# Security of Property as a Public Good: Institutions, Socio-Political Environment and Experimental Behavior in Five Countries*

Francisco Campos-Ortiz+, Louis Putterman†, T.K. Ahn‡, Loukas Balafoutas§, Mongoljin Batsaikhan¶ and Matthias Sutter#

**Abstract**

We study experimentally the protection of property in five widely distinct countries—Austria, Mexico, Mongolia, South Korea and the United States. Our main results are that the security of property varies with experimental institutions, and that our subject pools exhibit significantly different behaviors that correlate with country-level property security, trust and quality of government. Subjects from countries with higher levels of trust or perceptions of safety are more prone to abstain initially from theft and devote more resources to production, and subjects from countries with higher quality political institutions are more supportive of protecting property through compulsory taxation. This highlights the relevance of socio-political factors in determining countries' success in addressing collective action problems including safeguarding property rights.

KEYWORDS: Property Rights; Theft; Efficiency; Experiment; Socio-Political Factors
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+ Economic Research Department, Bank of Mexico. Email: fcampos@banxico.org.mx
† Department of Economics, Brown University. Email: Louis_Putterman@brown.edu
‡ Department of Political Science and International Relations, Seoul National University. Email: tkahn@snu.ac.kr
§ Department of Public Economics, University of Innsbruck. Email: Loukas.Balafoutas@uibk.ac.at
¶ School of Foreign Services in Qatar, Georgetown University. Email: mb1712@georgetown.edu
# Department of Public Economics, University of Innsbruck, Department of Economics, University of Gothenburg, IZA Bonn and CESifo Munich. Email: Matthias.Sutter@uibk.ac.at

# 1 Introduction

Private property might strike us as the antithesis of a public good. Yet efficient protection of individuals' rights to property is to a large extent a problem of collective action. Where property rights are not protected by some combination of fear of penalties and voluntary norm compliance, individuals are forced to devote time and other resources to defending whatever wealth they are able to obtain, and their incentives to invest and to produce may be greatly attenuated. Societies that fail to achieve well-enforced property rights can therefore be expected to be poorer than those that do.

While social norms of desisting from theft contribute to a public good of secure property, private investment in defense of property (e.g., locks, alarm systems, barbed wire, and so forth) is also observed in every society. Well-functioning modern societies also assign much of the task of protection to collective institutions—police forces, courts, prison systems—capable of protecting the property of large numbers of individuals and thus achieving economies of scale. Of course, the mix of norm compliance, private protection, and collective protection of property varies across societies (Tabellini, 2008), making it an intriguing question how cultural traits interact with institutional constraints to shape the security of property.

Indeed, the correlation between cultural and institutional factors can be rather tight, as illustrated by Figure 1. It plots the level of property crimes in 56 countries on which data is available against the quality of government institutions (Panel A) and the level of trust (Panel B) in each country.[1] As the two panels show, both effective national institutions and high trust among citizens exhibit inverse associations with the incidence of property crime in the full 56 country sample and in the five countries in which we conducted the experiments discussed below. At the same time, institutional and cultural variables are themselves highly correlated, as shown in Figure 2 by the correlation between the same governance and trust measures, again for both full sample and focal countries.

In this research, we present an experiment on property rights with three treatments that vary in terms of the level of institutional tools that subjects can utilize in solving the collective action problem of securing private property. We conduct the battery of

[1] We constructed measures of the incidence of property crimes, quality of political institutions and trust from the International Crime Victims Survey (United Nations), World Bank and World Values Survey data. See Appendix A for details.

experiments in five economically, institutionally, and culturally distinct countries: Austria, Mexico, Mongolia, South Korea and the United States. These countries cover five out of eight regions in the World Values Survey cultural map (see Inglehart and Welzel, 2005, p. 63), allowing us to study how underlying socio-political differences intervene in the way institutions shape behavior. In total, we have 555 participants across the five countries. Within each country, we study experimentally a world in which individuals, organized in micro-societies of five subjects, can choose between productive, protective and appropriative activities and where material incentives make theft tempting.

Behaviors within each of our subject pools respond to treatment differences in qualitatively similar ways: without collective protection, the frequency of theft is above the social optimum, but less than half of what standard theory would predict. When the opportunity to engage in collective protection is made available but depends on strictly voluntary contributions, we observe statistically significant but economically modest improvement. Only when collective action is taken by a binding majority vote on a tax do we observe substantial efficiency gains through increased production.

Although reactions to the different institutional settings follow similar patterns, we find significant cross-country differences that are related to the socio-political environment within the countries of our experiment, which we proxy with measures of trust, perceptions of safety, and the quality of government. In particular, in countries with higher levels of trust or higher perceptions of safety, a higher fraction of subjects initially abstain from theft entirely, although an inability to sustain cooperation ultimately besets all subject pools. This initial difference suggests conditional willingness to adhere to an implicit non-theft norm, which generates different behaviors due to differing culturally-conditioned beliefs. Likewise, higher trust correlates with higher allocations of resources toward production, while stronger perceptions of lack of safety are associated with higher expenditures in protecting individuals' accumulations. Finally, in the treatment offering subjects the possibility to vote for mandatory funding of collective protection, subjects from countries with higher-quality political institutions are more prone to support that funding arrangement, making the protection of private property more cost-effective in their groups.

Together, these observations suggest an important role of socio-political factors in determining the success of institutions for addressing an important social dilemma, that of

securing property rights and thus promoting productive activities. The varying success of the mandatory contributions mechanism, in particular, suggests that even incentive-compatible institutions may fail to produce theoretically efficient outcomes in the absence of a conducive socio-political atmosphere. Our results are also consistent with the hypothesis that differences in social capital help to explain differences in the quality of institutions and in economic performance (Knack and Keefer, 1997; Tabellini, 2008).

A number of economists, including Grossman (1991, 1994), Hirshleifer (1991, 1995), Skaperdas (1992), and Grossman and Kim (1995), have engaged in the theoretical study of the security of property by analyzing equilibrium allocations of resources between productive, protective, and appropriative activities in the absence of either external enforcement or norms. The basic general equilibrium framework of such papers has been extended to investigate the conditions under which the introduction of government favors the allocation of resources to production (Grossman, 2002). The seminal experimental paper is Durham, Hirshleifer and Smith (1998). They test, and largely confirm, the predictions of Hirshleifer's (1991) "Paradox of Power" hypothesis, according to which weaker or poorer parties may improve their position relative to stronger or richer opponents by engaging in conflict. Duffy and Kim (2005) assess the stability of an equilibrium in which agents devote resources to production, predation and defense against predation, as well as the effect of the introduction of a government. Powell and Wilson (2008) study experimentally the evolution of institutions in stateless societies by analyzing the level of efficiency in a Hobbesian state of nature, then offering subjects the opportunity to pledge support to a non-binding agreement not to engage in theft.[2]

Our experiment differs from those mentioned in several respects. Most importantly, ours is the first appropriation experiment to include subject pools in a diverse set of countries, which offers the possibility of assessing in a controlled way the operation of the same set of exogenously imposed institutions in different societies. In addition to this key difference, our subjects are neither assigned to nor required to choose between specialized producer or predator roles. Also, our focus on collective action and institutions leads us to introduce a novel collective protection technology with greater social but lower private

[2] Additional experimental research on appropriative conflict include Carter and Anderton (2001), and Kimbrough, Smith and Wilson (2010).

returns than private protection. And by running three different treatments, we can compare the effectiveness of collective protection technologies in both the absence and the presence of a state-like institutional structure (voting, taxation).

Our paper also adds to the literature examining how behaviors differ among countries or cultures through laboratory decision experiments, and to the still small strand of that literature combining experimental data with survey data drawn from representative national samples rather than from the experimental participants themselves (e.g., Herrmann et al., 2008; Thöni et al., 2012). We extend the approach to a specific problem of political economy not previously addressed by it, with an emphasis on the social dilemma feature of the property security issue that is often missing from its discussion.

The rest of the paper proceeds as follows. In Section 2, we spell out our experimental design and discuss the predictions of standard economic theory. Section 3 discusses our results. Section 4 concludes.

# 2 Experimental design and predictions

In each country, we study three treatments that share a common core structure. In each treatment, fixed-partner groups of five subjects each are formed. In each of 24 periods in total, each subject is endowed with ten "effort tokens" that he or she must allocate among three activities:

1. a productive activity that yields "wealth tokens" with diminishing returns. We denote the number of tokens for this activity by $m_i$ (for making wealth tokens);
2. theft directed at other group members' accumulation of wealth tokens, denoted by $T_i = \Sigma_{j \neq i} t_{ij}$, where $t_{ij}$ indicates the theft tokens $i$ directs at a specific individual $j$)[3]; and
3. private protection ($p_i$) of own accumulations from theft.

A fourth activity, collective protection, is available in two of the treatments and will be explained when these treatments are introduced.

*Table 1 about here*

[3] To make theft a live consideration from the outset, each subject is endowed with an initial accumulation of 100 wealth tokens at the beginning of the experiment.

Table 1 shows the production function from effort to wealth tokens. Marginal returns decrease from 15 wealth tokens to one wealth token. In contrast to production, each effort token devoted to theft transfers a constant 10 wealth tokens from targeted individual *j*'s accumulation to the targeting individual *i* with probability of success $1 - P_j$, where $0 \leq P_j \leq 1$ is *j*'s total level of protection stated as a probability that a given theft attempt against *j* will be thwarted. Each of the $p_j$ effort tokens *j* devotes to the private protection of her wealth accumulation raises $P_j$ by 0.1. Each theft attempt by some individual *i* against individual *j* is governed by an independent random draw with the indicated probability.[4]

At the end of each period, subjects learn the number of wealth tokens they and each other group member accumulated by production and theft and the number lost by theft, and cumulative information on these categories is subsequently available in a "stats" screen that can be opened at any time.[5] In the following sub-sections, we present the differences between treatments and discuss the subject pools and procedures.

## 2.a NCP treatment – No Collective Protection

In our first treatment, which we call No Collective Protection or **NCP**, subjects determined their allocations among production, theft and private protection simultaneously. We made collective protection unavailable to provide a benchmark against which to measure its effects when present. For subjects in this treatment, the experiment as a whole consisted of six four-period phases separated by one minute breaks, as shown by Panel A of Figure 3.a. The structure of the individual period is shown by Panel A of Figure 3.b.

*Figure 3 about here*

[4] The only exception to the rule regarding number of wealth tokens transferred occurs when a targeted subject's accumulation balance reaches zero. Because we prevent a subject's balance from becoming negative, those engaging in theft can split between them no more than the total accumulation a targeted subject has at the beginning of a period. We stipulate that this splitting is proportionate to the number of tokens each had allocated to theft from the targeted individual. Given that statistics on others' accumulations are always available and that those accumulations grow fairly large with time, the limitation was rarely binding. In more than 13,000 observations, the rule took effect only seventeen times.

[5] Group members have fixed letter identifiers throughout their sessions. Summary information on theft does not reveal who stole from whom, although that can be deduced if there is only one successful theft in a period.

