider either the natural logarithm of the 2010 real GDP per capita or the UTIP Gini inequality estimate averaged between 1963 and 2002. Finally, we also take into account the jurisdiction's legal tradition in 2000 through the variable *Common-Law*, which ranges between 0 and 1.[24] Since, as proved by Guerriero (2012), transplanted legal systems have been reformed to attain the best legal order given a jurisdiction's endowment of cultural heterogeneity and democracy, *Common-Law* can be endogenous.[25] Crucially,

[21] While the former is the share of respondent answering "most people" to the question "would you say that most people can be trusted or that you can't be too careful in dealing with people?", the latter is that mentioning "tolerance and respect for other people" as an important quality that children should learn.

[22] Dari-Mattiacci, Guerriero, and Huang (2012) also shows that protecting property is comparatively less appealing when law enforcement is more efficient, since then property is already safeguarded. In our model, however, γ encapsulates also the quality of public enforcement. Incorporating also the first principal component extracted from the total police personnel and the total professional judges and magistrates per 100,000 inhabitants averaged between 1973 and 2009 does not affect the gist of our empirical exercise.

[23] This measure ranges between 1 and 7 and assumes higher values when the holder of executive powers is accountable to the citizenry and the government is constrained by checks and balances or by the rule of law.

[24] *Common-Law* is the first principal component extracted from: 1. a dummy for case law; 2. a binary turning on if the judgement may be based on both law and equity grounds; 3. a dummy equal to one if only new evidence or issues of law can be reviewed, or if there is no appeal; 4. an indicator equal to 1 if judges cannot freely request or take evidence that has not been introduced by the parties and cannot refuse to collect or admit requested evidence, 0.5 if only one of these two bans is imposed, and 0 otherwise; 5. a binary turning on if the evidence is mostly submitted at oral hearings before the judge (Guerriero, 2012).

[25] Including instead an indicator for whether English common law was initially transplanted in the country (La

Culture, *Democracy*, and *Common-Law* also control for differences in transaction costs driven by interpersonal trust and the efficiency of political and contracting institutions (La Porta et al., 1999). This is key since, if omitted, transaction costs could bias our estimates if correlated with the extent of preference heterogeneity.

Turning to other drivers of preference heterogeneity, we build on the primordial theory of social evolution and add to the specification the standard deviation of land quality—*Land-Quality-SD*—and the average land ruggedness in Km, *Ruggedness*. Michalopoulos (2012) documents that these two geographical features summarize the geographic variability, which in turn gave rise to location-specific human capital and thus localized ethnicities.

Estimates of equation (1) controlling for the additional regressors are reported in columns (2) to (8) of tables 3 to 5. Our testable prediction continues to be strongly supported by the data whenever the dependent variable is either *AP-Movable* or *Government-Takings*. When instead the dependent variable is *AP-Immovable*, the coefficient on *Ethnic* albeit positive becomes at times statistically insignificant. This is mainly due to the difficulty to construct a synthetic measure of the relative protection of the original owner of an immovable good since registration makes third parties' rights pivotal. Finally, whenever significant, the coefficients attached to the additional control variables show the expected sign.

We undertake a number of robustness and sensitivity checks that we report partly here and partly in the internet appendix. First, since ethnic diversity is only one of the different aspects of preference heterogeneity, we turn in table 6 to three other alternative measures. The first two are defined in a way completely similar to *Ethnic* but concern the extent of language and religious fractionalization, respectively *Language* and *Religion* (Alesina et al, 2003). The third one is a measure summarizing both ethnic and language differences and is based on data from a Soviet ethnographic source—i.e., the Narodov Mira atlas—and Fearon and Laitin (2003). In a nutshell, whether the extent of preference heterogeneity is produced by different ethnic roots, different communication tools, or different religious values, it always reduces the need of welfare-enhancing transfers without consent.[26] This is even more remarkable, once it is noticed that the correlation between *Religion* and the other proxies for

Porta et al., 1999) has no effect on our estimates.

[26] It is worth noting that the estimates gathered in table 6 are pretty similar when we switch to an IV estimator exploiting the same instruments we discuss in section 5.3.4.

preference heterogeneity is quite low, i.e., nowhere higher than 0.32. Second, we check for robustness to alternative estimation methods. In particular, we obtain substantially similar results when we switch to the negative binomial model or when we estimate the specifications with dependent variable *Government-Takings* with a probit model (see the internet appendix). One final concern with our basic specification is that preference heterogeneity is relevant only when market networks are "dense" and so buyers with very different valuations are matched to owners. To test this idea, we estimate equation (6) by weighted least squares with weighting proportional to population density: the message of this robustness is consistent with our testable prediction (see the internet appendix).

