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Violence, access, and competition in the market for protection

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Abstract: We conduct a laboratory experiment to examine the performance of a market for protection. As the central feature of our treatment comparisons, we vary the access that "peasants" have to violence-empowered "elites". The focus of the experiment is to observe how elites enforce and operate their protective services to peasants, and to observe the degree to which elites engage in wealth-destroying violence in competition amongst each other for wealth-generating peasants. We find that greater access to peasants strikingly increases violence among the elites, but with limited access the elites markedly extract more tribute from the peasants. Our findings are particularly relevant to the discussion of violence in developing countries.

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1. The provision of protection

In the event of threats to their lives or possessions, people seek to protect themselves through whatever means are available, be it through personal effort, through contract with others, or through public administration. Typically, scholars divide these institutional mechanisms into two categories, private and public, with opinions differing on how effective either mechanism will be. Becker and Stigler (1974), for example, argue that bringing more law enforcement into the realm of the market instead of the public domain would provide enforcers with better incentives to accommodate their respective clients. Cowen (1992), on the other hand, argues that such enforcement would be susceptible to collusion in avoiding the consequences of conflict with other private enforcers and therefore inevitably devolve into monopolistic provision.

While this dichotomy is useful in treating the question of how effective the state is in providing protection relative to some conceptual private counterpart, the lack of consensus on such an important question exposes the limitations of this framework.[1] Moving beyond this simple dichotomy, North, Wallis, and Weingast (2009), henceforth NWW, present a theoretical framework based upon the development of historical conflict-reducing institutions, in which access to force-empowered persons, not competition (or the lack thereof), is the primary institutional incentive in determining how protection is provided. Their model attempts to explain how societies develop economically by managing the problem of violence through conflict with others.

At the nexus of this violence is a set of individuals with superior force they designate as "elites". Elites at first can scarcely afford to include any outside persons into their organizations. Thus, the environment is very tribal, conflict-ridden, and with low economic production. Recognition of this cost of conflict, though, encourages the development of richer networks of relationships between competing elites. These organizations consequently become more inclusive thereby creating lucrative economic rents for the elites. These rents are initially at the expense of the larger "peasant" population. However, as the organization of elites becomes even more inclusive by incorporating peasants as well, these rents are largely dissipated and the state in its modern incarnation is formed.

The contribution of NWW, which we use as the basis of our own project, is to show how the provision of protection emerges along a continuum of structures, resulting from greater

[1] See Powell and Stringham (2009) for an in-depth description of this ongoing debate.

access to force-empowered elites. On one extreme of the continuum is a conflict-ridden environment where peasants have to compete for access to the protective services of force-empowered elites. On the other extreme is monopolist provision of protection through the state, which is not imposed but is in fact a result of inclusion of all persons within the network of competing elites.

The important contribution this framework offers is to investigate how protection evolves in practice, as a result of this greater access. Building upon these considerations, we investigate a market for protection with the institutional feature of access as the primary treatment variable of interest. Our efforts focus upon the following question: How does allowing peasant's greater access/inclusivity to elites affect the level of expropriation (involuntary transfer) and violence (efficiency) in an experimental economy?

Using a laboratory experiment, we endow a set of elites with the ability to facilitate peasant production. These elites are capable of expropriating earnings from peasants across a wide range of options and may further engage in conflict with other elites for control of the wealth-generating peasants. Our treatment variable of interest is the capacity of each elite in facilitating peasant production. In one treatment, the capacity of the elites is constrained such that they are not in direct competition with each other in regard to the production of wealth in their sphere of influence. With an excess supply of peasants, the elites are monopolists who can use the threat of violence against the peasants in bargaining over the distribution of the gains from investment. In the contrasting treatment, the capacity of the elites is large enough to create an excess demand for peasants thus pitting the elites against each other in competition for the wealth-generating peasants.

The question we attempt to answer with these two treatments is, does granting greater access lead to wealth-destroying violence amongst the elite's vis-à-vis the condition with an excess supply of peasants? Or do the elites collude with each other to (a) avoid violence amongst each other and (b) negotiate more wealth from the peasants upon the threat of violence? The answer to this question is particularly salient to the ongoing discussion of the institutional mechanisms by which protection is provided, which we review below.

2. Institutional mechanisms of protection

Before reviewing previous contributions to this important question, it is worth asking if the word "protection" accurately describes the services described above. Would "extortion" not provide a more appropriate connotation for this behavior? As Demsetz argued (1972a, 1972b), the distinction, economically speaking, between supplying a valued service, such as protection, and extortion is insignificant. Both activities involve identical revenues and costs. Therefore, any labeling of private protection as somehow extortive and not protective imputes a non-substantive normative distinction.[2] Normatively, regarding suppliers of protection as extortive may have effects in the laboratory. Nevertheless, our positive hypotheses provided below are equally sound regardless of whether subjects consider protection a desired good or pure extortion (also see Skarbek, 2011 for extensive discussion along with an empirical example of the relationship between protection and extortion).

An extensive literature has developed around what institutional mechanisms are capable of providing protection. One of the earliest examinations of alternative institutions through which protection could be provided is David Friedman's *The Machinery of Freedom* (1973) in which Friedman argues that protection, along with all other goods, can be provided competitively through market processes.

Following Friedman's approach, Becker and Stigler (1974) examine the efficacy of private enforcement of rules. They conclude that private enforcement unleashes competitive forces which may reduce conflict as or more effectively than public enforcement. This was soon contested, however, by subsequent efforts, which found that a private market for protection would be subject to inefficient provision (Landes and Posner, 1979) or as Nozick (1974) argues, the inevitable establishment of a monopoly due to increasing returns to scale.

A related debate begins with the assertion by Cowen (1992) that given the effects of network externalities, the market for private protection results in the formation of a cartel that engages in monopolistic pricing (for responses and counter-responses, see, Friedman, 1994; Cowen, 1994; Cowen and Sutter, 1999; Caplan and Stringham, 2003; and Cowen and Sutter, 2005).

As noted above, North, Wallis and Weingast (NWW 2009) break away from this debate by confronting the issue at both theoretical and applied levels. At the heart of their project is determining how what they term "natural states" have emerged during the last ten millennia.

[2] Consider that the mafia is commonly referred to as a "protection racket".

These natural states are of interest, even to the modern era, as they constitute the vast majority of governments past and present.

A key element of natural states is that they "limit the ability of individuals to form organizations" (NWW 2009: 2). In such societies, a dominant coalition, composed of competing force-empowered elites, reduces the problem of endemic violence by restricting access to certain activities and services, most notably that of protection (NWW 2009: 18). These natural states are stable, but given that they rely on coalitions of elites capable of using force, exogenous shocks to the system can potentially disturb these coalitions, resulting in violence until a new coalition is established. The susceptibility of the ruling coalition in natural states to exogenous shocks limits the ability of these societies to develop.

NWW go on to argue that it is only once this coalition coalesces into a durable, centralized authority that the problem of violence is minimized, allowing individuals open access to form organizations. These "open access orders," of which the authors estimate that only 25 countries currently qualify (NWW: xii), are less susceptible to exogenous shocks as a legitimate monopoly on force is capable of acting as a third party enforcer. NWW argue that this stability, along with the ability for individuals to openly compete for economic and political power, provides the key to the development witnessed in these countries in the last hundred and fifty years.

While the debate initiated by Friedman focuses upon the competitive forces (or lack thereof) in the provision of protection, NWW instead place the locus of institutional mechanisms within the development of coalitions of force-empowered elites. This coalition can be competitive yet conflict-ridden, as is the case when access is limited, to somewhat competitive though stable, once access is expanded to include other elites, to monopolistic and highly durable, when access includes the entire society, such as is the case with the modern state.

Though NWW shed light on a number of institutional settings at various stages of development, the focus of this paper concerns development within what they label the natural state. Specifically, how does access to surplus-creating elites affect the amount of expropriation, which we define as involuntary transfer, from peasants to conquering elite and the overall violence (and hence efficiency) of the economy?[3]

[3] Powell and Wilson (2008) and Smith, Skarbek, and Wilson (2012) use laboratory methods to examine conflict over resources, but unlike in our experiment their resources are constant-sum and there is no deadweight loss associated

With regard to expropriation, as protection becomes more inclusive, the amount of elites' ill-gotten gains should begin to dissipate given that peasants, who previously were expropriated from, are now part of the coalition itself. Expropriation continues to decrease up until the state assumes full control of the protective apparatus.

The analytical narrative behind efficiency is more complicated. At first, efficiency is very low as investing in economic production is not possible in such a tumultuous environment. Once the environment stabilizes, though, then new productive possibilities arise and efficiency increases.[4] However, NWW argue that having competing elites will create episodes of conflict. Bates, Greif, and Singh (2002) provide a similar argument as they see widespread decentralized enforcement as giving way to "constant displays of military ability or skirmishes" (p. 610). Hence, the mere possibility for violence between competing elites, even those within a cooperative coalition, can generate wealth-destroying conflict. This will only subside once the state assumes control of the protective apparatus.