Considering the per-period constraint $m_i + T_i + p_i = 10$, and assuming risk neutrality and self-interested payoff-maximization, the unique equilibrium of the stage game—and also the finitely repeated game—is the vector $(m_i, T_i, p_i) = (3, 7, 0)$. Three effort tokens are allocated to production because, provided there are no allocations to protection, each effort token devoted to theft would yield for *i* 10 wealth tokens, so only the first three tokens devoted to production could compete with theft in terms of expected marginal returns (see Table 1). There is no investment in private protection for the following reason. Assuming that others devote seven effort tokens to theft and that a subject herself is thus on average targeted by seven theft tokens, a subject expects to reduce her losses to theft by an average of 0.1x70 = 7 wealth tokens for each token devoted to protection, versus the ten she can gain from theft. So a risk-neutral agent would engage in no protective effort. Risk-aversion will not weigh in favor of private protection either, since allocating tokens to this activity introduces further variability to the expected returns.

It is clear that in the **NCP** treatment, our subjects face a social dilemma. If all refrain from engaging in theft and put ten tokens each period into production, each earns 70 tokens per period, versus the 39 tokens that are the equilibrium prediction for selfish, rational, non-risk-loving agents. Abstinence from stealing can accordingly be thought of as a public good, and the (3, 7, 0) equilibrium thus represents a failure of public goods provision. With this in mind we introduced, in the remaining two treatments, mechanisms of collective action which might help to establish better property protection.

## 2.b VCP treatment – Voluntary Collective Protection

In this treatment, each period has two stages. While the second stage is identical to the allocation stage of **NCP**, the first stage offers an opportunity for group members to voluntarily devote effort tokens to a collective protection fund—hence the treatment name Voluntary Collective Protection or **VCP**. Panel B of Figure 3.b shows the timing of the stage game. Each token assigned to this fund raises *P* (the probability of protecting one's wealth against theft) of all members by 0.06, up to a maximum of 12 tokens or 72% protection (a 28% probability of a theft succeeding). We impose a ceiling on the level of collective protection because we deem it realistic that property cannot be made 100%

secure by public policing alone.[6] Subjects are informed of the total level of collective protection before each makes her production, theft, and private protection decisions in the period's second stage.

Private and collective protection combine to determine $j$'s total protection $P_j = \min[0.1p_j + \min(0.06\Sigma c_k, 0.72), 1]$, where $c$ indicates contributions to collective protection and $k$ indexes any group member including $i$ and $j$. Notice that tokens allocated to private protection raise the protection level of only the allocator's accumulation by 10 percentage points, whereas tokens allocated to collective protection raise all group members' protection levels by 6 percentage points, making free-riding on collective protection a dominant strategy.

Denoting the number of tokens that individual $i$ allocates to collective protection by $c_i$, we can denote $i$'s strategy by $(m_i, T_i, p_i, c_i)$, where $m_i + T_i + p_i + c_i = 10$. Since we have already demonstrated that a risk-averse or risk-neutral subject wishing to maximize her earnings will allocate no tokens to private protection, it is clear from the above arguments that standard theory assuming self-interested agents also predicts that there will be no tokens allocated to collective protection, yielding as the unique equilibrium (3, 7, 0, 0).

Of course, this constitutes an inefficient social dilemma outcome. Assuming that the social optimum of 100% production and zero theft is out of reach, improving joint outcomes by provision of collective protection may yet be feasible for subjects with mild preferences for cooperation, because the amount assigned to the activity becomes public knowledge before the remainder of the period's allocation decisions are taken, allowing it to serve as a low cost cue of intent to cooperate.[7] By putting only three tokens each into collective protection in the first stage, subjects can render it individually rational to assign the remaining seven tokens of each to production, leading to outputs of 64 wealth tokens per period instead of the 39 wealth token output that is otherwise predicted.[8]

[6] Note that since decisions are made simultaneously and without communication, over-allocation is possible. Group members learn the total contributions provided, but not the contribution of any individual member.

[7] By "preferences for cooperation," we refer to some kind of deviation from the standard economics assumption of exclusive concern for own money payoff. An example is conditional cooperation as discussed by Fischbacher and Gächter (2010).

[8] Clearly, it would be still more efficient were two subjects to allocate three tokens and three to allocate two tokens each to collective protection, leaving two more tokens for production. We discount this possibility as largely infeasible in the absence of a coordination device. Crawford, Gneezy and Rottenstreich (2008) show that coordination largely fails when subjects need to play asymmetric actions.

## 2.c VOTE treatment – Voting on collective protection

Our third treatment, which we call **VOTE**, differs from **VCP** in that groups are given the opportunity to solve the free-riding problem surrounding collective protection by voting to make contributions mandatory—a scheme analogous to using taxes to fund a police force. Following a first phase of four periods in which no collective protection is available, as in **NCP**, group members vote before each of the remaining five phases (of four periods each) on whether to make contributions to collective protection mandatory or keep them voluntary. If a majority prefers mandatory contributions, then in the first stage of each of the following four periods, group members indicate their preferred level of contribution knowing that the median proposal will bind all; otherwise, periods take the same form as in **VCP**. Panel B of Figure 3.a shows the timeline of this treatment, while Panels B and C of Figure 3.b illustrate the timelines of the stage game for each of the two possible scenarios.

As Section 2.b showed, the equilibrium under the voluntary scheme is (3, 7, 0, 0), yielding average earnings of 39 wealth tokens per period. If the mandatory scheme is adopted, however, subjects can vote to mandate contributions of either two or three tokens to collective protection and thus make it individually rational to put the other tokens into production and have expected earnings of approximately 64 wealth tokens.[9] A subject perceiving a positive probability of being pivotal should accordingly vote for the mandatory scheme, and without the means to coordinate voting, it is reasonable to expect all to vote this way.[10] This yields 64 wealth tokens as expected earnings according to standard theory, or 91% of the potential earnings. This is much better than the expected 39 wealth tokens (or 56% of the maximum) in **NCP**.

While the **VCP** treatment also offers subjects a means of boosting efficiency through actions in stage 1 that raise incentives to engage in production in stage 2, it still entails a collective action dilemma unsolvable without voluntary cooperation. The **VOTE** treatment, in contrast, offers a way of mitigating the dilemma of property protection that

[9] Details regarding the indeterminacy of the optimal mandatory contribution (2 or 3) and the resulting indeterminacy of production are relegated to Appendix B; it suffices to note here that expected earnings of approximately 64 wealth tokens hold with either approach.

[10] Being unable to know for certain how others are voting, a subject cannot rule out that she will be pivotal, and this should eliminate her indifference. A trembling hand perfection argument can similarly be enlisted in favor of the prediction of uniform voting for the mandatory scheme.

requires only self-interested rationality to operate. Standard economic theory thus predicts no greater efficiency in **VCP** than in **NCP**, but a large gain in efficiency in **VOTE**.

## 2.d Subject pools

Subjects' behavior toward the dilemma of property rights is likely to vary not only according to institutional contexts, which we control for with our treatments, but also with normative orientations and beliefs, which subjects bring with them into the lab. Hence, we conducted our experiment using subjects in a number of different countries having different historical and contemporary characteristics.[11] The five countries in which the experiments were conducted—Austria, Mexico, Mongolia, South Korea and the United States—represent a broad range of characteristics. Austria and the U.S. are economically developed, politically democratic societies, with Austria having considerably greater ethnic homogeneity and a long-standing social democratic institutional caste compared to the more individualistic free market qualities of the U.S. South Korea provides a more recently industrialized and democratized Asian setting with a less extensive welfare state, Confucian paternalistic traditions and a heavy dose of Western, Christian and modern technological influences. Mexico is an upper middle income developing country with a population of mixed Amerindian and Spanish origin which has experienced intermittent economic growth, partly facilitated by proximity to the United States, with a reputation for political instability, corruption, and, like South Korea, relatively recent effective democratization. Mongolia, which shares a high level of ethnic homogeneity with Austria and South Korea, is the least economically developed country in the sample. It is the only one to have gone through three generations under Communist rule before beginning a transition to free market capitalism in the 1990s, and is also the only one whose economy and society were based on semi-nomadic pastoralism rather than settled agriculture before modern times. Our sample accordingly represents three continents, five cultures (Inglehart and Welzel, 2005), a wide spectrum of economic development levels, a variety of levels of ethnic homogeneity, a range of experiences with democracy, and, as Appendix A illustrates,

[11] Noteworthy experiments suggesting cross-national differences between subject pools include Roth et al. (1992), Henrich et al. (2001), Herrmann, Thöni and Gächter (2008), Bohnet et al. (2008) and Bohnet, Herrmann and Zeckhauser (2010).

additional differences with respect to quality of government, social trust, and perceived and experienced security of property.

*Table 2 about here*

At each site, sessions of all three treatments were conducted in a university computer lab using college-age students as subjects, each participating in no more than one session and thus only one treatment. In each country, six to eight groups of five members each participated in each treatment, with numbers varying due to variation in "show up" rates (see Table 2). All participants were similar in age, education and socio-economic position in their respective countries. Specific sites were the University of Innsbruck (Austria), the Instituto Tecnológico Autónomo de México or ITAM (Mexico City), the Mongolian University of Science and Technology or MUST (Ulaanbaatar), Korea University (Seoul) and Brown University (Providence, Rhode Island, U.S.) [12]

In Appendix C, we discuss the representativeness of our university student subject pools for their countrymen more generally by comparing their responses in our post-experiment survey to those in general surveys including the World Values Survey, and by briefly considering the results of two treatments using a non-student subject population in Mongolia.

## 2.e Procedures

Experiments were conducted between January and July of 2010 on computers programmed in Multistage (software initially developed at U.C.L.A. and Caltech). At the beginning of each session, instructions were read aloud in the relevant language while subjects read along on paper.[13] In **NCP** and **VCP,** all instructions and practice took place before phase

[12] At four universities, subjects were drawn entirely from their own general undergraduate programs. The case of MUST is slightly different. This institution was selected as our site in Mongolia because it offered one of the few facilities in Ulaanbaatar with an adequate computer lab, but Mongolian student subjects were recruited from a total of nine institutions in the city, of which three, MUST, Mongolian National University, and Institute of Finance and Economics, account for the lion's share. We recruited from multiple universities because MUST lacks social science and humanities students, making its students less diverse than those in the other countries' subject pools.

[13] Instructions were translated from English to German, Korean, Mongolian and Spanish by native-speakers of each language belonging to our team and underwent "back-translation" to English by a different bilingual

one. In **VOTE**, the initial instructions and practice before phase one, as well as phase one play, resembled those of **NCP** except that subjects were told that additional instructions would follow that phase.[14] This was followed by further instructions describing collective protection and how to vote on it and determine its level. In all treatments, subjects were invited to ask questions of clarification before payoff-determining play commenced.

# 3 Results

## 3.a Comparing play by treatment

To simplify exposition, we first pool the data from our five sites and focus on differences among treatments, then turn to comparisons across sites in section 3.b. The four panels in Figure 4 display plots of average allocations to each of the four possible activities—production, theft, private protection, and collective protection—while Figure 5 shows the resulting average earnings per subject and period. Table 3 compares our theoretical benchmarks to the actual average choices and outcomes by treatment.