5.3.2 Focusing on Native Populations

The estimates in columns (2) and (3) of tables 3, 4, and 5 do not exclude that colonial rule is driving both ethnic diversity and property rights via a channel different from the precolonical disease environment and development. To grasp more insights into this possibility, we repeat the basic OLS analysis employing only those jurisdictions where more than 50 percent of the current population was indigenous as of 1500 AD according to the data developed by Putterman and Weil (2010). Table 7 clearly shows that our results do not rest on the inclusion of countries where ethnicity was heavily shaped by the European colonization.

5.3.3 Using Selection on Observables to Assess the Bias from Unobservables

Despite our attempts to control for relevant observable factors, such as colonial rule and other shifters of property rights, the estimates discussed so far may still be biased by unobservable factors correlated with preference heterogeneity and property rights selection. In this section, we use selection on observables to assess the potential bias from unobservables. In particular, we build on Altonji, Elder, and Taber (2005) who provide an index gauging how much stronger selection on unobservables, relative to selection on observables, must be to explain away the full estimated effect.[27] To see how the index is calculated, consider two regressions: one with a restricted set of control variables, and one with a full set of controls. Denote the estimated coefficient for the variable of interest from the first regression β^R, where R stands for "restricted", and the estimated coefficient from the second regression β^F, where

[27] We use the version developed by Bellows and Miguel (2009) for possibly endogenous continuous variables.

F stands for "full". Then, the index equals the absolute value of the ratio $\beta^F/(\beta^R - \beta^F)$. The intuition behind the formula is as follows. First, consider why the ratio is decreasing in $(\beta^R - \beta^F)$. The smaller is the absolute value of the difference between β^R and β^F, the less the estimate is affected by selection on observables, and the stronger selection on unobservables needs to be to explain away the entire effect. Next, notice that the larger the absolute value of β^F is, the greater is the effect that needs to be explained away by selection on unobservables, and thus the higher is the ratio. We consider the specification with no additional control variables as the restricted regression and those adding one at the time the sub-groups of other relevant covariates as the full regressions. The indexes calculated for the specifications with dependent variables *AP-Movable*, *AP-Immovable*, and *Government-Takings* are reported respectively in columns (1), (2), and (3) of table 8. None of them is less than one, whereas the median and average indexes are respectively 12.6 and 59.1. Therefore, to attribute the entire OLS estimate to selection effects, selection on unobservables would have to be on average over 59 times greater. In our view, these results make it less likely that the estimated effect of preference heterogeneity is fully driven by unobservables.

5.3.4 IV Estimates

Our final strategy is the use of instrumental variables. This requires an instrument that is correlated with ethnic fractionalization but uncorrelated with any characteristics of the jurisdiction affecting contemporaneous property rights. We rely on two plausible sources of exogenous variation. The first one is the absolute latitude, *Latitude*, of the country's capital. Cashdan (2001) shows that the negative correlation between latitude and ethnic diversity is mainly driven by habitat similarities of regions at the same vertical distance from the equator. Thus, conditional on the jurisdiction's historical pathogen load and variation in land quality and elevation, *Ethnic* should not be correlated to the within jurisdiction geography affecting property rights via colonial rule or the resources availability. Ahlerup and Olsson (2012) proposes a second aspect of the initial human settlement shaping the contemporaneous ethnic distribution: new ethnic groups endogenously and progressively emerge among peripheral populations as a response to an insufficient supply of public goods. In accordance with this prediction, the time from the first uninterrupted settlement by the

anatomically modern human, hereafter AMH, in 100,000s years—*Origin-Time*—is positively associated with ethnic diversity.[28] The AMHs first spread to Africa between 160,000 BC and 135,000 BC. Next, after a first attempt frustrated by a volcanic eruption in Sumatra, they occupied South-Eastern Asia and Australia in 65,000 BC, Southern Europe and Central Asia in 45,000 BC, Northern America between 22,000 BC and 10,000 BC, and Northern Europe after the retreat of the ice caps in 8,000 BC. Given this peculiar diffusion pattern, it is very difficult to envision a systematic relation linking continental natural disasters with unobserved within-country geographical factors driving the preference heterogeneity.