In summary, the position of NWW is that expropriation is minimal and efficiency is maximal only once the control of violence resides within a central authority. Competitive provision of protection may be effective in stabilizing economic conditions but will still be susceptible to occasional bouts of conflict. This is still an improvement over the initial stages of development when access to the elites is limited, causing pervasive conflict.

3. Experimental design

We design an environment in which a minority of participants has superior abilities in force that the majority does not enjoy. We further narrow this superiority to the dual functions of protection and expropriation. In our primary treatment, twelve participants interact using an online interface. We designate four of these as "elites" and the remaining eight as "peasants".[5] Each experimental session lasted approximately 55 minutes comprised of two phases, plus

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with the conflict in acquiring the resources. Wilson, Jaworski, Schurter, and Smyth (2012) incorporate a deadweight loss in ownership disputes when catching a freely roaming resource, but the agonists are unable to engage in wealth-destroying violence against each another.

[4] As one example of this effect, Gupta, Clements, Bhattacharya, and Chakravarti (2004) show empirically how cessation of conflict in low- and middle-income countries offers a "peace dividend", as resources can now be allocated towards non-violent pursuits.

[5] We use these labels for the purposes of presenting our design. We did not label subjects within the experiment as "elites" or "peasants" but instead as "castles" and "people", respectively. See our instructions in the appendix for further details.

private payment of earnings. In the first phase lasting 10-20 minutes, the subjects read the self-paced instructions and participated in a double elimination tournament, the four top performers of which were assigned the role of an elite. Then in the second phase the subjects read the self-paced instructions for the task of interest, lasting anywhere from 5-10 minutes, followed by participating in a 33-minute continuous term of decision-making. Finally, the participants were privately paid their earnings. Though the participants were recruited for 90 minutes, we did not notify them *ex ante* of the decision-making length of the session to mitigate end-game effects.

3.1 Phase I

The participants read the following instructions after being seated that their visually-isolated carrel:

> In this experiment there are two types of subjects. Four subjects will be *castles* and eight subjects will be *people*. The types will be determined by your performance in a double elimination tournament. The four winning subjects will be assigned the role of a *castle*, which is a definite advantage in this experiment. The remaining subjects will be assigned the role of *people*.
>
> To become a *castle*, you must win multiple rounds of the Game of 20. The rules of the Game of 20 are simple. One subject will be randomly determined to be first mover. The first mover must then click "1" *or* click "1" and "2" by the numbers below and then click the Submit button. Each person in turn increases the number by 1 or 2. The person who clicks "20" wins. The tournament bracket is displayed on the right portion of the screen. Once the tournament is complete, you will receive the instructions for the experiment.

This variant of the game of Nim can be solved by backward induction, such that the person who clicks "2" wins the game as long as he or she doesn't make a subsequent mistake by failing to click in turn "5", "8", "11", "14", "17", and finally "20". Following Hoffmann and Spitzer (1982) and Davis and Wilson (2000), our instructions and this feature of the design are intended to induce the elites to feel entitled to act in their own interest with regard to the peasants having "beaten" the peasants in a game of equal opportunity. Notice that with 12 people, a participant must win a minimum of two consecutive games, or more likely, a total of three games to be assigned the role of an elite. Thus, dumb luck has little to do determining a subject's role in the experiment.

3.2 Phase II

The session begins with the eight peasants located in a neutral territory in the center of the screen (see Figure 1). While in this neutral territory, peasants are unable to produce or in any

way generate earnings. To generate earnings, a peasant must 1) reside within the domain of one of the four elites and 2) have the elite make an up-front investment in him. At any time, an elite can choose whether to check (or uncheck) a box that enables the peasant to generate 10¢ in earnings every 5th second, at an investment cost (if checked) to the elite of 2¢ every 5th second. The elite must do this for each peasant located within his domain if he wants the peasant to generate earnings. (The elite's investment is subtracted from the participant's total earnings.) The elite cannot unilaterally produce or in any way generate earnings except through peasant production. Likewise, the peasant can only generate wealth with an investment from an elite.

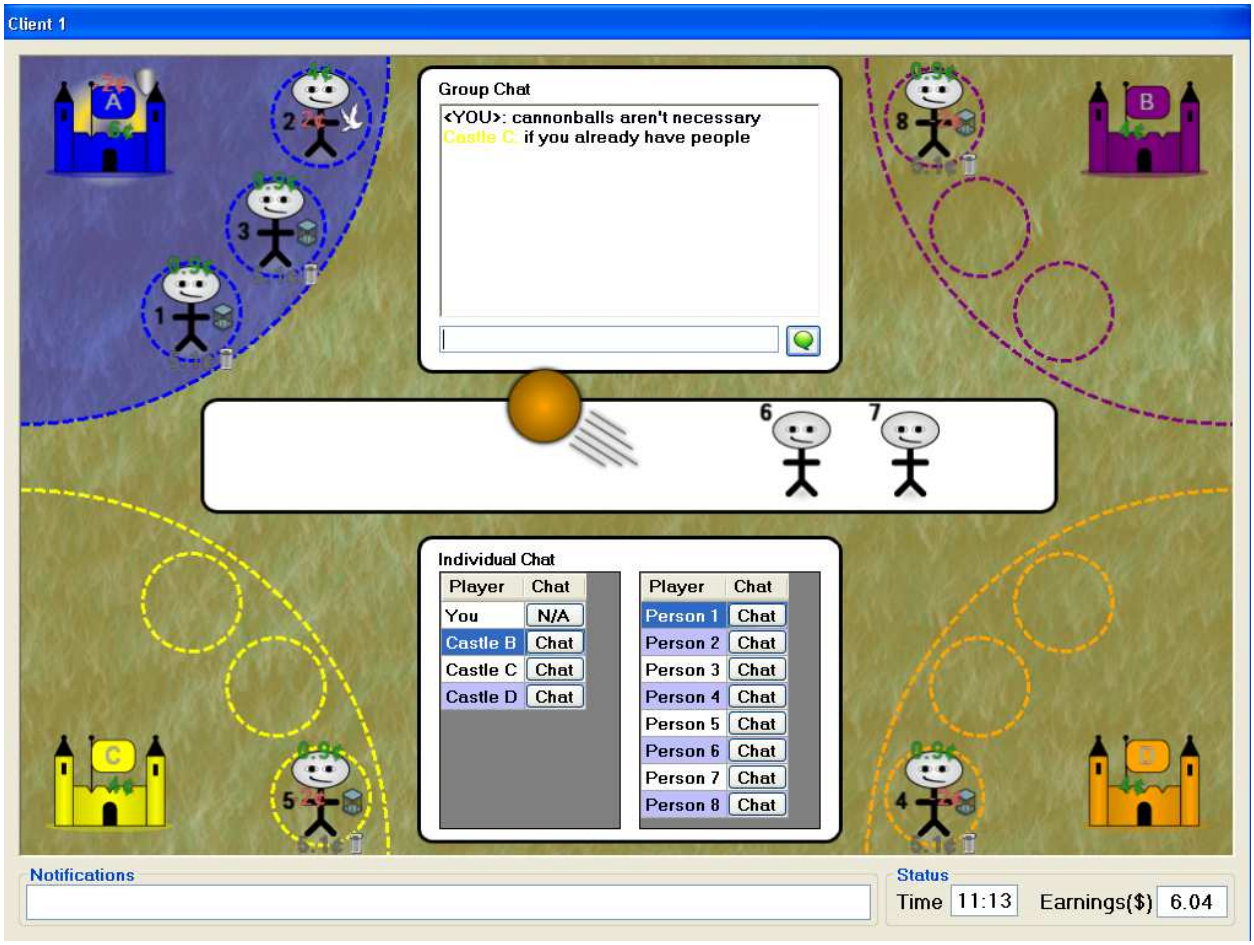

Figure 1. Screenshot from the Perspective of Castle A

An elite has the option of "capturing" or "freeing" any peasant within his domain by clicking an icon,  or  , respectively. Elites can also forcibly capture any unclaimed

peasant by right-clicking on an unclaimed peasant in the middle of the screen and selecting the "capture" icon. A captured peasant involuntarily transfers a portion of generated earnings to his elite. To involuntarily transfer earnings, the elite decides the rate of transfer (Figure 2), representing a 21 discrete choices between zero and full expropriation of earnings, inclusive. However, the more that the elite attempts to expropriate from the peasant, the more is lost in waste due to conflict. Thus, expropriation through means of this involuntary transfer mechanism is subject to a deadweight loss. An elite can also kick out a peasant by clicking on the boot icon in Figure 2.