*Figures 4, 5 and Table 3 about here*

Our first general observation is that in the **NCP** treatment, average token allocations to production (4.3) and theft (2.9) lie between the equilibrium prediction (3 to production and 7 to theft) and the social optimum (10 to production and 0 to theft). There are also substantial allocations to private protection—averaging 2.9 tokens—which are high enough to deter rational decision-makers from attempting further theft. Positive allocations to private protection are however at odds with the zero allocation predicted. In Appendix D we discuss three potential explanations to this conundrum: loss aversion, moral reservations against stealing, and asymmetric protective motives (i.e., following theft, a subject who anticipates retaliation may expect a higher return from protective investment). We

individual who had not read the English version to check for consistency. Instructions and practice scripts for all treatments in English are included in Appendix E.

[14] In the **VOTE** sessions, we had subjects play first under the **NCP** condition in order to reduce the amount of instructions to be absorbed at the outset and to lay the groundwork for subject appreciation of the potential uses of voted or voluntary collective protection arrangements.

demonstrate the theoretical possibility of the first factor and find evidence for the last two factors.

As a result of the aforementioned choices in **NCP**, subjects earned an average of 46.6 tokens per period rather than the predicted 39, thus capturing about a quarter of the potential gain from cooperation but leaving the remaining three quarters "on the table."[15]

In the **VCP** treatment, the average voluntary contribution to collective protection begins at 1.5 effort tokens per subject in period one, but declines rapidly, yielding an overall average of 0.4 tokens per period. Taking into account the average allocations of 2.7 tokens to private protection, the average subject's total protection level is about 40% in **VCP** (versus 29% in **NCP**). This level renders the expected return to theft for a hypothetical subject with perfect foresight 6 wealth tokens, one less than the certain return on a 5$^{th}$ token assigned to production. Presumably in part because of this higher protection, average allocations to production were 0.54 tokens higher than in **NCP** (4.83 vs. 4.29) and those to theft 0.84 tokens lower (2.01 vs. 2.85)—both differences being significant at the 1% level according to a Mann-Whitney test using group averages as independent observations (see Table 4). Average earnings were thus 50.35 per period, 3.7 tokens higher than in the **NCP** treatment, a difference that is also significant at the 1% level. While modest, the introduction of a collective protection technology raises the percentage of potential cooperative surplus obtained by subjects by 12 percentage points, to 36.6% (cf. Table 3).

*Table 4 about here*

Recall that in theory, the **VOTE** treatment offers subjects their best opportunity to attain higher efficiency on the basis of individual rationality and self-interest. By voting to mandate the contribution of two or three tokens per subject to collective protection, sufficient protection can be assured so that allocating the remaining seven tokens to production becomes rational and thus about 80% of potential efficiency gains are attained. Figures 4 and 5 show that subjects did boost production and earnings in **VOTE** relative to

[15] The potential gains from cooperation are 31, which is the difference between 70 (if all tokens are invested into production and no theft occurs) and 39 (the earnings in equilibrium).

the first two treatments; collective protection also received a lift. Table 4 shows that these differences are statistically significant with $p < 0.01$ according to Mann-Whitney tests. Hence, our **VOTE** treatment successfully illustrates the emergence of a tax-financed public policing institution. The impact is less than predicted, however, since the average efficiency gain in the five phases when the mandatory collective protection scheme was available is slightly under 50%, rather than the predicted 80%.

The failure to attain more of the potentially available gains in **VOTE** is largely explained by the facts that majorities voted to use the more efficient mandatory scheme in only 64% of the available opportunities and that the mandated collective protection level when the scheme was selected was not always ideal. Groups set contributions at three tokens in 10.3% of periods and at two tokens in 59.5%, so an efficient scheme with mandatory contributions of either two or three tokens was in place in only about 45% (≈ (.103+.595)*.64) of periods 5-24. Mandatory contributions of zero tokens, one token, and four tokens were chosen in 5%, 25% and 0.2% of periods, respectively. Even in those periods in which groups selected the mandatory contributions of two or three tokens, allocations to production averaged only 6.05 rather than the privately optimal seven effort tokens, so earnings per period averaged ~~only~~ 58.81 wealth tokens; this is significantly more than the 50.35 of the **VCP** treatment but still below the feasible 64 tokens. Also, we again see a surprising attraction to private protection. Subjects assigned an average of 1.13 (2.35) tokens to private protection when playing under the mandatory (voluntary) contribution scheme.

Summing up, the combined results across the five countries show that institutions matter. As in other social dilemma experiments, subjects achieve some level of cooperation under institutional settings of **NCP** and **VCP** in which they are not expected to do so based on standard economic theory, but cooperation wanes with time (see Figure 4). The opportunity for voluntary collective action in **VCP** allowed subjects to achieve higher levels of cooperation than they could in **NCP**, but the achievements were modest. Incentive-compatible institutional opportunity in **VOTE** further improved the outcome, as subjects utilized opportunities for making a binding contract to increase the level of production, but there was considerable variation in the degree to which different groups grasped the available benefits of this institution.

## 3.b Comparing play by country

The pooled results reported in the previous subsection are representative of many aspects of the experimental outcome in each country, but hide differences across the five subject pools that we think give rise to the most interesting contribution of our study. In this and following subsection we focus on the differences across countries and check for the role of socio-political factors.

*Figure 6 about here*

Figure 6 shows average allocation to each of the four activities in the five countries separately. Before pointing out differences, it is useful to note the considerable number of qualitative similarities across countries. At all five sites, production is lowest in **NCP**, intermediate in **VCP**, and highest in **VOTE**, though the difference is negligible in two of the comparisons: between **NCP** (4.62) and **VCP** (4.63) in the U.S., and between **VCP** (4.57) and **VOTE** (4.62) in Mongolia. Allocations to theft are everywhere higher in **NCP** than in **VCP** or **VOTE**.[16] In all countries, allocations to private protection are similar in **NCP** and **VCP** (only significantly different at the 10% level in Mongolia), and lowest in **VOTE**. And collective protection is higher in **VOTE** than in **VCP** in every country, though again the difference is quite small in Mongolia.

*Table 5 about here*

Despite this considerable consistency, there are some important differences. Consider first the **NCP** and **VCP** treatments, in which voluntary cooperation offers the only possibility for increasing efficiency. Differences between the subject pools with regard to allocations to theft and protection (private in **NCP**, both private and collective in **VCP**) fail to attain statistical significance according to Kruskal-Wallis tests based on group averages as independent observations and country as the grouping variable (see Panels A and B of Table 5). However, Figure 6 shows suggestive differences in theft and protection

[16] In none of the countries is the difference between allocations to theft in **VCP** and **VOTE** statistically significant. As a corollary, theft choices are not statistically different between these treatments (see Table 4).

allocations, and the corresponding differences in average allocations to production, are associated with statistically significant differences. This observation is confirmed by the results from Kruskal-Wallis tests shown in Table 5.[17] In **NCP**, Austrian and U.S. subjects attain considerably higher production and hence efficiency than do Mongolians and Koreans, with Mexican subjects in between. The line-up in **VCP** is similar except that the U.S. subjects in this case join the Korean and Mongolian ones with lower efficiency. Adding to this the fact that highest efficiency is shown by the Austrians and lowest by the Mongolians also in **VOTE** treatment, there is a definite indication of between-country difference in proclivity/ability to cooperate.

More evidence of differences between subject pools in the pure social dilemma treatments can be found by focusing on behaviors in the first period. With forces common to all such settings tending to erode cooperation over time, the strongest evidence of differences in initial predispositions and beliefs may be displayed before subjects have received feedback of others' behaviors. Although Table 5 shows allocations to theft in **NCP** to be statistically indistinguishable when we consider the behaviors of all 24 periods, there are large and significant differences in period 1 choices. Average allocations to theft during the first period are statistically different with $p = 0.07$ according to Kruskal-Wallis tests based on individual choices as independent observations and country as the grouping variable, with values going from 1.5 effort tokens in Austria to 2.6 tokens in Mongolia, and slightly above 2 tokens in the other countries.[18] Decisions to engage in no theft at all may be especially revealing because, given the strong incentive to devote most of one's tokens to the activity, not stealing at all may represent an attempt to convey a desire to cooperate for mutual benefit, and choosing to do so may in turn reflect a belief that the likelihood that others are so disposed is not negligible. During the first period, the fraction of subjects who

[17] Mann-Whitney tests for every pair of countries reveal that the difference in allocations to production in **NCP** are statistically significant for Austria and South Korea ($p = 0.018$), Austria and Mongolia ($p = 0.015$), South Korea and Mexico ($p = 0.082$), South Korea and the U.S. ($p = 0.036$), Mexico and Mongolia ($p = 0.063$, and Mongolia and the U.S. ($p = 0.010$). Parallel tests show the difference in allocations to production in **VCP** are significant between Austria and South Korea ($p = 0.049$), Austria and Mongolia ($p = 0.007$), and Austria and the U.S. ($p = 0.021$). Differences in average earnings parallel those in production.

[18] Kruskal-Wallis tests of allocation choices in period 1 in **NCP** need to be done at the individual level since subjects decide simultaneously in that period and have no previous interaction with other group members, so individual choices can be taken as independent observations. Because of the feedback subjects obtain regarding their fellow group members' performance starting at the end of period 1, group-level tests are required for allocations made after period 1.

decide to devote no resources to theft ranges from 38% in the U.S. to 7% in Mongolia, with Austria (29%), Mexico (20%) and South Korea (20%) in between. A Kruskal-Wallis test indicates that these differences are statistically significant at the 5% level. Further, "no theft" decisions in the first period are also statistically different according to Kruskal-Wallis tests both in **VCP** ($p = 0.08$) and **VOTE** ($p = 0.012$).[19] These differences in initial decisions about theft show some alignment with differences in overall production and earnings outcomes, for instance with regard to Austria and Mongolia again being at or near the more and less cooperative ends of the spectrum, respectively.

A final notable difference is found in the **VOTE** treatment, where we observe considerable variation in institutional preferences among subject pools, with the proportion of individual votes in favor of the mandatory scheme ranging from 29.5% in Mongolia to 69.7% in Austria, with the U.S. (58%), Mexico (61.1%) and South Korea (63%) occupying the middle slots. The frequency of majority selection of the scheme follows a similar but not identical order, ranging from 22.5% in Mongolia, to 62.5% in the U.S., 75% in South Korea, 80% in Austria and 82.9% in Mexico. Panel C(i) in Table 5 shows that such differences in the preferences for and choice between the two schemes are statistically significant according to Kruskal-Wallis tests.[20] Not surprisingly, these differences translate into significant differences in achieved production and earnings. Figure 6 shows a particularly wide gap between the Austrian and Mongolian subject pools, with the other three groups of subjects bunched together in between.[21, 22]

[19] Both Kruskal-Wallis and Mann-Whitney tests of "no theft" decisions in period 1 are performed at the individual level for the **NCP** and **VOTE** treatments as all decisions in that period are simultaneous so subjects have had no interaction with fellow group members. For the **VCP** treatment, in turn, group-level tests are more appropriate because theft choices are taken after group members learn about the level of collective protection, so individual choices are not fully independent. The tests find differences between subject pools that are statistically significant at the 10% level or better for Mongolian and Austrian, South Korean and U.S., Mexican and U.S. and Mongolian and U.S. subjects in **NCP**; for the Mongolian and Austrian, Mongolian and South Korean, Mongolian and U.S., Mexican and South Korean, and Mexican and U.S. subjects, in **VOTE**; and between Mongolian subjects and each other subject pool in **VCP**.