Table 9 reports in panels (A), (B), and (C), the estimates of the IV regressions with dependent variables respectively *AP-Movable*, *AP-Immovable*, and *Government-Takings*. Once again, our results are in tune with the testable prediction and the implied effects are not too dissimilar from the OLS estimates. Indeed, in more than half of the cases we cannot reject the null hypothesis of the endogeneity test that *Ethnic* can be treated as exogenous at the 5 percent level or higher. These results suggest that selection into ethnic diversity is not strongly biasing the OLS estimates and are consistent with the findings discussed above.

Turning to the consistency of the estimates, the instruments enter the first stages always with the expected sign and in a strong manner as confirmed by the Kleibergen-Paap statistic.[29] In addition, we cannot reject the overidentifying restrictions at a level nowhere lower than 5% except in column (7) of panel (A) (see also Guerriero, 2012). A similar evidence is produced by the semi-reduced-form specifications reported in the internet appendix. There, we show that *Latitude* is often insignificant when included directly in the second stages and thus it is dubious that it might affect property rights through channels other than *Ethnic*.

5.4 Interpreting the Empirical Results

Overall, it is fair to summarize our basic results and the battery of robustness and sensitivity checks we perform by saying that jurisdictions endowed with higher preference heterogeneity afford a stronger protection to the original owners' property rights. A key issue however remains: in which way our theory and measurement strategy relate to the

[28] The coefficient on *Ethnic* will be similar but the first stages will be weaker, should we use instead of *Origin-Time* its main geographical predictor, i.e., migratory distance from Addis Abeba (Michalopoulos, 2012).

[29] To save space we do not report the first stages in panel (B) and (C) of table 9.

subjective measures of property rights currently used in the development literature?

To answer this question, we correlate our private-taking-based measures of property rights to the two subjective measures of coercion by powerful elites most widely used in the development literature (Acemoglu and Johnson, 2005): *Private-Property*, which is a five categories scale coded by the Heritage foundation and increasing in the de facto protection of private property in 1997, and *Av-Expropriation*, which is a ten categories scale produced by the Political Risk Services and assuming higher values whenever the perceived risk of expropriation of private foreign investment was lower between 1985 and 1995. A glance to table 10 immediately reveals two patterns. First, coercion-based measures of property rights correlate in a small and positive way with *AP-Movable* and negatively with both *AP-Immovable* and *Government-Takings*. Second, they correlate with *Ethnic* in a way opposite to the one foreseen by our model. Even if preliminary, these pieces of evidence imply that *Private-Property* and *Av-Expropriation* capture institutional characteristics different from the legal protection of property from direct and indirect private takings. This inconsistency requires that more attention should be devoted to the interpretation of the estimates grounded on the coercion-based measures and that future contributions should linger on the relation between these metrics and the private-taking-based measures of property rights we discussed above.

6 Conclusions

This paper has developed a theory of "endogenous property rights" characterizing how societies, heterogeneous in their preference diversity, select the extent to which they allow direct and indirect private takings. When property is fully protected, some buyers with valuation higher than that of original owners are inefficiently excluded from trade due to transaction costs. When protection of property is weak, low-valuation buyers inefficiently expropriate original owners. A rise in the heterogeneity of the buyers' preferences makes inefficient expropriation by low-valuation buyers weigh more heavily on social welfare than inefficient exclusion from trade and, hence, it is optimal to strengthen property rights. This prediction survives when original owners have higher political influence on institutional design, when private expropriation is costly, and when transaction costs are endogenous.

To evaluate the model's prediction, we build a novel data set and measure property rights

with the rules regulating adverse possession of personal and real property and government takings of real property. We elect the degree of ethnic fractionalization as our proxy for preference heterogeneity. OLS estimates suggest that jurisdictions endowed with higher preference heterogeneity afford a stronger protection to the original owners' property rights. To determine whether this relationship is causal, we pursue a number of different strategies. First, we control for the potential impact of colonial rule and other determinants of property rights. Second, we show that our results are pretty similar when we focus only on those jurisdictions where the majority of contemporary inhabitants can trace their ancestry in 1500 AD to the same area. Third, building on Altonji, Elder, and Taber (2005), we show that on average selection based on unobservables would have to be 59 times greater than selection on observables in order for the positive effect of ethnic fractionalization on property rights to be completely spurious. Finally, we report IV estimates confirming the OLS results.

Surprisingly, our data are not positively correlated with the existing coercion-based metrics of property rights. This evidence casts several doubts on the interpretation to give to the literature stressing the pivotal role of property rights protection and solicits more research on the relation between private-taking-based and coercion-based measures.