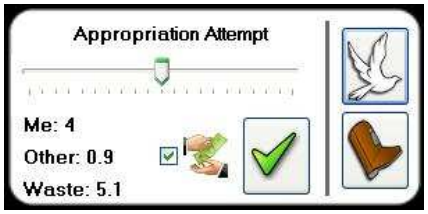

Figure 2. Elite Expropriation Interface

We impose this deadweight loss to involuntary transfers between elites and peasants to reflect the fact that transfers made through involuntary plunder are more likely to result in destruction of the transferred resource than those made through voluntary exchange.[6] The stacked area graph in Figure 3 below depicts the relationship between the (attempted) expropriation rate on the *x-axis* and the amount accrued to each party on the *y-axis*. The elite maximizes his respective earnings under involuntary transfer by selecting an expropriation attempt of 50%, in which case the elite receives 4¢ out of the 10¢ generated by the peasant, the peasant receives 0.9¢, and 5.1¢ are lost to the luminiferous ether. The elite are capable of choosing a unique transfer rate for each of the peasants within his domain.

An elite also has the option to "free" any captured peasant in his domain. This feature of the design is particularly important in devising Pareto-improving voluntary transfers from previously captured peasants to their respective elites. Once freed, a peasant is able to (1) voluntarily send any amount of the 10¢ (in one cent increments, see Figure 4) to the elite or to (2) move to the unclaimed domain or to another elite's domain.

[6] See Grossman and Kim (1995) for a theoretical treatment of this parameter, which they call a "destructiveness" parameter. For other examples, see Anderton (2003) and Garfinkel and Skaperdas (2000, 2007).

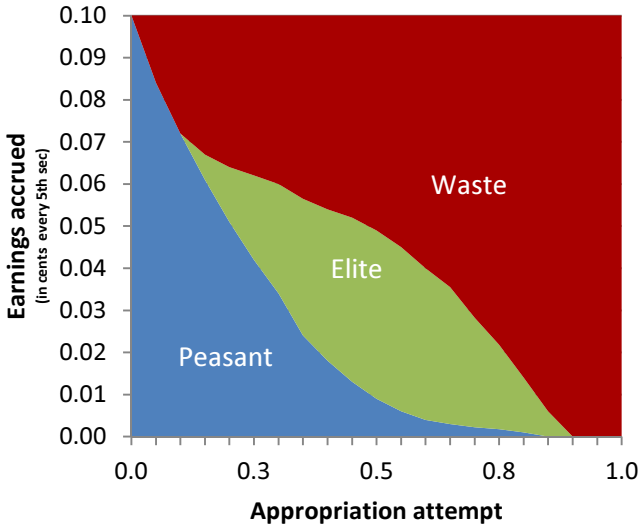

Figure 3. Distribution of Earnings with Involuntary Expropriation

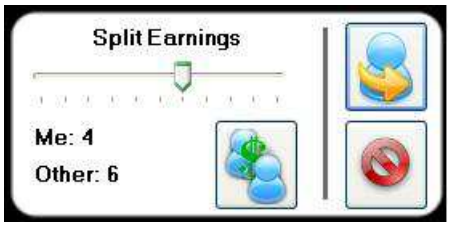

Figure 4. Free Peasant Decision Interface

Finally, we incorporate the ability of an elite to war against another elite in order to free peasants currently held by that other elite. After right-clicking on another elite, an elite can click on the cannon icon  to fire a cannonball at that elite (in Figure 1 Castle D has fired upon Castle A). Each cannonball costs 24¢ and an elite must have accrued at least 24¢ in total earnings to be able to fire upon another elite. Once attacked, an elite loses all of their currently held peasants (captured or freed), which are sent to the unclaimed area in the center of the screen. To partially protect against an attack, an elite can also shield herself at a cost of 2¢ every 5 seconds. Thus, the cost of using one cannonball per minute is equal to the cost of shielding one's domain per minute. When a shielded elite is attacked, each peasant in his domain is freed

with an independent probability of ½. The domains of a shielded elite are transparently cloaked in the color of the elite's castle (see upper left corner of Figure 1).

We assume conflict between elites to be costly with no net pecuniary advantage. As we specify in our motivation above, the focus of our paper is the economic performance among competing elites. We are therefore assuming the issue of potential gains arising through inter-group conflict to be already resolved due to the relatively high strengths of the elites.[7] Consequently, an attacking elite has no guarantee of success in procuring newly unclaimed peasants nor does the attacked elite automatically lose captured peasants, at least when shielded. By imposing this constraint, we narrow the rationale for inter-group conflict to enforcing agreements among elites through punishment of "outlaw" elites and to acquiring wealth-generating peasants for one's self.

What constitutes an outlaw elite is, of course, to be defined by the participants themselves. We can only speculate as to what this might constitute. Note, however, that punishment of elites (for whatever reason) yields public benefits, as all other elites may acquire newly freed peasants formerly in the attacked elite's domain. Consequently, the social gain of punishing "outlaw" elites is greater than the private gain. Furthermore, this mechanism can be used in a more sophisticated manner to, for example, enforce certain minimum thresholds of tribute or even specific distributions of captured peasants between the four elites. We embed this feature in reference to Cowen's argument that elites who are able to overcome the public goods dilemma of punishing other elites should be able to use the same mechanism to organize cartels. Whether elites will utilize the feature along the lines of Cowen's argument or will indeed define "outlaw" elites in the same manner is ultimately an empirical question.

Finally, we incorporate two methods of communication into the online interface. The first method is a public chat room, in which all participants may enter and read text messages. A second method allows each subject to bilaterally and privately chat with any other subject of their choosing. We incorporate this means of using private chat rooms to allow elites to engage in greater collusive opportunities. Without private communication channels, elites would be less able to discover and agree upon optimal strategies in how tributes are determined. Yet because

[7] Several studies in the conflict literature support this assumption, showing that the destruction of rents generated under conflict between similarly endowed combatants threatens to subsume the value of the contested resource itself (see Bloch, 1996; Chwe, 1994; Garfinkel, 2004; Ray and Vohra, 1997; and Yi, 1997). Interestingly, this literature assumes that alliance formation is a natural consequence of this, an outcome not evident in our own results as we discuss below.

ultimately communication is non-binding, this should not interfere (in theory) with the rationale for competitive outcomes.

3.3 Treatment conditions

We utilize two treatment comparisons to explore how non-competitive pricing emerges within our environment. These treatments center on the role of "access" to the earnings-generating capacity of the elite. NWW employ access as a central feature of their theoretical framework, as elites are able to gain rents by limiting access to wealth-generating opportunities. As this access expands, more wealth is generated by the greater productive capacity of the society as a whole, while the degree of expropriation is simultaneously hampered by the competition among elites engendered by this greater access.

Translating this narrative into our environment, elites should be more capable of wealth-extraction under limited access. Limited access is in a sense equivalent to the monopoly provision of protection, explored in our remarks in Section II above. By limiting access, peasants are forced to compete with one another to gain earnings generated by the elite's investment. When access is expanded, peasants have multiple elites to choose from. Hence, competition among elites emerges and expropriation is reduced.

We investigate this notion of access using the following two treatments. In our primary treatment, *3Slots*, each elite may have up to three peasants at once. This means not only that all eight peasants may reside within the domains of the four elites at once, but that there is excess capacity of four slots allowing peasants to rotate (provided they are free or have been freed by the attack of another elite). We expect that peasants will try to use this to their advantage by being mobile when able, while elites may find it necessary to utilize inter-elite conflict as a means to retain and procure peasants.

In the contrasting treatment, *1Slot*, each elite has the capacity to invest in at most one peasant. Thus, with an excess supply of four peasants at most half of the peasants are producing at any time. (Note the intentional symmetry with the excess supply in the *3Slots* treatment.) Consequently, competition among peasants is expected to be particularly fierce, with the concomitant greater expropriation levels discussed by NWW. These two treatments differ only

in the number of peasants who may simultaneously gain access to the elite.[8] All other institutional and environmental features, including the instructions, are consistent across the two treatments.[9]

3.4 Theoretical benchmarks and hypotheses

Through our design, we are able to derive certain benchmark levels of provision, which we use to gauge the level of surplus-seeking on the part of the elites. We derive these benchmark comparisons as follows. First, assume that elites engage in the earning-maximizing amount of transfer. Under involuntary transfer, elites maximize their earnings by choosing an expropriation rate of 50%. By transferring half of the peasant's generated earnings, the elite receives revenue of 4¢ every five seconds from each captured peasant. Each peasant correspondingly receives 0.9¢ every five seconds.

Suppose now that the peasant wishes to negotiate with the elite by offering a greater amount of future generated earnings through voluntary transfer. He can do so by offering anything from 5-10¢ (from this point on we will suppress the timing of every five seconds), for any transfer above 4¢ is an improvement over the elite's unilateral expropriation from the peasant. However, if peasants are maximizing their own earnings, subject to the constraint of potential plunder, then they will transfer no more than 9¢, in which case the peasant earns 1¢ as opposed to the 0.9¢ when being optimally plundered.