[20] In Mann-Whitney tests between subject pools using group-level observations, vote outcomes differ at the 5% level in 2-tailed tests between Mongolia and Austria, South Korea and Mexico; and at the 10% level in 1-tailed tests between South Korea and Mexico, Mexico and the U.S., and Mongolia and the U.S.

[21] Mann-Whitney tests find that allocations to production differ overall (regardless of chosen institution) in phases 2 – 5 of **VOTE** between the Austrian and Mongolian and between the Mexican and Mongolian subject groups with $p < 0.05$. The same pairs of countries show statistically significant differences in earnings, although the Austria-Mongolia difference is significant at the 10% level only. In the Kruskal-Wallis tests for differences by subject pool in phases 2 – 5 regardless of chosen scheme, amount allocated to theft and amount allocated to collective protection both differ among countries with $p < 0.10$.

## 3.c Socio-political environment and experimental choices

Does the overall performance of each subject pool correspond in any way to economic outcomes of their respective countries? Figure 7 suggests this is the case by showing a positive relationship between countries' average GDP per capita (by purchasing power parity) over the last decade and the average earnings of wealth tokens per period that each subject pool attained across all treatments.

*Figure 7 about here*

What might account for the correlation between country incomes and success in providing the public good of secure property in our experiment? Identifying a single definitive factor is impossible, since so many institutional, cultural, and socioeconomic factors are so highly correlated in the relevant international data and since we have experimental observations from five countries only. Nonetheless, we think it plausible to suggest that the main mechanism at work is social capital or trust which is closely associated with the level of security of property and of persons in the societies in question (Figure 1, Panel B) and with the quality of their governmental institutions (Figure 2). In a society in which theft and violence are experienced relatively rarely by most individuals, people are likely to have a higher level of trust in others. As experimental subjects, they are also likely to assign a higher probability to others upholding during the experiment the prohibition on theft that is the law outside the lab. Furthermore, in a society in which people feel they can trust the public authorities to implement laws fairly and trust their fellow citizens to make sensible use of their democratic rights, subjects are likely to have less hesitation about addressing the property protection issue through binding, democratically set taxes.

While formal statistical proof of the factors underpinning the cross-country differences in our results is ruled out by our small number of country observations, we *illustrate* the correlations that support our intuitions with a series of cross-country plots. The premise of these exercises is that subjects' behaviors in the lab are (partly) shaped by the same intricate social, cultural and political forces that determine their behavior in naturally

[22] Conditional on the choice of the mandatory scheme, however, Panel C(ii) of Table 5 shows that behaviors are statistically indistinguishable across countries. There are some differences in behavior among groups operating under the independent contributions scheme (see Panel C(iii)), but we do not focus on them because in most subject pools, groups operating under it are few and likely to be unrepresentative (see Table 6).

occurring settings. We stress that the measures we utilize as proxies of each country's socio-political environment are themselves highly correlated, so replacing one gauge with another generates similar visual impressions. For this reason, we make no claims of causality and we view our exercises more in the spirit of illustration. For the sake of parsimony, we will with one exception focus on mean experimental outcomes across all three treatments.

In a first exercise, we provide evidence that subjects from countries with better perceptions that property is secure and higher levels of trust among people are more prone to abstain from theft entirely at the start of the experiment. To measure perceptions of safety, we exploit data from the United Nations' International Crime Victims Survey (ICVS)[23] to construct a composite index aimed at capturing how safe people feel in each country. We built this index via factor analysis[24] of the responses to the survey questions (i) "How safe do you feel walking alone in your area after dark? (1=very safe, 2=fairly safe, 3=a bit unsafe, 4=very unsafe)," and (ii) "What would you say are the chances that over the next twelve months someone will try to break into your home? (1=very likely, 2=likely; 3=not very likely)". A higher value of the index reflects a perception that people and their possessions are at higher risk. Our results indicate that, among our sites, Mongolians feel the least safe, followed by Mexicans and South Koreans, with Austrians and Americans exhibiting the highest perceptions of safety. As a measure of trust, we employ a "Trust Index" that captures the difference between the share of national respondents to the most recent World Values Survey or similar regional survey who chose "Most people can be trusted" and the share of respondents who chose "You can't be too careful" in response to the question "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?"[25] Thus, a higher score of the trust index entails more trust among people. According to this measure, people from the U.S. and Austria trust others the most, followed by South Koreans and Mexicans, while Mongolians

[23] http://www.unodc.org/unodc/en/data-and-analysis/Crime-Victims-Survey.html

[24] See Johnson and Wichern (2002) for a detailed description of factor analysis methods. We implemented this technique using the *factor/predict* commands in Stata.

[25] The Trust Index captures the difference between the shares of responses rather than just the fraction of respondents who chose "Most people can be trusted" in order to adjust for the "No Answer" option that is offered in some of the regional surveys, or for slight differences in wording (e.g., by framing the question as a statement with which respondents would agree or not).

are the most careful in their interaction with others. Appendix A provides further details on these measures.

*Figure 8 about here*

Panel A of Figure 8 displays the inverse relationship between our measure of perceived lack of safety index and the fraction of subjects who do not allocate any resources toward stealing from their fellow group members in period one. Panel B exhibits the positive association between the trust index and the same experimental outcome. These results provide support to the idea that subjects condition their initial adherence to an implicit non-theft norm on the belief that others will do the same. Although the number of subjects completely abstaining from theft declined rapidly after the first period as subjects learned that not all in their group were so norm-following, subject pools in which more individuals initially abstained from theft still tended to produce more, on average, over the course of their sessions.

*Figure 9 about here*

Our conjecture that trust lies at the root of cooperation and hence production choices in our experiment finds illustrative support when we graph the country-level trust measure against average allocations to production over all periods and treatments, as shown in the left panel of Figure 9. Arguably, moreover, subjects' socio-political environment plays a more prominent role in shaping choices at the outset of the experiment, before the natural unfolding of the game introduces additional incentives that sway behaviors in different directions. Hence, period one choices offer more pristine evidence of the influence that socio-political conditions exert on individuals' behaviors. When we focus on period 1 production allocations, we find a stronger correlation between trust and production, as the right panel of Figure 9 shows.

Next, we check for the correlations between perceptions of safety and allocations to protective activities. The motivation of this exercise stems from the notion that if individuals face conditions of poor security of their property, they would dedicate a higher share of resources to defend their wealth at the expense of productive activities.

*Figure 10 about here*

The left panel of Figure 10 shows that subjects from countries where people feel less safe tend, on average across all periods and treatments, to allocate more resources to private protection. The right panel exhibits a stronger positive correlation between the perceived lack of safety and initial allocations to private protection.

*Figure 11 about here*

Similar patterns are observed regarding allocations to collective protection. The left panel of Figure 11 displays a positive relationship between the extent to which people feel unsafe and average amount of tokens utilized for collective protection across all periods. The fit becomes considerably stronger when we focus on period one, as shown by the right panel. Checking for initial allocations to collective protection is particularly relevant in this case because there is one clear force (free riding) determining contributions in **VCP** that becomes a more dominant driver of contribution choices as the experiment progresses.

*Figure 12 about here*

The **VOTE** treatment invites cross-country comparison because it is the only one in which our subjects decide on the use of an institution and the level of a tax by voting. We wondered whether differences in the quality of the political institutions among the countries represented could help to explain some of the cross-country variation in the support for provision of collective protection by mandating tax-like contributions. To explore this issue, we constructed a composite "Governance Index" applying factor analysis methods to three variables included in the World Bank's Worldwide Governance Indicators (WGI) dataset: government effectiveness, rule of law and control of corruption. A higher value of our Governance Index reflects political institutions of higher quality. Of the countries included in this study, Austria exhibits the highest Governance Index, followed by the U.S., South Korea and Mexico, with Mongolia having the lowest score (see Table A4 in Appendix A, where we also provide definitions for the components of the index).

Figure 12 shows a positive association between our Governance Index and the share of individual votes for the mandatory scheme. Although the positive correlation is mainly driven by the two countries on the extremes of the governance spectrum, Mongolia and Austria, the overall pattern suggests that subjects from countries with political institutions of higher quality are more prone to support the government-like institution meant to foster efficiency.

# 4 Conclusion

We used laboratory decision-making experiments to study how groups of individuals may attempt to establish secure rights to property that permit a socially efficient allocation of resources to production. In addition to a purely anarchic setting (**NCP**) in which voluntary abstinence from theft and a private protection technology are the only ways to make property secure, we studied two treatments that incorporate a technology of collective property protection simulating real world counterparts (e.g., police). This collective protection technology adds a second social dilemma element, reinforcing the idea that property rights are a public good. We conducted all treatments with undergraduate subjects in five economically, institutionally, and culturally distinct countries: Austria, Mexico, Mongolia, South Korea and the U.S.

Our results in the treatments without voting, i.e., in **NCP** and **VCP**, echo those of more standard voluntary cooperation experiments. Attempts to cooperate are rarely entirely absent, especially in the initial periods of play, as indicated in our data by the fact that 30 – 40% of subjects completely refrained from theft in first period play in the **NCP** treatment in the Austrian and U.S. subject pools. But cooperation tended to unravel with repetition much as in the canonical voluntary contribution mechanism (Ledyard, 1995), so overall efficiency was closer to the non-cooperative equilibrium prediction than to the social optimum. About a quarter of potential gains from cooperation were achieved in **NCP**, and slightly over a third in **VCP**.

In our **VOTE** treatment, a majority of subjects voted rationally to fund collective protection by a mandatory levy, illustrating how governments help to address the dilemma of property in modern societies. With a substantial minority of votes favoring the non-

mandatory institution and with frequent choice of lower-than-efficient tax levels, however, the institutional solution fell short of its theoretical potential. Nevertheless, introducing mandatory collective protection in **VOTE** led to the highest levels of efficiency gains in all countries, reaping almost 59% of potential efficiency gains, which is significantly better than in **VCP** (37%) and **NCP** (25%).

Perhaps most interesting is our finding of considerable variation across countries, correlating with differences in country characteristics that are suggested by large-scale surveys. Our findings support the view that underlying socio-political conditions are important to the security of property rights and that these conditions vary in a manner which also affects whether effective institutions will be built in a society, as evidenced by the failure of the majority of Mongolian groups to adopt the tax-like scheme. Also, we find that many individuals seem willing to refrain from theft conditional on others not stealing, which makes expectations of the proportion of others who would steal an important determinant of initial cooperation (e.g., only 10% of Mongolian subjects refrained from first period theft in the same treatment that saw three to four times more Austrian and U.S. subjects do so). Assuming that expectations of the frequency of theft within subject pools are correlated with people's perceptions of how secure their property is, or the trust they have in others, helps to explain observed cross-country variation in allocations to protection. Our findings also provide support to the view that social capital facilitates cooperation, thereby promoting economic efficiency. And differences in the quality of political institutions help to understand the variation in subjects' inclination to employ a mechanism akin to a government to fund collective protection from theft: almost 70% of Austrian subjects but less than 30% of Mongolian ones voted to make contributions to collective protection mandatory in the **VOTE** treatment.