Appendix

General Probability Density Functions of the Potential Buyers' Valuation

We first consider a generic probability density function of the potential buyers' valuation whose dispersion increases as in the basic model; then we discuss the impact of a mean preserving spread of the unimodal probability density function of λ on γ^*. In the former case, a share $\Delta/2$ of potential buyers value the good at $\underline{\lambda} > 0$, a share $\Delta/2$ of them value x at $\overline{\lambda} > v > \underline{\lambda}$, and the remaining potential buyers have valuation $\lambda \in \left[\underline{\lambda}, \overline{\lambda}\right]$ distributed according to the generic probability density function f with cumulative distribution function F.[30] If strictly higher than $(v+\alpha)\left(\overline{\lambda}\right)^{-1}$, the optimal level of property rights maximizes

$$\left(\overline{\lambda}-\alpha\right)\tfrac{\Delta}{2}+(1-\Delta)\int_{\hat{\lambda}}^{\overline{\lambda}}(\lambda-\alpha)\,dF(\lambda)+(1-\Delta)\int_{\underline{\lambda}}^{\hat{\lambda}}\left[(1-\gamma)\lambda+\gamma v\right]dF(\lambda)+\tfrac{(1-\gamma)\underline{\lambda}+\gamma v}{2}\Delta,$$

which is strictly concave if $\frac{d\hat{\lambda}}{d\gamma}\left[\frac{1-\gamma}{\gamma}v\hat{\lambda}f'\left(\hat{\lambda}\right)+\frac{v-\alpha}{\gamma}f\left(\hat{\lambda}\right)\right]<0$. We assume this last condition throughout. $\frac{d\gamma^*}{d\Delta}>0$ since the unique interior γ^* is implicitly defined by

$$\tfrac{1-\gamma^*}{\gamma^*}v\hat{\lambda}f\left(\hat{\lambda}\right)-\left(\hat{\lambda}-v\right)F\left(\hat{\lambda}\right)+\int_{\underline{\lambda}}^{\hat{\lambda}}F(\lambda)\,d\lambda+\tfrac{(v-\underline{\lambda})l\Delta}{1-\Delta}=0.$$

The intuition for this result is straightforward: since preference heterogeneity continues to enter linearly in the first order condition, the comparative statics $\frac{d\gamma^*}{d\Delta}>0$ remains unaffected.

Turning to the case of a mean preserving spread of the unimodal f, the necessary and sufficient condition for an interior solution for $\hat{\lambda}<\overline{\lambda}$ is $\frac{1-\gamma^*}{\gamma^*}v\hat{\lambda}f\left(\hat{\lambda}\right)-\left(\hat{\lambda}-v\right)F\left(\hat{\lambda}\right)+\int_{\underline{\lambda}}^{\hat{\lambda}}F(\lambda)\,d\lambda=0$. Therefore, if $v+\alpha$ is sufficiently high, the rise in heterogeneity raises γ^* since $f\left(\hat{\lambda}\right)\left(F\left(\hat{\lambda}\right)\right)$ weakly rises (falls) and $\int_{\underline{\lambda}}^{\hat{\lambda}}F(\lambda)\,d\lambda$ increases because F becomes inferior in the second order stochastic dominance sense. Intuitively, because the left hand side of the first order condition strictly falls in γ by assumption, as soon as it becomes bigger because of the mean preserving spread, γ^* has to increase in order to restore the necessary and sufficient condition for a stationary point. When, for instance, F is the normal distribution a sufficient condition for $\frac{d\gamma^*}{d\Delta}>0$ is $\frac{1-\gamma^*}{\gamma^*}v\hat{\lambda}\left[\left(\hat{\lambda}-E(\lambda)\right)^2-\sigma^2\right]+\sigma^2\left(\hat{\lambda}-v\right)\left(\hat{\lambda}-E(\lambda)\right)>0$, which is true when α and/or v are not too small with respect to the variance σ^2. □

[30] Notice that to assure that a rise in Δ implies a mean preserving spread of F, a share $(1-\zeta)\Delta$ of potential buyers should value the good at $\underline{\lambda}>0$ and a share $\zeta\Delta$ of them should value x at $\overline{\lambda}$ with $E(\lambda)=\zeta\overline{\lambda}+(1-\zeta)\underline{\lambda}$.