The maximum amount of money that a 12-person economy total in the *3Slots* treatment could earn in is \$253.44 (= 1980 seconds / 5 x 8¢ x 8 peasants) and in the *1Slot* treatment \$126.72 (= 1980 seconds / 5 x 8¢ x 4 slots).[10] The average subject then has the potential to earn \$21.12 in the *3Slots* treatment and \$10.56 in the *1Slot* treatment.

Given this set of optimal conditions, we can now derive our primary hypotheses.

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[8] Hillman (2004) explores the conditions under which development fails when "weak" peasants are in conflict with "strong" elites who do not face constraints on their actions. In the *3Slots* treatment, the competition among the peasants creates such a constraint on how well the elites can treat the peasants, whereas in the *1Slot* treatment such a constraint disappears with their reduced capacity to invest in peasants.

[9] In a single, unreported pilot session intended to flush out any software glitches (there were none), each elite had only two units of capacity, the intermediate case between our two treatment conditions in which the capacity of the elites is exactly equal to the number of peasants.

[10] Recall that the subjects earn every 5th second and an elite's investment of 2¢ generates 10¢ in wealth by the peasant. Thus, if the an elite receives revenue of 4¢ every five seconds, his profit is 2¢ every five seconds.

Hypothesis 1: *Elites will earn more revenue per peasant in the* 1Slot *treatment than the* 3Slots *treatment.*

If the elites compete for peasants in the *3Slots* treatment, the predicted voluntary transfer from the peasant is the smallest amount above the 4¢ that an elite can unilaterally plunder from the peasant. Hence, surplus-maximizing elites should approximate this 4¢ threshold. If the elites do not compete for peasants, as in the *1Slot* treatment, then the peasants accept 1¢, which is the minimum amount greater than 0.9¢ when being optimally plundered. Hence, surplus-maximizing elites should approximate this 9¢ threshold.

Hypothesis 2: *Elites will engage in more involuntary transfer in the* 1Slot *treatment than the* 3Slots *treatment.*

If the peasant refuses to barter with the elite, the elite forfeits gains from voluntary transfer. The opportunity cost of this action differs across the two treatments. In the *3Slots* treatment, peasants stand to gain up to 6¢, assuming elites are surplus-maximizing. In comparison, a refusal to barter nets the peasant 0.9¢, a difference of 5.1¢. In the *1Slot* treatment, peasants stand to gain only 1¢, when elites are surplus-maximizing. A refusal to bargain once again nets them 0.9¢, a difference of a mere 0.1¢. Since the opportunity cost of refusing to cooperate is greater in the *3Slots* treatment, we expect to see greater levels of cooperation in this treatment.

Hypothesis 3: *Elites will engage in more conflict with each other in the* 3Slots *treatment than the* 1Slot *treatment.*

In the *3Slots* treatment, elites have the potential to gain from conflict with other elites by procuring peasants captured by or voluntarily associated with other elites. In the *1Slot* treatment, on the other hand, the limited capacity renders such strategies moot, as a freed peasant cannot be utilized. Consequently, we expect little in the way of conflict in the latter treatment.

Hypothesis 4: *Elites will attempt to collude in the* 3Slot *treatment in order to raise their respective transfer from the peasants.*

What if elites collude in the *3Slot* treatment to negotiate with the peasants for greater than competitive returns? Then, the elites will be willing to extract anything greater than or equal to 4¢, their opportunity cost of plunder under involuntary transfer. A successful collusion will consequently raise their earnings. Echoing Cowen (1992), we expect to observe attempts to collude. Whether they will be successful is something we do not speculate upon.[11]

3.5 Procedures

Excluding a pilot session, we conducted five sessions in each of the two treatments, for which we used 120 volunteers, 62 men and 58 women, from the at-large undergraduate population at a private university with approximately 5,000 undergraduates.[12] Each session had twelve subjects who only participated in a single session of this experiment. For showing up on time, participants received $7 in addition to what they earned in the session. The average earnings in the *3Slots* and *1Slot* treatments, excluding the show-up payment, are respectively $15.19 (s.d.= $8.61) and $9.21 (s.d.= $5.30).

4. Results

We begin the presentation of our results by breaking down the relative distribution of earnings that accrues to the peasant, elite and waste categories for each of our ten sessions. We then further break down these relative distributions to those observations involving involuntary transfer and those that are voluntary. We next present the prevalence of inter-elite conflict for each session with comparison across the two treatments. Following this, we break down the inefficiency that resulted not only from inter-elite conflict but from unused production and involuntary transfer as well. Finally, we comment upon several chat transcripts that further illustrate our findings.

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[11] We note though that previous experimental studies demonstrate the difficulty with collusion, even among as few as three subjects (see Huck, Normann, and Oechssler, 2004).

[12] In a single, unreported pilot session intended to flush out any software glitches (there were none), each elite had only two units of capacity, the intermediate case between our two treatment conditions.

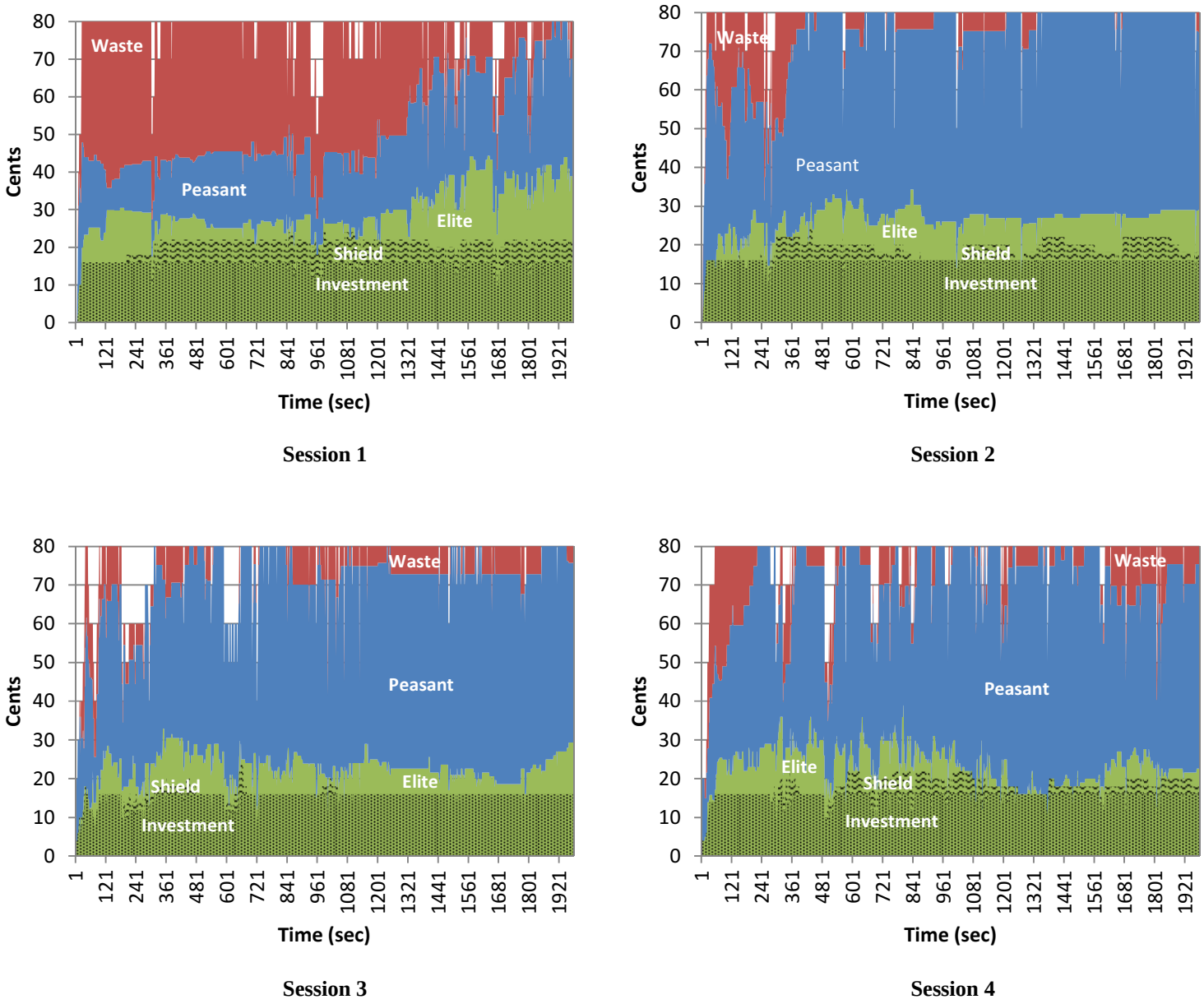
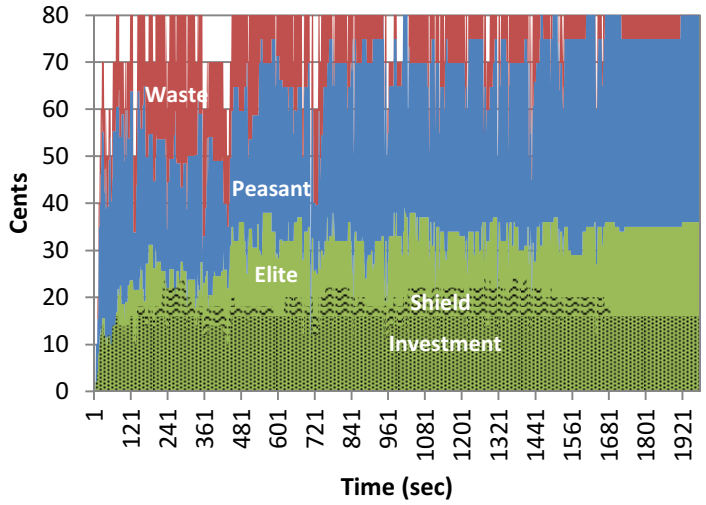
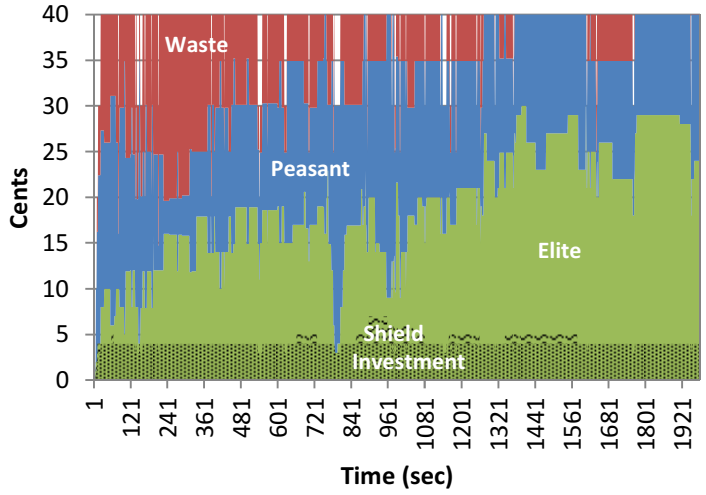