Many of our results invite interpretations applicable to a broad class of collective action dilemmas. Nevertheless, we would like to conclude by noting that our experiment delivers several findings particularly relevant to the problem of property rights. The choices of our experimental subjects support the argument that normative constraints may play a part in making property secure, but that they require supportive initial beliefs and channels of reinforcement. The operation of institutions to support collective action is likewise shown to be possible, but not automatic. The underpinnings of effective norms and good

institutional choices are to a significant degree historically and culturally contingent. Cross-country evidence from outside of the lab may also be called on in support of the idea that secure property rights are requirements of more productive economies. The fact that the per capita incomes of the five countries from which our subjects were drawn are positively associated with perceptions of safety, social trust, quality of government institutions, and ultimately with the efficiencies achieved in the lab by our subjects, suggests interconnections that are worthy of further study.

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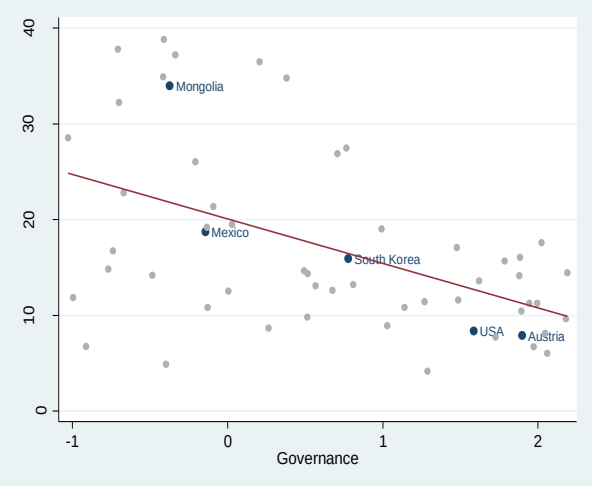
# Figures and Tables

**Figure 1: Governance, Trust and Incidence of Property Crimes**

Panel A




Panel B

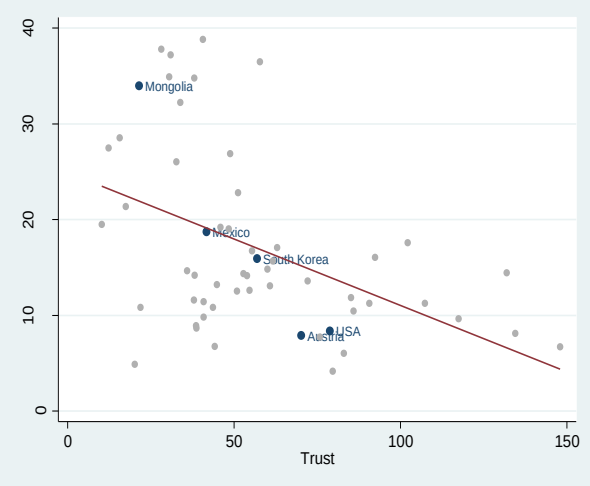
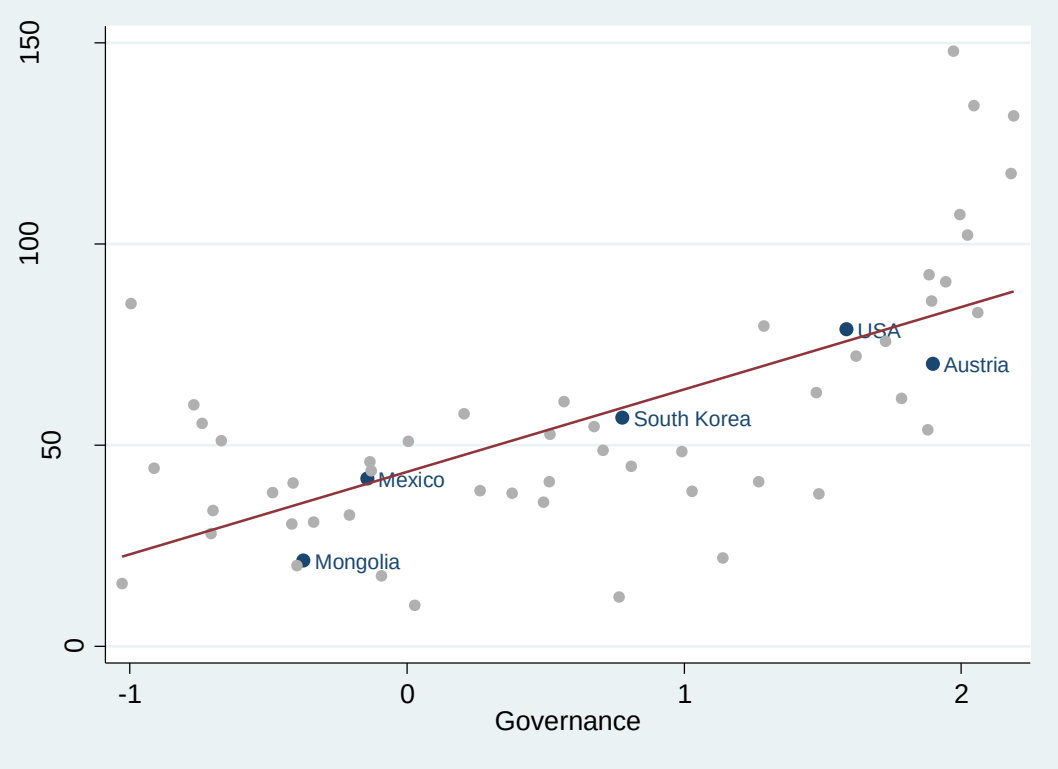
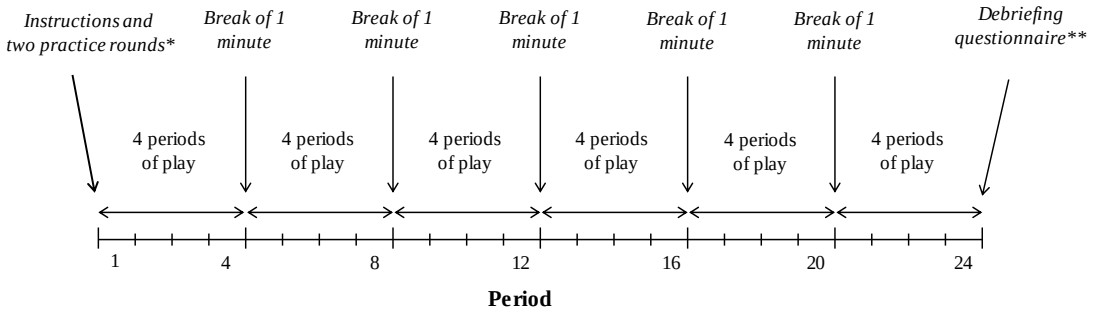



**Figure 2: Governance and Trust**

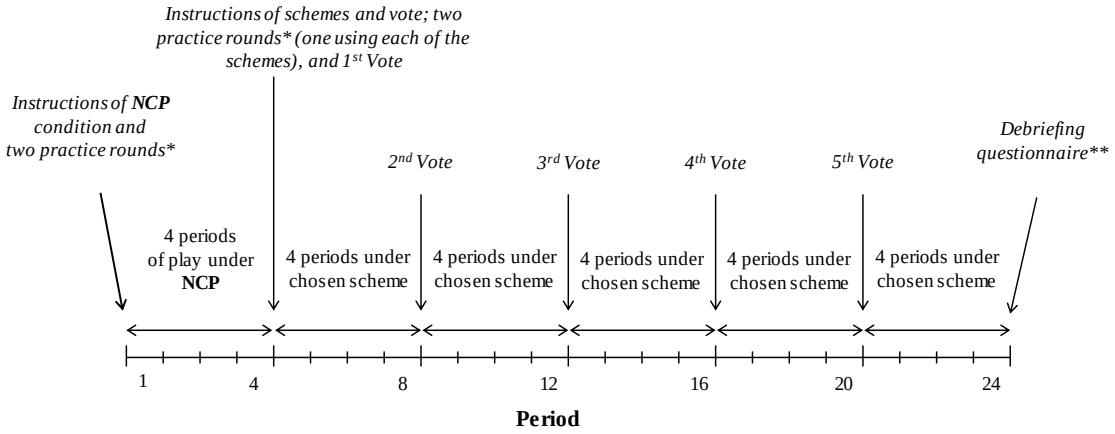


## Figure 3.a: Session timelines for each treatment

Panel A: **NCP** and **VCP**




Panel B: **VOTE**

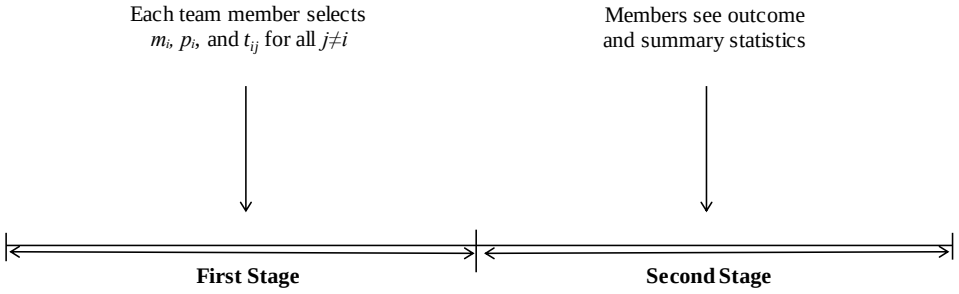



* Practice rounds were guided by experimenter directions for familiarization with the software interface and without indications of others' likely choices.

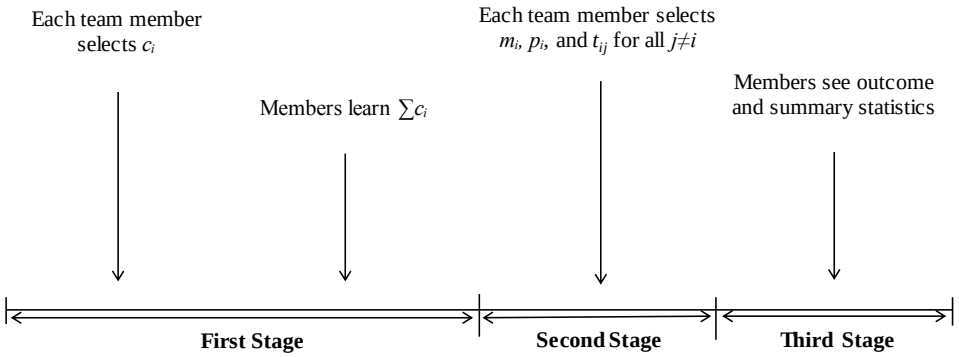
** In Austria, Korea, Mongolia and the U.S., sessions ended with a debriefing questionnaire. In Mexico, subjects completed the questionnaire several days before their participation in the lab; sessions ended with subjects writing down their comments about the experiment.