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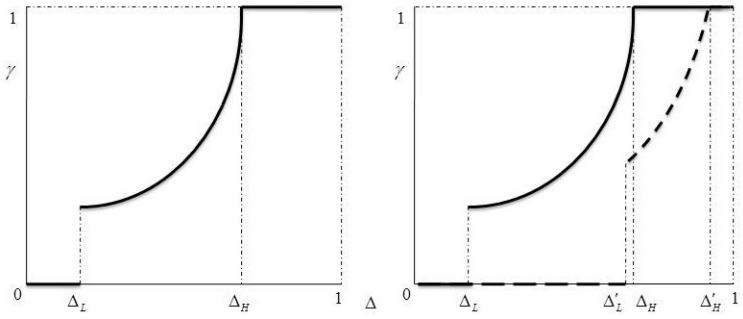
Figures and Tables

Figure 1: Property Rights, Preference Heterogeneity, and Transaction Costs

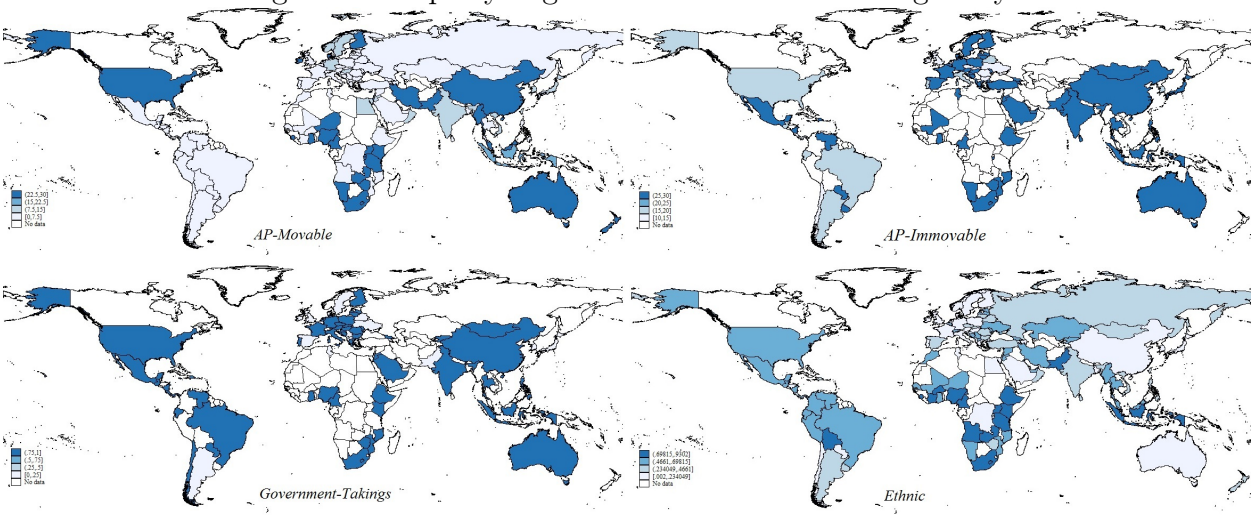


Note: 1. In the right-hand side figure is depicted the effect of a rise in transaction costs from α to α'.

Table 1: Sample

Albania; Angola; Argentina; Armenia; Australia; Austria; Azerbaijan; Bahrain; Bangladesh; Belarus; Belgium; Belize; Bolivia; Bosnia and Herzegovina; Brazil; Bulgaria; Burkina Faso; Burundi; Cameroon; Chile; China; Colombia; Costa Rica; Cóte d'Ivoire; Croatia; Cyprus; Czech Republic; Denmark; Dominican Republic; Ecuador; Egypt; El Salvador; Estonia; Ethiopia; Finland; France; Georgia; Germany; Ghana; Great Britain; Greece; Guatemala; Honduras; Hong Kong; Hungary; India; Indonesia; Iran; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kazakhstan; Kenya; Kosovo; Kuwait; Kyrgyz Republic; Latvia; Lesotho; Lithuania; Luxembourg; Macedonia; Malaysia; Mali; Malta; Mauritius; Mexico; Moldova; Mongolia; Montenegro; Morocco; Mozambique; Myanmar; Namibia; Netherlands; New Zealand; Nicaragua; Niger; Nigeria; Northern Ireland; Norway; Oman; Pakistan; Panama; Paraguay; Peru; Philippines; Poland; Portugal; Puerto Rico; Romania; Russia; Rwanda; Saudi Arabia; Scotland; Senegal; Serbia; Sierra Leone; Singapore; Slovak Republic; Slovenia; South Africa; South Korea; Spain; Sri Lanka; Sweden; Switzerland; Syria; Taiwan; Tanzania; Thailand; Trinidad and Tobago; Tunisia; Turkey; Uganda; Ukraine; United Arab Emirates; United States; Uruguay; Venezuela; Vietnam; Zaire; Zambia; Zimbabwe.