Figure 5. Stacked Area Graph of Earnings, Waste, and Costs in the *3Slots* Treatment



Session 5

Figure 5. Stacked Area Graph of Earnings, Waste, and Costs in the *3Slots* Treatment



Session 1

Figure 6. Stacked Area Graph of Earnings, Waste, and Costs in the *1Slot* Treatment

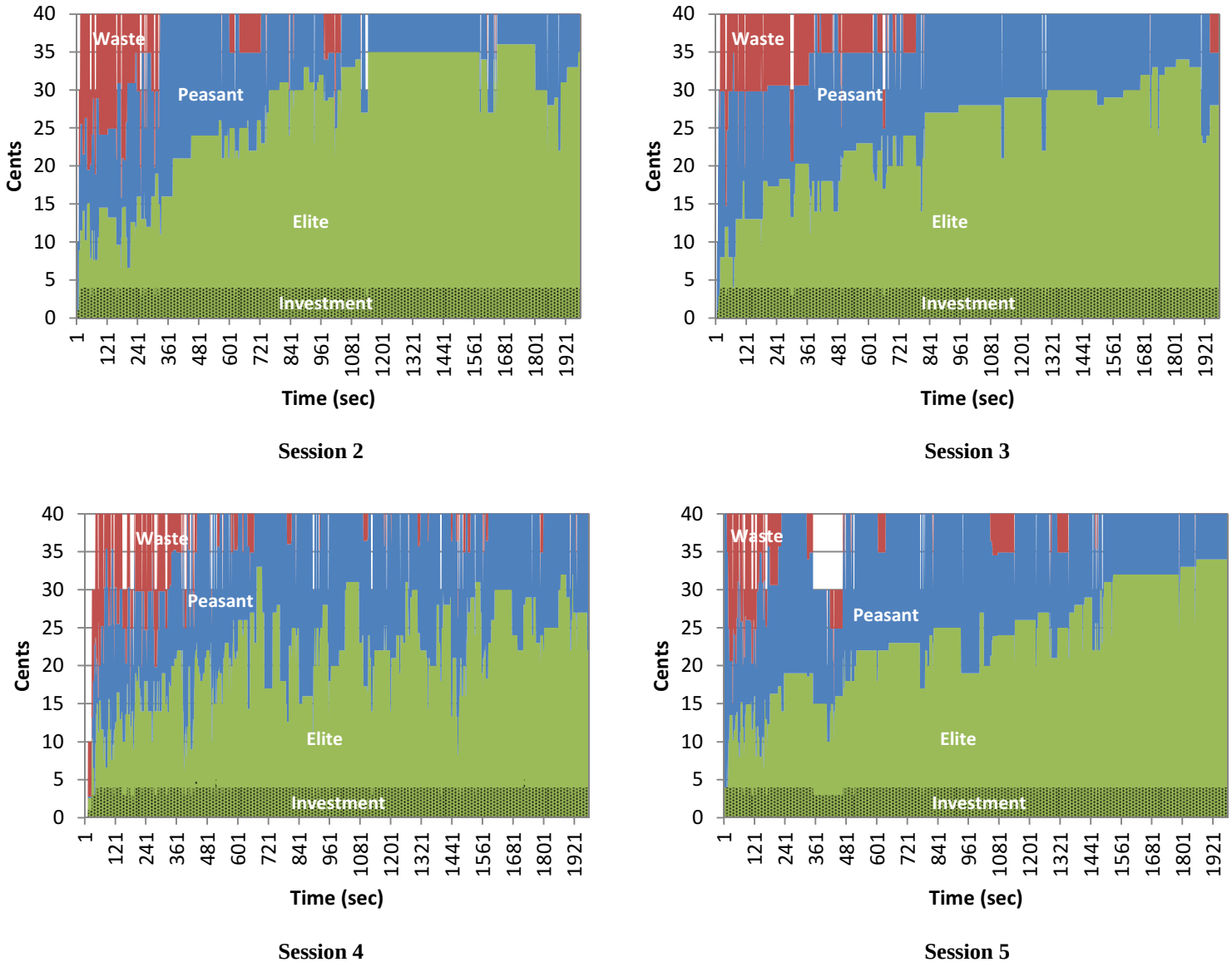


Figure 6. Stacked Area Graph of Earnings, Waste, and Costs in the *1Slot* Treatment

4.1 Overall distribution of earnings

The stacked area graphs in Figures 5 and 6 summarize by session the earnings of the peasants and elites, waste from expropriation, and the investment and shield costs incurred by the elites. Recall that a peasant is able to generate 10¢ every five seconds from a 2¢ investment by an elite. Note that in the *3Slots* treatment, for example, the sum of the earnings and waste need not add up to 80¢ (8 peasants x 10¢/peasant), as peasants without investment by an elite generate 0¢.

Finding 1: *Elites earn more revenue per peasant in the* 1Slot *treatment than the* 3Slots *treatment.*

We first note that in the *3Slots* treatment the elites barely secured their opportunity cost of expropriating 4¢ of revenue per peasant. Over the last half of the session, the average total revenue for the elites was, by session, 33.6, 27.3, 22.4, 20.4, and 34.0¢, which using Wilcoxon signed rank test is not significantly different from 32¢ (8 peasants x 4¢/peasant) ($V = 3$, p-value = 0.6875, one-sided alternative of more revenue due to collusion).

When the elites failed to achieve their opportunity cost, as in *3Slots.4*, the lowest elite-earning session of the five, it was not because the elites did not use or appeal to violence. For example, at time (in seconds) 785-792, Elite3 tells Peasant8: “at least 6 and 4/you can take 6/just not 7”. Later in time 928, Elite3 threatens Peasant8, who is only sending 3¢: “make it at least 6 and 4 or else ill capture you”.

Because free peasants are free to move anywhere they please, they must be trusted with their freedom. Thus, to induce loyalty, to attract peasants (particularly if you have none), and to avoid worrying that peasants may leave, elites frequently offered terms that yielded less than 4¢ for themselves. Continuing with the previous example, at time 1766 Elite3 tells Peasant7 “thank you for being faithful/go ahead to 7 and 3 if you want” and to Peasant5 at time 1849, “if you stay for a few minutes you can change it to 7 and 3”. But Peasant7 is not content. She inquires privately with Elite1 at time 1962: “can i get 8 for the first few minutes?/im getting a solid 7 here”.