## Figure 3.b: Timelines of stage games for each treatment

Panel A: **NCP**




Panel B: **VCP** and **VOTE** if the independent contributions scheme is chosen




Panel C: **VOTE** if the mandatory contributions scheme is chosen

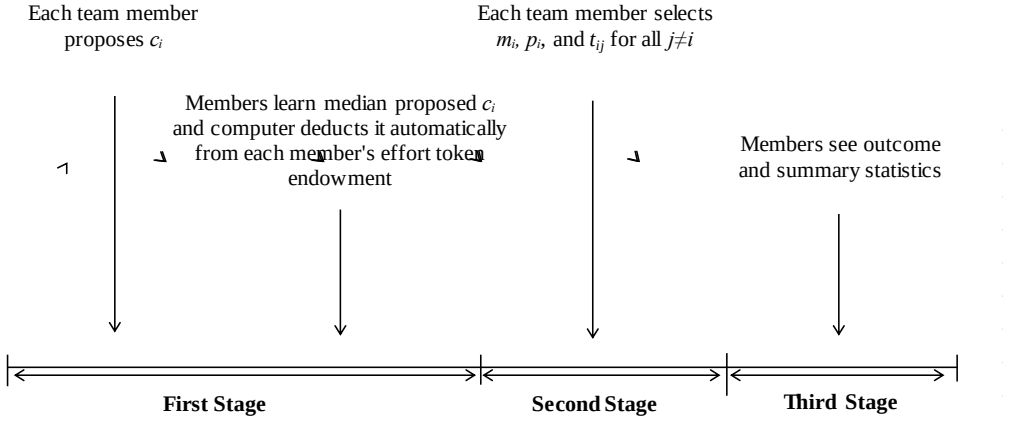


**Figure 4: Average allocations by period and treatment**

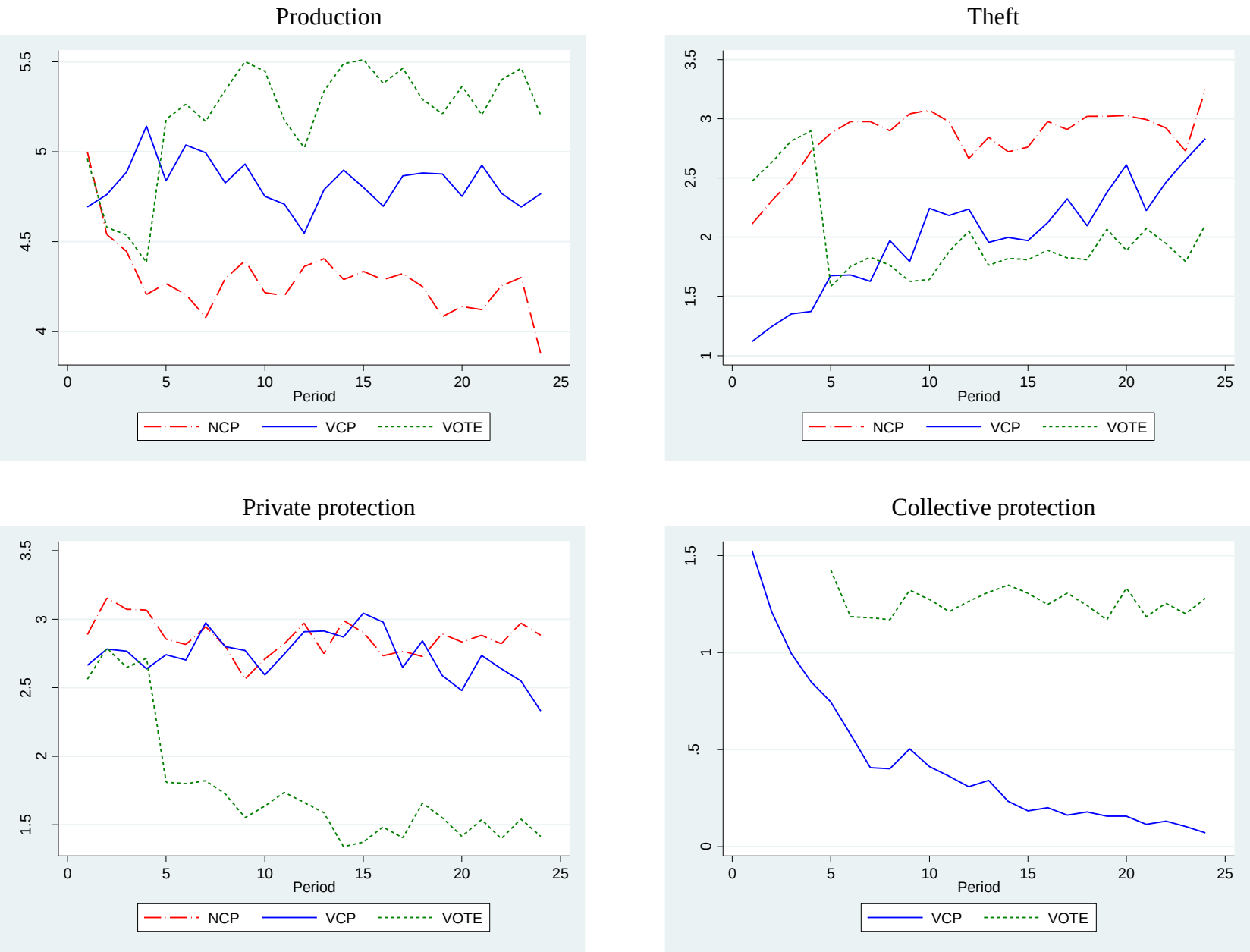


**Figure 5: Average earnings by period and treatment**

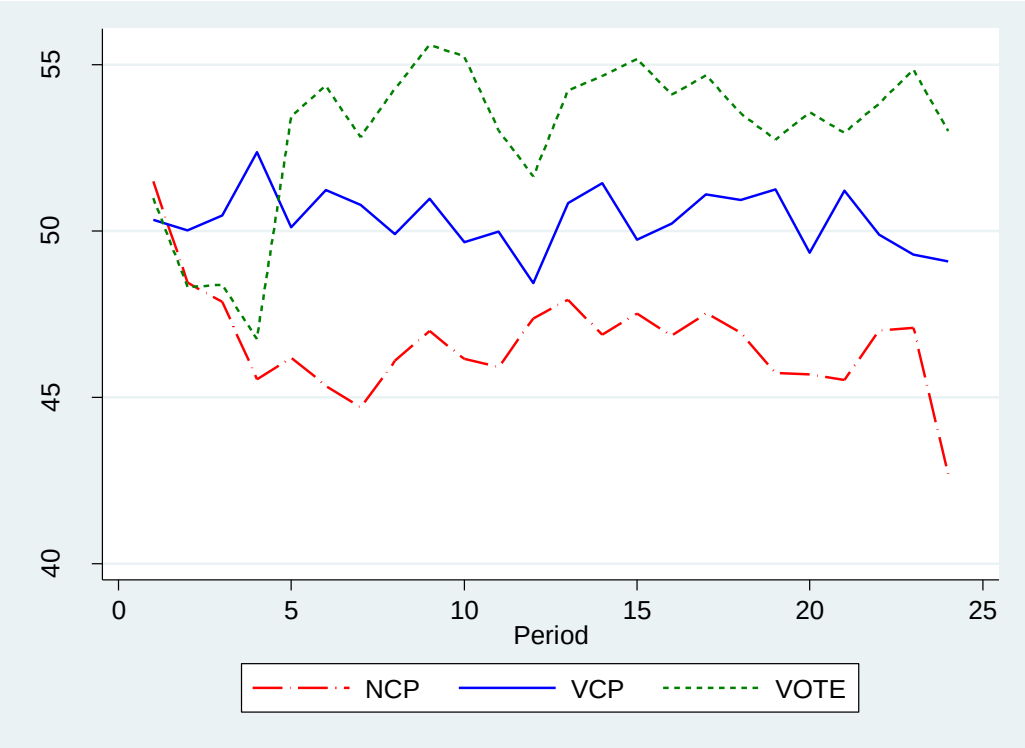


**Figure 6: Average allocations by country and treatment**

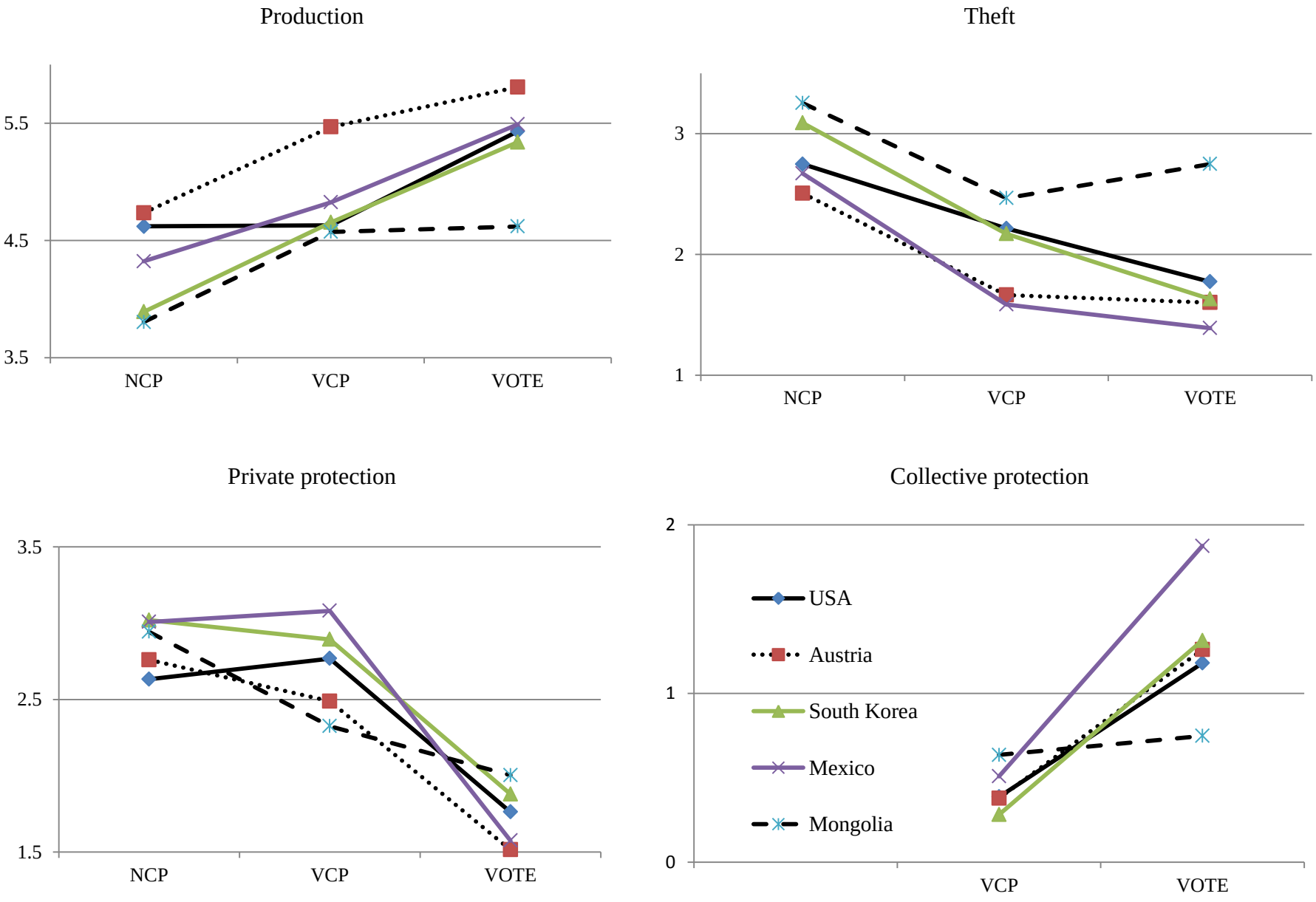