Figure 2: Property Rights and Preference Heterogeneity



Note: 1. To draw the maps, we have divided the range of each variable into four equal intervals. See table 2 for the definition and sources of each variable.

Table 2: Summary of Variables

	Variable	Definition and Sources	Statistics
Property rights:	*AP-Movable*:	Years needed for adverse possession by any good-faith possessor of a movable good. Source: see text.	11.212 (11.781)
	AP-Immovable:	See text. Source: see text.	25 (7.861)
	Government-Takings:	Dummy equal to 1 if the state can take private real property only for public use but not to transfer it to a private entity for private for-profit use, 0 otherwise. Source: see text.	0.737 (0.443)
Preference heterogeneity:	*Ethnic*:	Ethnic fractionalization. Source: Alesina et al. (2003).	0.406 (0.242)
	Language:	Language fractionalization. Source: Alesina et al. (2003).	0.374 (0.279)
	Religion:	Religious fractionalization. Source: Alesina et al. (2003).	0.445 (0.225)
	Elf:	Ethnolinguistic fractionalization. Source: Fearon and Laitin (2003).	0.380 (0.273)
Other controls:	*Pathogen-Load*:	Measure of the historical prevalence of seven different kinds of disease-causing pathogens, i.e., Leishmania, Trypanosoma, Malaria, Schistosoma, Filaria, Spirochetes, Leprosy. Source: Murray and Schaller (2010).	0.101 (0.631)
	Urbanization-1500:	Natural logarithm of the population density in 1500. Source: McEvedy and Jones (1978).	1.105 (1.576)
	Culture:	See text. Source: World Value Survey and European Value Study.	- 0.011 (0.998)
	Reserves:	Crude oil proved reserves in billion barrels per capita. Source: Energy Information Administration and available at http://www.eia.gov/cfapps/ipdbproject	0.001 (0.005)
	Democracy:	Executive constraints from the POLITY IV data set averaged over all available years before 2010. Source: Marshall and Jaggers (2010).	4.149 (1.828)
	Common-Law:	See text. Source: Guerriero (2012).	0.343 (0.247)
	Land-Quality-SD:	Standard deviation of land quality calculated as product of a measure of the climatic suitability for cultivation and a measure of the soil suitability for cultivation. Source: Michalopoulos (2012).	0.202 (0.093)
	Ruggedness:	Average ruggedness of the terrain in Km. Source: G-Econ database and available at http://gecon.yale.edu/	0.184 (0.124)
Instruments for preference heterogeneity:	*Origin-Time*:	Time from first uninterrupted settlement by the anatomically modern human in 100,000s years. Source: Ahlerup and Olsson (2012).	52269.60 (45304.33)
	Latitude:	Absolute latitude divided by 90 and taking values between 0 and 1. Source: World CIA Factbook and available at https://www.cia.gov/library/publications/the-world-factbook	0.333 (0.191)

Note: 1. The last column reports the mean value and, in parentheses, the standard deviation of each variable. The statistics are computed for the sample used to produce table 3, except those relative to *AP-Immovable* (*Government-Takings*) that refers to the sample employed in table 4 (5) and *Language*, *Religion*, and *Elf*, which are calculated for the sample relative to table 6.

Table 3: Movable Goods — OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	The dependent variable is *AP-Movable*							
Ethnic	10.506 (4.497)**	10.844 (4.730)**	10.438 (4.716)**	16.676 (5.341)***	11.114 (4.540)**	12.011 (4.584)***	10.986 (5.245)**	10.157 (4.755)**
Pathogen-Load		0.036 (1.927)						
Urbanization-1500			- 0.619 (0.766)					
Culture				4.257 (1.214)***				
Reserves					- 257.773 (108.827)**			
Democracy						1.192 (0.624)*		
Common-Law							6.943 (4.424)	
Land-Quality-SD								- 4.688 (12.418)
Ruggedness								- 6.947 (8.166)
Estimation	OLS							
R^2	0.05	0.05	0.06	0.18	0.06	0.07	0.07	0.05
Number of observations	125	122	122	91	125	119	93	112

Notes: 1. Robust standard errors in parentheses.
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
3. All specifications include a constant term.