In the *1Slot* sessions, on the other hand, competition among peasants was fierce. Once peasants were forced to compete with one another to gain access, elites were capable of bargaining for much higher levels of revenue than observed in the other treatment. The average

revenue received per peasant (per every 5th second) in the last half of the session was, respectively for each session, 5.96, 8.32, 7.38, 6.22, and 7.17, which, using a Wilcoxon rank sum test, is significantly higher than in the *3Slots* treatment ($U_{5,5}$ = 25, *p*-value = 0.0040, one-sided test). In the first half, elite revenue per peasant as much lower (3.54, 5.24, 4.79, 4.50, and 4.62), but it still significantly higher than in the *3Slots* treatment ($U_{5,5}$ = 25, *p*-value = 0.0040, one-sided test).

Another result of interest is that there was significantly less waste due to expropriation in the *1Slot* treatment relative to the *3Slots* treatment, presumably because a *1Slot* elite could always boot out a free unyielding peasant ($U_{5,5}$ = 23.5, *p*-value = 0.0159, two-sided test). The average waste per session (per every 5th second) in the last of the *1Slot* treatment was 0.62, 0.08, 0.05, 0.11, and 0.19¢, whereas in the *3Slots* treatment it was 2.24, 0.19, 0.66, 0.66, and 0.74¢. For the first half of the session, though, there is no significant difference in expropriation waste in the two treatments ($U_{5,5}$ = 13, *p*-value = 1.0000, two-sided test). The analysis above was the sum of revenue regardless of whether the peasants were free or captured. In the next two subsections, we break this down conditional on a peasant being free and captured.

4.2 Involuntary transfer

We next report in Table 1 the same breakdown in distribution revenue generated by the peasant but confine the observations to those that take place when the transfers were involuntary. This means that only those observations are counted that occurred when a peasant was captured and being invested in by an elite. Once freed, transfer becomes voluntary.

Table 1 reports that there is little difference in how much surplus elites expropriate across the two treatments, once they have decided to engage in involuntary transfer. On average, in the second half of the session elites confiscated for themselves around 3.44¢ in the *3Slots* treatment and 3.03¢ in the *1Slot* treatment, which is statistically insignificant ($U_{5,5}$ = 16, *p*-value = 0.5476, two-sided test). Note also that the elites utilized the involuntary transfer more during the first half of the sessions than in the second half, reflecting possibly the time needed to bargain for Pareto-improving voluntary trade opportunities between captured peasants and conquering elites. Finally, we observe far more periods of involuntary transfer in the *3Slots* sessions than the *1Slot* sessions, 32% of all periods in the *3Slots* treatment versus 9% in the *1Slot* treatment (first half and second half, respectively: $U_{5,5}$ = 22.5, *p*-value = 0.9841, one-sided test; $U_{5,5}$ = 24, *p*-value =

0.9921, one-sided test). Thus we fail to find support for our second hypothesis, which is our second finding:

Finding 2: *Elites do not unambiguously engage in more involuntary transfer in the* 1Slot *treatment than the* 3Slots *treatment.*

Table 1. Revenue and Waste Conditional on Expropriation and Investment by the Elite

	Peasant	***Elite***	***Waste***	***Percentage of Total Periods***		***Peasant***	***Elite***	***Waste***	***Percentage of Total Periods***
3Slots.1					*1Slot.1*				
1st Half	2.10	3.37	4.53	0.98	1st Half	2.06	3.48	4.46	0.28
2nd Half	2.19	3.37	4.44	0.52	2nd Half	1.31	3.83	4.86	0.07
3Slots.2					*1Slot.2*				
1st Half	2.88	3.00	4.12	0.28	1st Half	1.68	3.53	4.79	0.12
2nd Half	1.80	3.64	4.57	0.04	2nd Half	2.29	3.39	4.32	0.01
3Slots.3					*1Slot.3*				
1st Half	1.99	3.35	4.65	0.22	1st Half	2.45	3.31	4.24	0.16
2nd Half	0.57	2.82	6.61	0.10	2nd Half	3.72	2.76	3.52	0.01
3Slots.4					*1Slot.4*				
1st Half	1.93	3.46	4.61	0.26	1st Half	1.67	3.6	4.74	0.13
2nd Half	1.69	3.63	4.68	0.15	2nd Half	5.34	1.76	2.90	0.02
3Slots.5					*1Slot.5*				
1st Half	1.75	3.53	4.71	0.47	1st Half	2.56	3.19	4.25	0.10
2nd Half	1.45	3.75	4.80	0.16	2nd Half	2.14	3.4	4.46	0.02
1st Half Average	**2.13**	**3.34**	**4.52**	**0.44**		**2.08**	**3.42**	**4.50**	**0.16**
2nd Half Average	**1.54**	**3.44**	**5.02**	**0.19**		**2.96**	**3.03**	**4.01**	**0.03**
Overall Average	**1.84**	**3.39**	**4.77**	**0.32**		**2.52**	**3.23**	**4.25**	**0.09**

4.3 Involuntary transfer

Table 2 reports the allocation of the 10¢ when a peasant resided in the domain of one of the four elites but was free to move elsewhere. When elites have the capacity for three peasants, they take on average 37% of the surplus, leaving 63% for the peasants in the second half of the experiment. This distribution shifts dramatically when elites have the capacity for only one peasant, in which case the elites earned 72% of the surplus on average, leaving the peasants with a meager 28%. This difference is statistically significant in both the first and second half of the session (both tests: $U_{5,5} = 25$, p-value = 0.0040, one-sided test).

Table 2. Distribution of Revenue Conditional on Free Peasant and Investment by the Elite

	Peasant	***Elite***	***Percentage of Total Periods***		***Peasant***	***Elite***	***Percentage of Total Periods***
3Slots.1				*1Slot.1*			
1st Half	7.39	2.61	0.01	1st Half	6.08	3.92	0.21
2nd Half	4.67	5.33	0.47	2nd Half	3.65	6.35	0.43
3Slots.2				*1Slot.2*			
1st Half	6.68	3.32	0.71	1st Half	4.07	5.93	0.37
2nd Half	6.58	3.42	0.95	2nd Half	1.53	8.47	0.49
3Slots.3				*1Slot.3*			
1st Half	6.9	3.1	0.75	1st Half	4.36	5.64	0.34
2nd Half	7.17	2.83	0.89	2nd Half	2.53	7.47	0.49
3Slots.4				*1Slot.4*			
1st Half	6.62	3.38	0.72	1st Half	4.86	5.14	0.36
2nd Half	7.58	2.42	0.84	2nd Half	3.55	6.45	0.48
3Slots.5				*1Slot.5*			
1st Half	6.16	3.84	0.5	1st Half	4.81	5.19	0.39
2nd Half	5.59	4.41	0.83	2nd Half	2.63	7.37	0.48
1st Half Average	**6.75**	**3.25**	**0.54**		**4.84**	**5.16**	**0.33**
2nd Half Average	**6.32**	**3.68**	**0.80**		**2.78**	**7.22**	**0.47**
Overall Average	**6.53**	**3.47**	**0.67**		**3.81**	**6.19**	**0.40**

4.4 Inter-elite conflict

Below we report the amount of conflict between the four elites, as manifested in the purchase of cannonballs and shields. Recall that there is little reason to use cannonballs or shields when the elite can only hold one peasant at a time. Each *1Slot* elite is the master of his own domain; any gains from displacing another's peasant cannot be realized by the attacking elite for there is no capacity to house them. This design feature, however, is particularly important for understanding how competing elites in the *3Slots* treatment use and defend against violence. As discussed above, elites in the *3Slots* treatment do not collude on the amounts they bargain from the peasants, but do they destroy earnings by engaging in violence to secure peasants.

Finding 3: *More inter-elite conflict occurs in the* 3Slots *treatment than the* 1Slot *treatment.*

Table 3 unambiguously reports this difference between the two treatments, supporting our third hypothesis. In the *3Slots* treatment, elites maintained a shield on average for 37% of the session. The average *3Slots* session spent $11.67 on defensive shields and about half as much, $6.38, on offensive cannonballs. It is clear from the table that expenditures on violence are not decreasing in the second half of the session. As NWW discuss, natural states are nasty and unstable when competing elites have equal access to means of violence for appropriating rents. To our knowledge, this is the first experiment to observe both offensive violence and wasteful defense in competition for resources capable of positive sum exchanges, and the consequences are anything but minor. As NWW argue, violence is indeed a nontrivial problem to overcome in human history.

Finally, and perhaps due to the above result, collusion was noticeably absent from inter-elite interaction. The competition among elites for prospective peasants nullified any behavior that would be considered collusive.