**Figure 7: GDP per capita and earnings of wealth tokens per period**

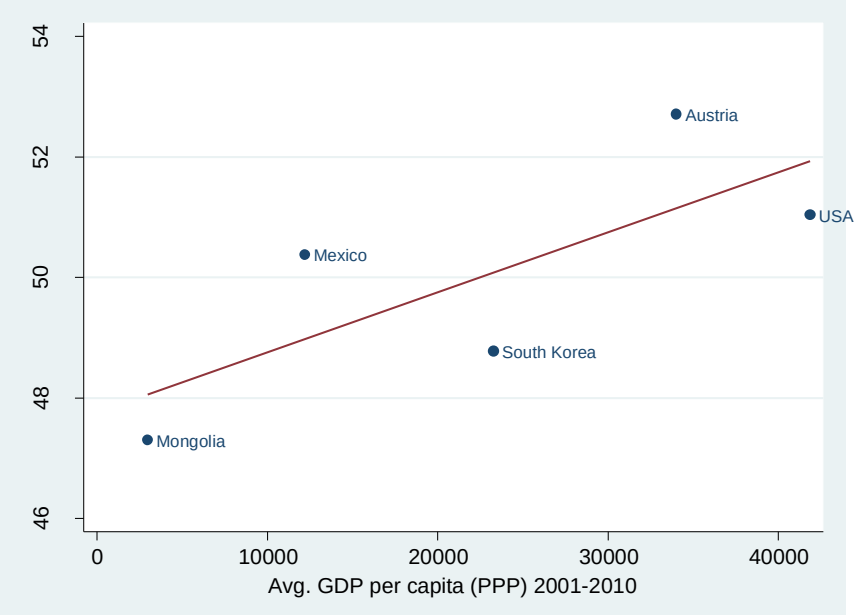
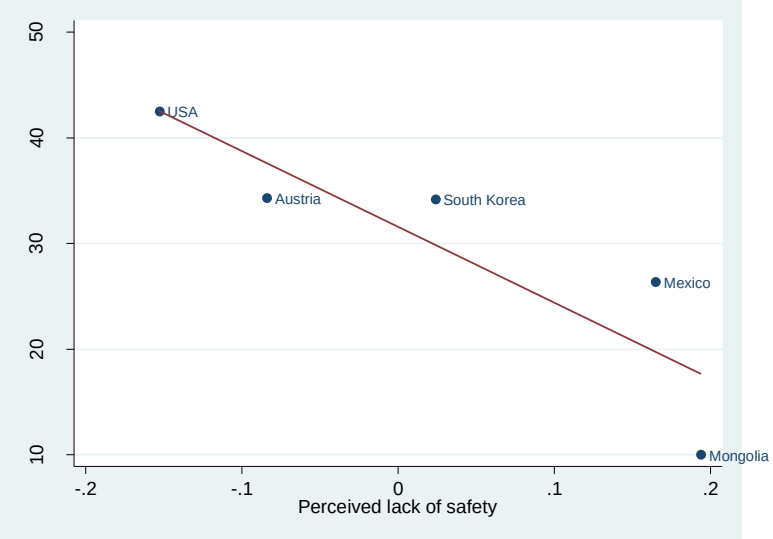



**Figure 8: Perceived lack of safety, trust, and abstaining from theft in period 1**

Panel A




Panel B

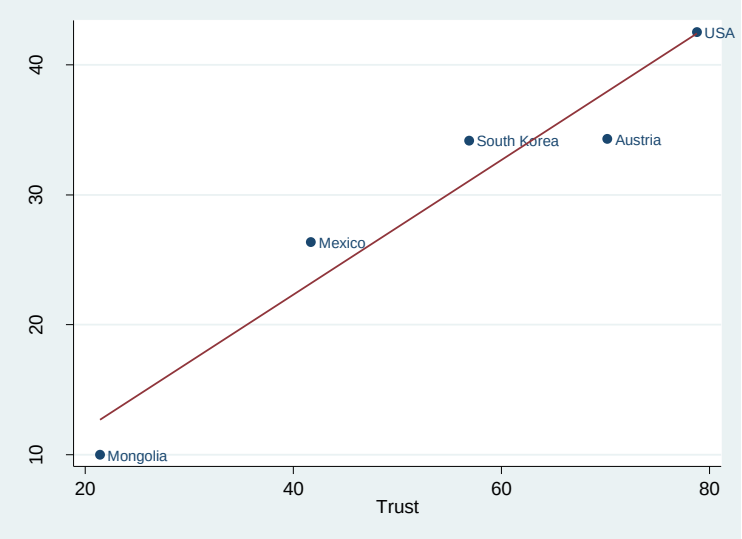
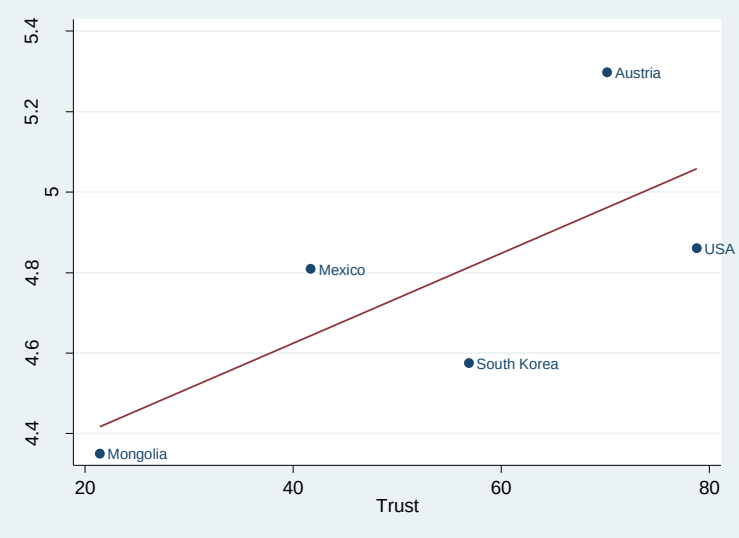


**Figure 9: Trust and production**

All periods




1st period

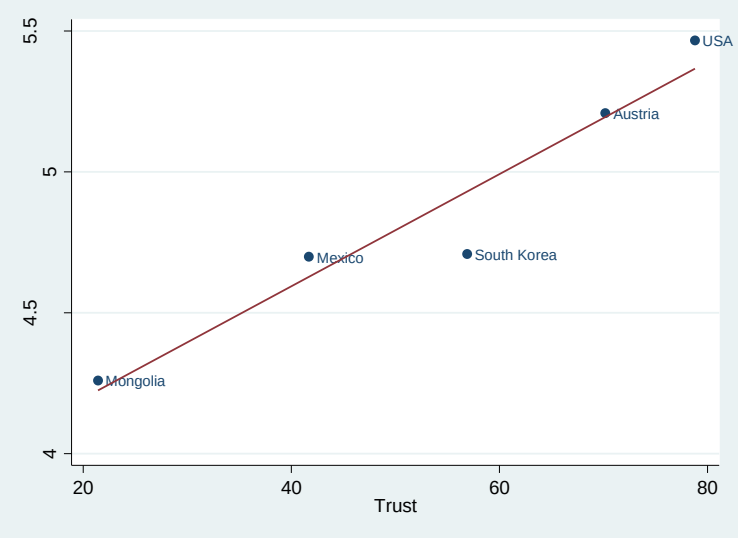
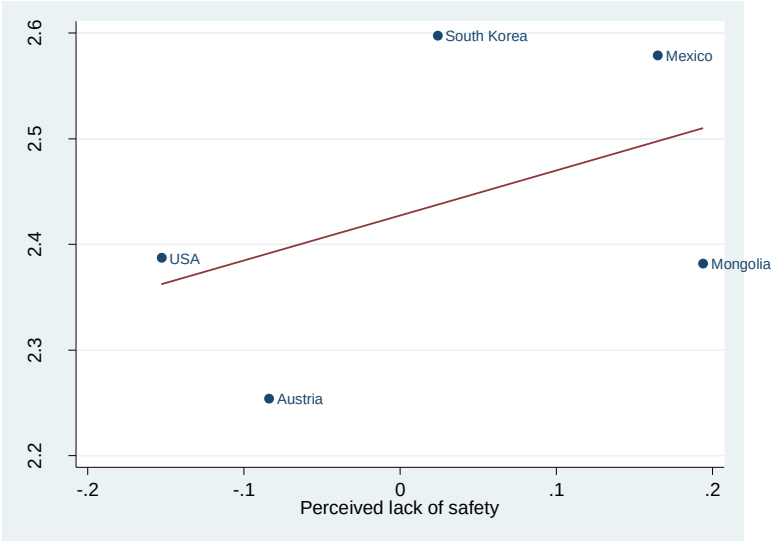



**Figure 10: Perceived lack of safety and private protection**

All periods




1st period

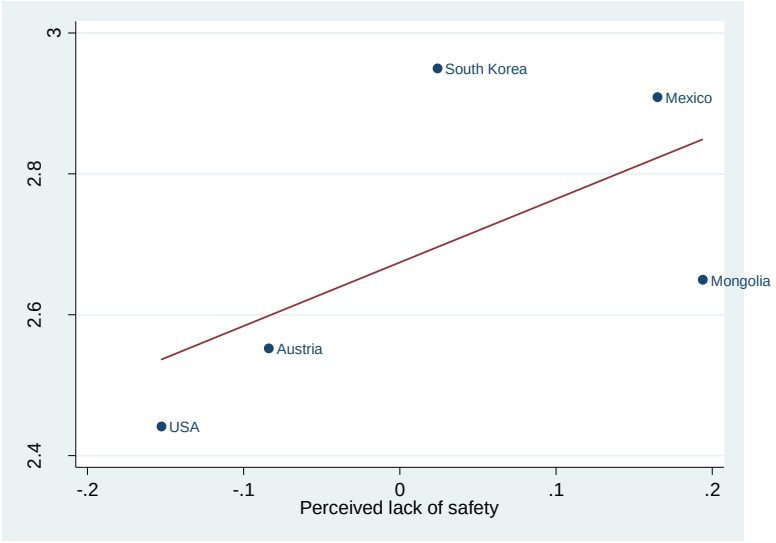
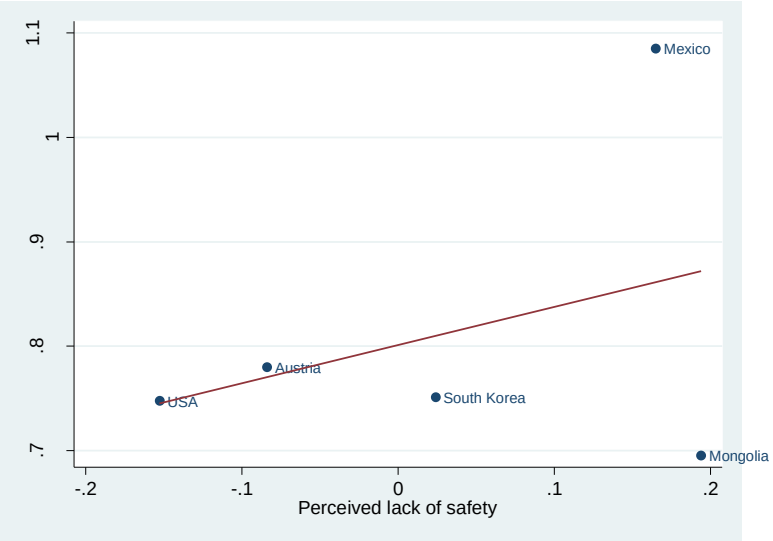