Table 4: Immovable Goods — OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	The dependent variable is *AP-Immovable*							
Ethnic	6.468	3.134	7.145	8.980	7.025	4.505	4.356	6.312
	(3.393)*	(3.782)	(3.531)**	(3.747)**	(3.355)**	(3.452)	(4.381)	(3.530)*
Pathogen-Load		3.061						
		(1.512)**						
Urbanization-1500			0.168					
			(0.539)					
Culture				0.360				
				(1.084)				
Reserves					- 105.126			
					(142.017)			
Democracy						- 0.694		
						(0.497)		
Common-Law							1.302	
							(4.871)	
Land-Quality-SD								- 10.735
								(10.486)
Ruggedness								2.068
								(8.225)
Estimation	OLS							
R^2	0.03	0.08	0.04	0.06	0.04	0.05	0.02	0.05
Number of observations	79	78	77	62	79	75	62	73

Notes: 1. Robust standard errors in parentheses.
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
3. All specifications include a constant term.

Table 5: Government Takings — OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	The dependent variable is *Government-Takings*							
Ethnic	0.595	0.525	0.553	0.419	0.584	0.571	0.400	0.545
	(0.189)***	(0.237)**	(0.208)***	(0.250)*	(0.192)***	(0.210)***	(0.213)*	(0.195)***
Pathogen-Load		0.065						
		(0.093)						
Urbanization-1500			- 0.037					
			(0.035)					
Culture				- 0.070				
				(0.064)				
Reserves					4.416			
					(3.247)			
Democracy						- 0.007		
						(0.029)		
Common-Law							- 0.446	
							(0.222)**	
Land-Quality-SD								- 0.966
								(0.495)*
Ruggedness								0.437
								(0.372)
Estimation	OLS							
R^2	0.10	0.11	0.13	0.09	0.11	0.10	0.13	0.14
Number of observations	76	76	74	61	76	73	59	70

Notes: 1. Robust standard errors in parentheses.
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
3. All specifications include a constant term.

Table 6: Endogenous Property Rights — Alternative Measures of Preference Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		AP-Movable			The dependent variable is *AP-Immovable*			*Government-Takings*	
Language	11.469			7.448			0.366		
	(3.819)***			(2.397)***			(0.157)**		
Religion		17.853			- 5.828			0.032	
		(4.644)***			(3.831)			(0.213)	
Elf			10.975			6.550			0.304
			(4.021)***			(2.482)***			(0.156)*
Estimation	OLS								
R^2	0.07	0.12	0.07	0.06	0.03	0.05	0.05	0.00	0.03
Number of observations	122	124	121	78	78	77	75	75	74

Notes: 1. Robust standard errors in parentheses.
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
3. All specifications include a constant term.

Table 7: Endogenous Property Rights — Native Populations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A. The dependent variable is *AP-Movable*							
Ethnic	9.446	7.810	10.527	16.679	9.834	10.055	9.721	10.250
	(4.860)**	(5.165)	(5.444)*	(5.849)***	(4.871)**	(4.999)**	(5.910)*	(5.028)**
Estimation	OLS							
R^2	0.04	0.06	0.05	0.15	0.06	0.05	0.07	0.07
Number of observations	99	96	98	74	99	95	69	93
	Panel B. The dependent variable is *AP-Immovable*							
Ethnic	7.037	2.650	4.947	7.654	6.776	5.750	5.410	7.984
	(3.265)**	(3.779)	(3.265)	(3.453)**	(3.320)**	(3.336)*	(4.425)	(3.483)**
Estimation	OLS							
R^2	0.05	0.12	0.08	0.06	0.05	0.09	0.03	0.11
Number of observations	61	60	60	52	61	58	46	58
	Panel C. The dependent variable is *Government-Takings*							
Ethnic	0.544	0.456	0.430	0.206	0.560	0.547	0.329	0.567
	(0.202)***	(0.263)*	(0.251)*	(0.263)	(0.205)***	(0.223)**	(0.241)	(0.209)***
Estimation	OLS							
R^2	0.09	0.10	0.12	0.14	0.10	0.10	0.09	0.12
Number of observations	60	60	59	52	60	58	45	57

Notes: 1. Robust standard errors in parentheses.
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
3. All specifications include a constant term. Furthermore, the specifications in columns (2) to (8) consider respectively *Pathogen-Load*, *Urbanization-1500*, *Culture*, *Reserves*, *Democracy*, *Common-Law*, *Land-Quality-SD* and *Ruggedness*.