Finding 4: *Elites do not attempt to collude in the* 3Slots *treatment.*

Table 3. Inter-Elite Violence

	Cannonballs (number)	Shields (sec)		Cannonballs (number)	Shields (sec)
3Slots.1			*1Slot.1*		
1st Half	14	2230	1st Half	1	392
2nd Half	22	2930	2nd Half	0	483
3Slots.2			*1Slot.2*		
1st Half	6	1142	1st Half	1	0
2nd Half	12	1802	2nd Half	1	0
3Slots.3			*1Slot.3*		
1st Half	11	523	1st Half	0	0
2nd Half	8	59	2nd Half	0	0
3Slots.4			*1Slot.4*		
1st Half	20	1288	1st Half	5	11
2nd Half	9	1316	2nd Half	0	4
3Slots.5			*1Slot.5*		
1st Half	14	1485	1st Half	0	0
2nd Half	17	1813	2nd Half	0	0
Overall Average	**13**	**1459**		**1**	**89**

The chat transcripts are noticeably silent regarding any discussions of collusion among the castles. As noted in by our first finding above and unmistakably and contra Cowen (1992), the four elites were never successful in colluding on the terms offered to the peasants. To repeat, the average total revenue for the elites was, by session, 33.6, 27.3, 22.4, 20.4, and 34.0¢, which is not significantly different from 32¢ (8 peasants x 4¢/peasant).

4.5 Inefficiency

Our final table of results reports the overall efficiency of the sessions, as measured by the realized earnings divided by the maximum possible. Table 4 also breaks down the inefficiency into three categories: 1) earnings lost from not investing in a peasant, 2) waste from elites

expropriating revenue from peasants, and 3) conflict between elites through the use of shields and cannonballs.

While all three sources of inefficiency were more pronounced in the *3Slots* treatment, the major source of divergence is inter-elite conflict. Overall, while our *1Slot* sessions have one-half the potential in earnings, the dearth of violence resulted in more efficient economies.

Table 4. Breakdown of Inefficiency

	Lost Production	***Expropriation Waste***	***Inter-Elite Conflict***	***Overall Efficiency***		***Lost Production***	***Expropriation Waste***	***Inter-Elite Conflict***	***Overall Efficiency***
3Slots.1					*1Slot.1*				
1st Half	0.04	0.42	0.16	0.39	1st Half	0.02	0.24	0.01	0.73
2nd Half	0.03	0.22	0.21	0.54	2nd Half	0.01	0.06	0	0.93
3Slots.2					*1Slot.2*				
1st Half	0.03	0.11	0.08	0.79	1st Half	0.01	0.11	0.01	0.87
2nd Half	0.01	0.02	0.13	0.85	2nd Half	0	0.01	0.01	0.98
3Slots.3					*1Slot.3*				
1st Half	0.1	0.07	0.06	0.78	1st Half	0.01	0.13	0	0.86
2nd Half	0.01	0.07	0.03	0.9	2nd Half	0	0.01	0	0.99
3Slots.4					*1Slot.4*				
1st Half	0.07	0.1	0.13	0.71	1st Half	0.03	0.11	0.03	0.83
2nd Half	0.02	0.07	0.09	0.83	2nd Half	0	0.01	0	0.98
3Slots.5					*1Slot.5*				
1st Half	0.08	0.19	0.12	0.62	1st Half	0.02	0.07	0	0.91
2nd Half	0.01	0.07	0.14	0.77	2nd Half	0	0.02	0	0.98
Overall Average	**0.04**	**0.13**	**0.12**	**0.72**		**0.01**	**0.08**	**0.01**	**0.91**

4.6 Chat transcripts

We now process-trace the differences in our two treatments above using the chat transcripts. The participants unabashedly reveal the differences in their bargaining positions. The following conversation from *3Slots.1* typifies a conversation between a captured peasant and a conquering elite in the *3Slots* treatment:

Time	Speaker	Listener	
55	Peasant4	Elite1	i will give you good earnings if you free me
77	Elite1	Peasant4	but i enjoy your company
105	Peasant4	Elite1	then let me changes my rate
112	Elite1	Peasant4	what do you want
127	Peasant4	Elite1	more than .3 cents hahah
134	Elite1	Peasant4	oh haha i didn't realize
135	Elite1	Peasant4	sorry
164	Elite1	Peasant4	is that better?
179	Peasant4	Elite1	ya maybe four cents and I'll be quite haha

As the chat indicates, peasants may be captured but still have some discretion over their pay in the early minutes of the session. The elite is apologetic for giving the peasant a low rate and increases the peasant's portion of the surplus. But then some acrimony over the distribution occurs and the peasant sows the seeds of subterfuge. Even while singing the praises of his captor, the peasant seeks to gain freedom through the intercession of another elite:

Time	Speaker	Listener	
196	Elite1	Peasant4	you are making more than me at the moment
209	Peasant4	Group Chat	castle A is sweet
226	Peasant4	Elite3	can you free me ?
242	Peasant4	Elite1	you make 3.3 i make 2.4
244	Elite1	Group Chat	if you want a considerable income, join my castle
249	Elite3	Peasant4	I already have a full castle!
262	Elite1	Group Chat	the proof is in the numbers
272	Peasant4	Elite3	bummer
328	Elite3	Peasant4	ok come on over! how do I free you?
346	Peasant4	Elite3	you have to cannon ball him
351	*Elite3 fires cannonball at Elite1*		
355	Elite1	Group Chat	ow
362	Elite3	Peasant4	fail...
376	Peasant4	Elite3	ya haha he has a shield on
407	Elite3	Peasant4	I tried!

After attempting to be freed by the other elite, the peasant then uses the incident to bargain for a more favorable earnings ratio.

Time	Speaker	Listener	
410	Peasant4	Elite1	how about i get a bit more then the rest of the peeps man
421	Elite1	Peasant4	haha why
436	Peasant4	Elite1	because you dropped how much i make again haha

451	Peasant4	Elite1	and if you pay me well i wont reble and ask peopel to save em from you
453	Elite1	Peasant4	it costs money to offer the shield protection plan
472	Peasant4	Elite1	look at how much d [Elite4] is making
500	Elite1	Peasant4	can you make more money if i give you more or something
513	Peasant4	Elite1	ya
559	Elite3	Peasant4	theres a 50% chance if I fire that I will get him right?
560	Peasant4	Elite1	3.4 is more like it
579	Elite1	Peasant4	start making that money haha
581	Peasant4	Elite3	i dont remember hes oaying me pretty well what would you offer if i cam over
595	Peasant4	Elite1	oh i am and i appreciate the increase
600	Elite3	Peasant4	well it's not really your choice...
619	Peasant4	Elite3	true but my castle is paying me well and i appreciate it

Consequently, even though the elite has captured the peasant, the peasant is able to utilize competition with other elites in gaining a more favorable earnings ratio.

Our *1Slot* sessions display a reversal in these bargaining positions. As the following discussion for *1Slot.3* illustrates, a peasant convinces an elite to abandon her current captor through promise of greater returns. The elite and the peasant then come to an agreement on a split that is quite favorable to the elite and the peasant:

Time	Speaker	Listener	
137	Peasant3	Elite1	You should ditch the loser you have and take on me. I'm hardworking and loyal.
259	Elite1	Peasant3	only if you split the money with me where i get 70% and you get 30%
274	Peasant3	Elite	Down
296	*Elite1 captures Peasant3 from the middle area and then frees him.*		
300	Elite1	Peasant3	ok do it
314	*Peasant3 transfers 7¢ to Elite1 and 3¢ to himself.*		
356	Elite1	Peasant3	perfect

Peace and tranquility would seem to reign, yet the peasant soon becomes anxious over this unfavorable split.

Time	Speaker	Listener	
390	Peasant3	Elite1	I'll keep it this way for 4 minutes. Then I'll leave unless it your willing to change it to 60%-40%
397	Peasant3	Elite1	you 60% me 40%
438	Elite1	Peasant3	what time is four minutes from now
451	Peasant3	Elite2	Are you making any money?
457	Peasant3	Elite1	10 minutes
468	Elite1	Peasant3	you mean 11 minutes

492	Peasant3	Elite1	ill do 11 minutes is fine
519	Elite2	Peasant3	well i am now i guess haha

The peasant tries to bargain for a more favorable split by threatening to leave. The peasant further attempts to negotiate with another elite. The first elite, however, is not without his own options.

Time	Speaker	Listener	
526	Peasant5	Elite1	whats the split you want
531	Peasant8	Elite1	castle a you should put me in your castle
548	Peasant3	Elite2	If you take on me I'll split the money with you 50/50 if you want to take on me
560	Peasant3	Elite2	damn nevermind
568	Elite2	Peasant5	what are you trying to offer me?
599	Elite1	Peasant5	75 me 25 for you would be good
651	Elite1	Peasant5	ok i'll release my person now and take you
658	*Elite1 kicks out Peasant3.*		
660	*Elite1 captures Peasant5 from the middle area.*		
670	*Elite1 frees Peasant5.*		
676	*Peasant5 sends 7¢ to Elite1.*		

Elite1 finds two suitors in place of the disgruntled Peasant3. After receiving a greater offer from one of them, the elite unceremoniously kicks out the conniving peasant and gains a more harmonious relationship as a result.

5. Discussion and conclusion

In this paper, we set out to move beyond the simple dichotomy of competitive and monopolistic provision of protection to explore the richer framework presented in North Wallis, and Weingast. We find that the crucial variables of interest in their framework, access and violence, are indeed a strong determinant of outcomes in terms of both expropriation and efficiency. Specifically, we find that reducing access increases the revenues of the elites by forcing peasants to compete for a favorable earnings ratio, while expanding access decreases the elites' revenues through competition for peasants.