**Figure 11: Perceived lack of safety and collective protection**

All periods




1st period

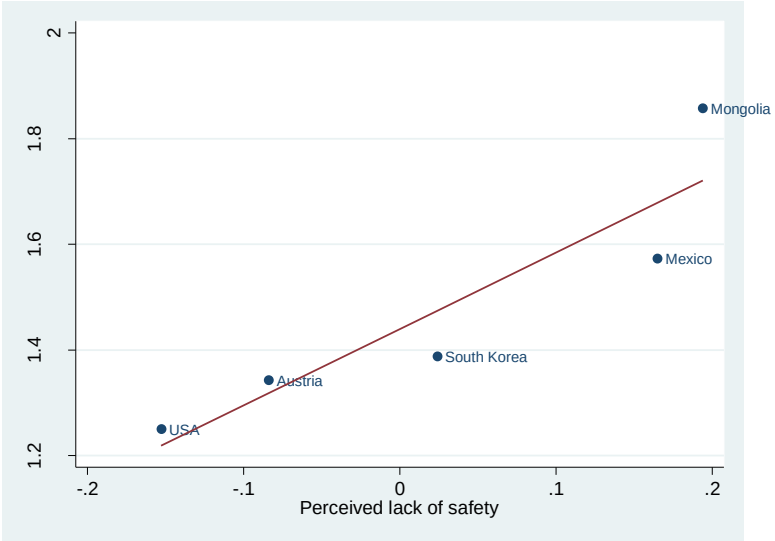


**Figure 12: Governance and share of individual votes for the mandatory scheme**

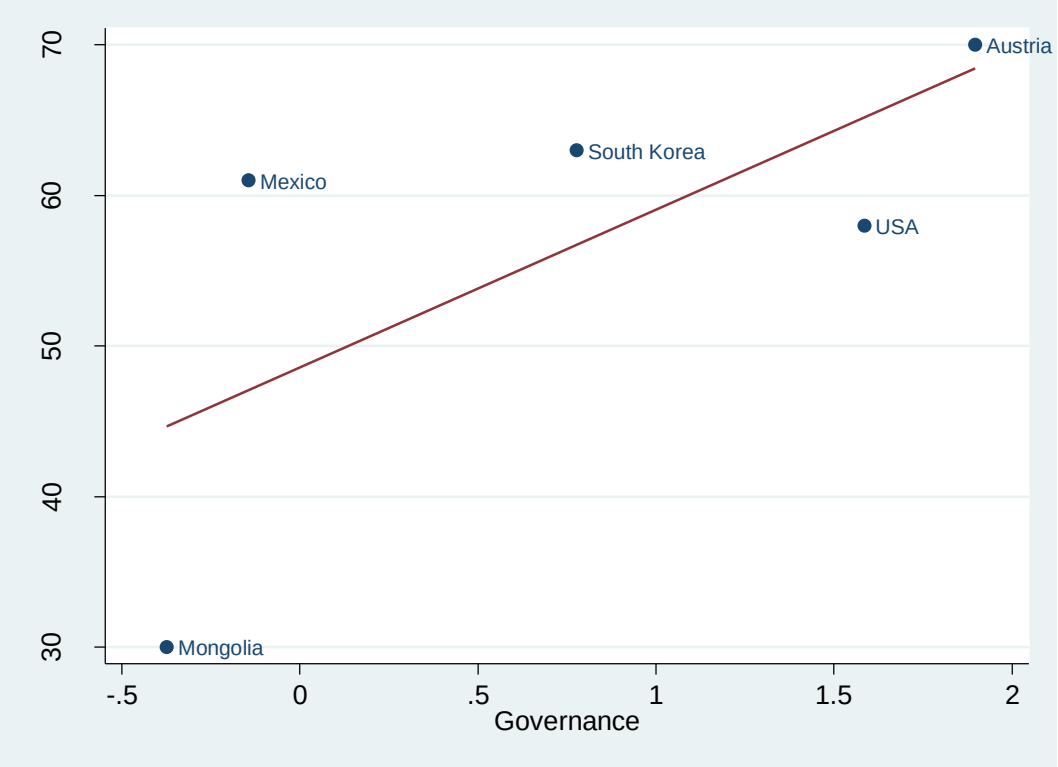



**Table 1: Wealth production schedule**

| # Effort Tokens | # Wealth Tokens Produced |
|---|---|
| 1 | 15 |
| 2 | 28 |
| 3 | 39 |
| 4 | 48 |
| 5 | 55 |
| 6 | 60 |
| 7 | 64 |
| 8 | 67 |
| 9 | 69 |
| 10 | 70 |

**Table 2: Treatments and group (subject) numbers by site**

| Treatment | Description | Number of Groups (Subjects) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Austria | Mexico | Mongolia | South Korea | U.S. | Total |
| **NCP** (No Collective Protection) | Identical period structure with simultaneous allocation of endowments among three activities only. | 7 (35) | 7 (35) | 6 (30) | 8 (40) | 8 (40) | 36 (180) |
| **VCP** (Voluntary Collective Protection) | Identical period structure with stage 1 allocations to collective protection, stage 2 allocations to remaining three activities. | 7 (35) | 8 (40) | 6 (30) | 8 (40) | 8 (40) | 37 (185) |
| **VOTE** | Phase 1 like **NCP**, then vote on independent versus mandatory voted allocations to collective protection at beginning of each of phases 2–6. | 7 (35) | 7 (35) | 8 (40) | 8 (40) | 8 (40) | 38 (190) |
| Total | | 21 (105) | 22 (110) | 20 (100) | 24 (120) | 24 (120) | 111 (555) |

**Table 3: Predicted and actual average behaviors and outcomes by treatment**

| | Production | | Theft | | Private Protection | | Collective Protection | | Earnings | | % of Max. Efficiency Gain | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NCP** | **3** | 4.29 | **7** | 2.85 | **0** | 2.87 | **n.a.** | n.a. | **39** | 46.64 | **0%** | 24.6% |
| **VCP** | **3** | 4.83 | **7** | 2.01 | **0** | 2.74 | **0** | 0.43 | **39** | 50.35 | **0%** | 36.6% |
| **VOTE** | **7** | 5.32 | **0 or 1** | 1.85 | **0** | 1.57 | **2 or 3** | 1.26 | **64** | 53.89 | **80.6%** | 48.0% |
| Voluntary Scheme | **3** | 4.45 | **7** | 2.82 | **0** | 2.35 | **0** | 0.39 | **39** | 48.21 | **0%** | 29.7% |
| Mandatory Scheme | **7** | 5.82 | **0 or 1** | 1.29 | **0** | 1.13 | **2 or 3** | 1.76 | **64** | 57.12 | **80.6%** | 58.5% |

Bold entries are predicted values assuming rational self-interested decision-makers with common knowledge of type. For the **VOTE** treatment, entries refer to phases 2–6 when choice between two methods of contributing to collective protection is available. Earnings are assumed equal to 64 regardless of whether 2 or 3 tokens are mandated to collective protection assuming that slight risk-aversion leads subjects to allocate a seventh token to production rather than theft despite an equal expected return. Percentage of maximum efficiency gain is the fraction of the 31 wealth token difference between earnings predicted in conditions without mandatory collective protection (39) and socially optimal earnings (70).

**Table 4: *p*-values of Mann-Whitney tests of difference in allocations across treatments**

| | **VCP** | **VOTE** |
|---|---|---|
| Collective protection | | |
| **VCP** | - | <.01 |
| Production | | |
| **NCP** | <.01 | <.01 |
| **VCP** | - | <.01 |
| Private protection | | |
| **NCP** | 0.33 | <.01 |
| **VCP** | - | <.01 |
| Theft | | |
| **NCP** | <.01 | <.01 |
| **VCP** | - | 0.28 |
| Earnings per period | | |
| **NCP** | <.01 | <.01 |
| **VCP** | - | <.01 |

For the **VOTE** treatment, only results from phases 2–6, when choice between two methods of contributing to collective protection is available, are taken into account.

**Table 5: Kruskal-Wallis tests of difference in allocations across countries**

| | $\chi^2(4)$ adjusted for ties | *p*-value |
|---|---|---|
| **Panel A: NCP** | | |
| Production | 12.57 | 0.01 |
| Private protection | 2.43 | 0.66 |
| Theft | 4.63 | 0.33 |
| Earnings per period | 12.10 | 0.02 |
| **Panel B: VCP** | | |
| Collective protection | 5.32 | 0.26 |
| Production | 8.44 | 0.08 |
| Private protection | 6.29 | 0.18 |
| Theft | 7.20 | 0.13 |
| Earnings per period | 5.46 | 0.24 |
| **Panel C: VOTE (phases 2-6)** | | |
| **(i) Institutional preferences** | | |
| Support for mandatory scheme | 13.69 | 0.01 |
| Selection of mandatory scheme | 10.62 | 0.03 |
| **(ii) Under mandatory scheme** | | |
| Support for mandatory scheme (next vote) | 4.24 | 0.37 |
| Collective protection | 5.70 | 0.22 |
| Production | 6.42 | 0.17 |
| Private protection | 7.52 | 0.11 |
| Theft | 5.20 | 0.27 |
| Earnings per period | 5.67 | 0.23 |
| **(iii) Under independent contributions** | | |
| Support for mandatory scheme (next vote) | 14.66 | 0.01 |
| Collective protection | 9.49 | 0.05 |
| Production | 1.05 | 0.90 |
| Private protection | 9.56 | 0.05 |
| Theft | 3.41 | 0.49 |
| Earnings per period | 2.28 | 0.69 |

**Table 6: Adoption of mandatory or voluntary contribution schemes in VOTE**

| | Number of groups adopting the mandatory scheme/Number of groups adopting voluntary contribution scheme | | | | |
|---|---|---|---|---|---|
| | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 |
| Austria | 4/3 | 5/2 | 6/1 | 7/0 | 6/1 |
| Mexico | 5/2 | 6/1 | 6/1 | 6/1 | 6/1 |
| Mongolia | 1/7 | 4/4 | 1/7 | 1/7 | 2/6 |
| South Korea | 7/1 | 6/2 | 7/1 | 5/3 | 5/3 |
| U.S.A. | 3/5 | 5/3 | 6/2 | 5/3 | 6/2 |