Table 8: Using Selection on Observables to Assess the Bias from Unobservables

	(1)	(2)	(3)
	The dependent variable is:		
	AP-Movable	*AP-Immovable*	*Government-Takings*
Extra controls in the full set:			
Pathogen-Load	309.829	1.009	7.500
Urbanization-1500	11.624	20.298	8.641
Culture	3.112	17.040	4.457
Reserves	18.280	12.612	53.091
Democracy	5.755	3.786	47.583
Common-Law	378.828	242	10.256
Land-Quality-SD and *Ruggedness*	57.384	10.644	18.167

Notes: 1. Each cell reports ratios based on the coefficient for *Ethnic* from two regressions. In one, the covariates include only *Ethnic* and a constant. Call this coefficient β^R. In the other, the "full set" of covariates include *Ethnic* plus the extra controls enumerated each time. Call this coefficient β^F. The sample size of both regressions is the same. The reported ratio is calculated as the absolute value of $\beta^F/(\beta^R - \beta^F)$.

Table 9: Endogenous Property Rights — IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. The dependent variable is *AP-Movable*								
Ethnic	28.068 (9.581)***	51.125 (15.009)***	30.315 (10.704)***	55.642 (14.103)***	28.482 (9.624)***	41.926 (9.823)***	21.344 (9.090)**	28.906 (9.570)***
First Stage for *Ethnic*								
Origin-Time	$1.54e^{-06}$ ($4.41e^{-07}$)***	$1.77e^{-06}$ ($4.85e^{-07}$)***	$1.60e^{-06}$ ($4.50e^{-07}$)***	$1.63e^{-06}$ ($6.23e^{-07}$)***	$1.54e^{-06}$ ($4.45e^{-07}$)***	$1.63e^{-06}$ ($4.37e^{-07}$)***	$1.68e^{-06}$ ($4.91e^{-07}$)***	$1.39e^{-06}$ ($4.89e^{-07}$)***
Latitude	- 0.421 (0.103)***	- 0.573 (0.153)***	- 0.372 (0.112)***	- 0.375 (0.124)***	- 0.418 (0.103)***	- 0.452 (0.105)***	- 0.533 (0.106)***	- 0.477 (0.116)***
R^2	0.29	0.30	0.31	0.29	0.30	0.33	0.36	0.32
P-value of underid test	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-value of Hansen test	0.13	0.35	0.06	0.49	0.13	0.14	0.00	0.05
Endogeneity test	0.05	0.00	0.05	0.00	0.05	0.00	0.36	0.08
Number of observations	125	122	122	91	125	119	93	112
Panel B. The dependent variable is *AP-Immovable*								
Ethnic	16.167 (5.908)***	3.949 (7.261)	19.681 (6.703)***	24.766 (8.792)***	17.040 (6.106)***	14.389 (6.205)**	11.173 (7.977)	17.907 (5.294)***
P-value of underid test	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00
P-value of Hansen test	0.16	0.06	0.16	0.56	0.17	0.10	0.08	0.05
Endogeneity test	0.02	0.61	0.01	0.02	0.02	0.01	0.16	0.00
Number of observations	79	78	77	62	79	75	62	73
Panel C. The dependent variable is *Government-Takings*								
Ethnic	0.862 (0.318)***	0.797 (0.439)*	0.774 (0.333)**	0.995 (0.412)**	0.854 (0.319)***	0.984 (0.326)***	1.150 (0.328)***	0.899 (0.303)***
P-value of underid test	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00
P-value of Hansen test	0.05	0.06	0.15	0.37	0.05	0.07	0.20	0.82
Endogeneity test	0.58	0.82	0.66	0.22	0.58	0.30	0.02	0.25
Number of observations	76	76	74	61	76	73	59	70

Notes:
1. Robust standard errors in parentheses.
2. *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
3. All specifications include a constant term. Furthermore, the specifications in columns (2) to (8) consider respectively *Pathogen-Load*, *Urbanization-1500*, *Culture*, *Reserves*, *Democracy*, *Common-Law*, *Land-Quality-SD* and *Ruggedness*.
4. While the endogenous variable is *Ethnic*, the excluded instruments are *Origin-Time* and *Latitude*.
5. The null hypothesis of the Kleibergen-Paap underidentification test is that the excluded instruments are uncorrelated with the endogenous regressors.
6. The null hypothesis of the Hansen test of overidentifying restrictions is that the excluded instruments, as a group, are exogenous.
7. The null hypothesis of the endogeneity test is that *Ethnic* can be treated as exogenous.

Table 10: Correlation Among Measures of Property Rights

	Private-Property	*Av-Expropriation*	*AP-Movable*	*AP-Immovable*	*Government-Takings*
Av-Expropriation	0.69				
AP-Movable	0.10	0.15			
AP-Immovable	- 0.25	- 0.24	0.14		
Government-Takings	- 0.41	- 0.36	- 0.15	0.12	
Ethnic	- 0.50	- 0.55	0.09	0.16	0.33

Notes:
1. Number of observations: 55.