This result parallels that found in a similar experimental context, that of incomplete contracts. For instance, Brown, Falk, and Fehr (2004) find that wages are highest when managers must establish trust in repeated interaction with the same worker, similar to the

relationships described in the chat transcripts above. Through treatment comparison, they find that when managers compete for trustworthy workers, effort rewards are more pronounced than when contracts are enforceable or work assignments are random, again echoing our result. Fehr, Brown, and Zehnder (2009) present an even more related experimental environment as they compare wages when there is an excess supply of workers to when there is an excess supply of managers. Interestingly enough, and contra our result, they do not find a significant difference in the level of wages across the two treatments. They did find, however, that the relationship between managers and workers was shorter when workers could easily find offers with other managers. Finally, Brown and Serra-Garcia (2010) show that when agents can expropriate funds, markets contract accordingly. While not significant, we did see a reduction in investment in peasants in the *3Slots* treatment, an outcome that would perhaps become more manifest as earnings to the elite were even more susceptible to inter-elite competition and consequently extraction by peasants.

While the above result is mostly compatible with existing experimental results, we provide new understanding of destruction under conflict in that while enabling greater access generates more favorable earnings for peasants, it comes at the expense of costly violence among elites and towards the peasants. This latter result is indicative of what Greif, Bates, and Singh (2002) called the tradeoff between order and prosperity. As we noted above, they argue that decentralized mechanisms of enforcement give way to "constant displays of military ability or skirmishes" (p. 610). Consequently, decentralized enforcement can provide order but at a certain cost of conflict, which in our experimental environment constitutes the destruction of nearly a quarter of the surplus. Importantly, we also fail to observe collusion among elites to garner greater revenues from the peasants.

The broader lesson of our paper is that the strict dichotomy between monopolistic and competitive protective services may be less distinct, or indeed informative with respect to expropriation, than the literature proclaims. As we discovered in our experimental environment, surplus to the elites is most directly determined by access to—as opposed to the number of—force-empowered elites. That is, when access is open, elites still exercise more force over their captured peasants, but this control is tempered by the ability, though limited, of peasants to move to the domain of other elites. When access is limited, however, peasants no longer are able to leverage mobility against unfavorable earnings ratios and elites take advantage of it. This shift in

the balance of power provides elites with the advantage needed to significantly increase their revenues.

This finding challenges us in how we depict the state, or whatever entity is providing protection. Instead of claiming that monopolistic provision inevitably results in excess expropriation, or equivalently that competitive enterprises would invariably solve the social dilemma, we should consider how access and violence interact with the provision of protection. Further exploring this link between access and violence is a potential avenue for future research. For example, allowing elites to endogenously alter their own access constraints would provide greater insight into the dynamics of state-formation and its accompanying volatile byproduct of violence. An open question in history is how hierarchies of lords and kings of agrarian-supported societies evolved out of relatively egalitarian hunter-gatherer societies. No doubt violence was a problem to be solved. As our results robustly indicate, access and violence may be far greater determinants of socially undesirable outcomes than previously understood.

Acknowledgements

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Appendix (Phase II instructions)

<Page 1: Castle >
This is an experiment in the economics of decision-making. The instructions are simple, and if you understand them, you may earn a considerable amount of money that will be paid to you in CASH at the end of the experiment. Your earnings will be determined partly by your decisions and partly by the decisions of others. If you have questions at any time while reading the instructions, please raise your hand and a lab monitor will assist you.

In this experiment you have earned the right to be *Castle* {*A, B, C,* or *D*}. In order to earn money, you must invest 2 cents in a person every 5 seconds. Once you invest money in a person, Persons 1-8 can then produce 10 cents every 5 seconds.

To bring people to your castle, you can capture a person by right clicking on a person and then clicking the  icon. Do this now.

<Page 2: Castle>
For every person by your castle, you can invest in a person by right clicking on the person and then checking the box next to the  icon. Do this now.

You can also appropriate a portion of money that a person produces. To set this amount, right click on the person, move the slider, and then click the  icon to set your choice. Do this now. You will notice as you appropriate money from people, some of what the person produces is lost as waste.

You can free a person by your castle by right clicking on the person and then clicking on the  icon. You will be automatically investing in the person when you free him or her. Do this now. A person can choose to voluntarily split the amount of money he or she produces without waste, but the person must be free in order to do so.

If a person is free they can be captured again by right clicking on the person and pressing the  icon. Do this now. You can also choose *not* to invest in a person by unchecking the investing box when they are captured.

You can kick a person out of your castle by right clicking on the person and then clicking on the  icon. Do this now.

Lastly, people can also voluntarily move themselves to your castle. If they voluntarily move to your castle, you will be automatically investing them as long as they are not captured.

<Page 3: Castle>
You can attempt to free people from other castles by firing a cannon ball. To do this, right click on another castle and then click the  icon. Do this now. Each cannon ball costs 24 cents, which is deducted from your earnings when you click the  icon. You must have at least 24 cents in your earnings to fire a cannon ball.

A castle can fire, at most, one cannon ball every 5 seconds. When a castle is struck by a cannon ball it will be stunned for 5 seconds, preventing it from taking any actions.

To protect yourself against a cannon ball attack, you can shield your castle and the people in it by right clicking on your castle and clicking the  icon. While your shield is on, 2 cents are deducted from your earnings every 5 seconds.

When you fire a cannon ball at an unprotected castle, each person in that castle has an independent 100% chance of being freed. When you fire a cannon ball at a protected castle, each person in that castle only has an independent 50% chance of being freed.

<Page 4: Castle and Person>
You may chat with anyone in the experiment using the "Group Chat" frame at the top center of the screen. To send messages, type in the line next to the  icon. Your text will appear in the textbox above and will be visible to everyone. You can also engage in bilateral conversations with any other person or castle in the experiment by clicking on the Chat button in the "Individual Chat" frame at the bottom center of the screen.

You are free to discuss all aspects of the experiment, with the following exceptions: you may not reveal your name, discuss side payments outside of the experiment, make threats, or engage in inappropriate language (including such shorthand as 'WTF'). If you do, you will be excused and you will forfeit your earnings.

Chatting will be disabled until the instruction phase is over.

<Page 5: Castle and Person>
A summary of your earnings in the "Summary" frame at the bottom right corner of your screen. Your earnings will be paid to you privately at the end of the experiment. You will *not* be told how long the experiment will last.

As a reminder, some participants have earned the right to be a *castle*. A *castle* must invest money in a person in order to earn money either by (a) unilaterally appropriating money from a person or by (b) a person voluntarily sending money to the *castle*.

This is the end of the instructions. If you have any questions please raise your hand and a monitor will come by to answer them. If you are finished with the instructions please press Start. The experiment will begin once everyone has clicked on the Start button. The instructions will remain on your screen until the experiment begins.
<Page 1: Person >
This is an experiment in the economics of decision-making. The instructions are simple, and if you understand them, you may earn a considerable amount of money that will be paid to you in CASH at the end of the experiment. Your earnings will be determined partly by your decisions and partly by the decisions of others. If you have questions at any time while reading the instructions, please raise your hand and a lab monitor will assist you.

In this experiment you are Person {1, 2, ..., or 8}. In order to earn money, a *castle* must invest 2 cents in a person every 5 seconds. Once a *castle* invests money in a person, Persons 1-8 can then produce 10 cents every 5 seconds.

A *castle* can capture a person by clicking on a person and pulling them to the castle. For every person by a castle, the castle can appropriate a portion of money that a person produces. As a castle appropriates money from people, some of what a person produces is lost as waste. The  icon indicates from which people a castle can currently appropriate money. A castle can also choose *not* to invest in a captured person.

<Page 2: Person >

A *castle* can also free a person. The  icon indicates which people are free. A *castle* will automatically invest in a free person. A free person next to a castle can choose to voluntarily split the amount of money he or she produces without waste. To do this, right click on your person icon, move the slider, and then click the  icon to set your choice. Do this now.

A free person is also able to leave a castle. To do this, right click on your person icon, and then click the  icon. Do this now.

Lastly, free people can also voluntarily move themselves to a castle. To do this, right click on a castle and then click the  icon. Do this now.

<Page 3: Person >

A castle can attempt to free people from other castles by firing a cannon ball. Each cannon ball costs 24 cents, which is deducted from the castle's earnings.

To protect itself against a cannon ball attack, a castle can shield the castle and the people in it. While the shield is on, 2 cents are deducted from the castle's earnings every 5 seconds.

When a castle fires a cannon ball at an unprotected castle, each person in that castle has an independent 100% chance of being freed. When a castle fires a cannon ball at a protected castle, each person in that castle only has an independent 50% chance of being freed.

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