Pork Versus Public Goods Provision: An Experiment Within a Legislative Bargaining Setting*

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Abstract

This paper provides a direct experimental test of the recent theory of legislators' incentives to produce particolaristic and collective goods from a fixed budget. Depending on the relative value of private and public goods in the utility function, the experiments confirm that the equilibrium accepted proposals of budget shares either determine allocations of only private goods and only to minimum winning coalitions, or else, for higher values of the public good, allocations where the private good is only allocated (and in small proportions) to the proposer. In contrast with the non-monotonicity result in the theory, however, The share of the budget devoted to private goods (for the proposer) is decreasing in the relative value of the public good.

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1 Introduction

For the most part, legislative bargaining theory has focused on distributive politics or on policy decisions. Only recently there has been an important effort to model legislators' incentives to provide public goods when the alternative use of the budget is its division in particularistic goods.[1] Lizzeri and Persico (2001) capture some of the tradeoffs between public good and private good platforms in electoral competition, but assume that legislators produce either only public goods or exclusively redistributive goods, and that elected politicians can commit to produce one or the other before the election. The recent paper by Volden and Wiseman (2006) model a bargaining game where legislators can agree on any division of the budget between particularistic and collective good spending. Hence this is the benchmark model that we will use for our experimental analysis.[2]

The motivation behind previous experimental work on legislative bargaining in purely distributive settings has been to test whether indeed subjects could follow the logic of subgame perfection, to measure the bargaining power of the agenda setter, and to determine whether or not Riker's minimum-winning-coalition view of coalition formation is confirmed. Adding the possibility for subjects to propose different combinations of private and public goods introduces a number of new behavioral questions that we consider interesting: Given that public good offers are by definition to everyone, can agents be biased in favor of the public good with respect to the theoretical predictions for equity reasons? Can the proposer's power, on the other hand, actually increase in the presence of the posibility of public goods in some situations? What happens to the proposed combinations of private and public goods when the relative value of the public good in the utility function goes down? The interesting issue related to this last question is that when the relative value of the public good in the utility function goes down there is a reduction of the total utility to share as well as a change in the *marginal rate of substitution* between private and public goods, and these income and substitution effects could play in different ways in the proposers' decision making.

Description of design, the treatments, the results, the intuition behind the different comparative statics, and the relationship with other results on public

[1] There had been a line of research incorporating collective and particularistic aspects (e. g., Austen- Smith and Banks 1988, Crombez 1996, Banks and Duggan 2000, Baron and Diermeier 2001, Jackson and Moselle 2002, Morelli 1999), but those models did not capture the explicit tradeoffs ensuing from the fact that private and public good spending decisions are alternative uses of *the same* fixed budget.

[2] Snyder and Tripathy (20??) and Battaglini and Coate (2006) also contain interesting predictions about legislative bargaining on multi-policy decision making. However, Snyder and Tripathy (20??) does not present any additional theoretical prediction to the ones we consider here that would be worth, in our opinion, to test in the lab; and Battaglini and Coate's paper is focusing mostly on dynamic issues, whereas we want to focus the analysis on static forces. More precisely, Battaglini and Coate describe the path of *endogenous* budgets, both in the sense that the choices of time t affect the feasibility of choices at time $t+1$, and because the determination of tax revenue is part of the model.

good provision or bargaining in the experimental literature.

2 Model

In this section we describe the model of Volden and Wiseman (2006), in the form that we will directly test in the laboratory.

Consider a legislature of N politicians, representing different legislative districts, who have to make a collective decision on how to allocate a fixed budget between a public good and private goods (pork barrell projects). Let N be an odd number. Denoting by y the share of the budget allocated to the public good and by x the N-dimensional vector of private good shares allocated to the N legislators ($y + \sum_{i=1}^{N} x_i \leq 1$), the utility function of each legislator is given by

$$U_i(x, y) = \alpha x_i + (1 - \alpha) y q$$

where $\alpha \in [0, 1]$ is the relative weight of private goods in the utility function and q represents the absolute value (or return) of spending a dollar in public good production. Each legislator has the same probability of being selected by Nature as the proposer of a division of the (unitary) budget. If at least $(N - 1)/2$ responders accept the proposal the budget is divided according to the proposal. If the majority rejects, another random proposer is selected, and the budget shrinks using the discount factor δ. The status quo is no division of the budget. The bargaining game is therefore a straightforward extension of the (closed rule) infinite horizon bargaining game of Baron and Ferejohn (1989) to a budget division involving two dimensions - public goods and particularistic goods. The solution concept is therefore stationary subgame perfection.

The model predicts that, fixing q, for low values of α only the public good should be supplied. At the other extreme, for high values of α only the private goods should be offered, in which case only a minimum winning coalition (MWC) should receive positive shares. For intermediate values of α the public good is supplied and the proposer also takes some private benefits for himself, but does not offer any private benefits to anyone else. The lower bound on the mixed region is given by

$$\alpha_{CM} = \frac{q}{1 + q}.$$

The upper bound on the mixed region depends on more parameters, it is

$$\alpha_{MP} = \frac{qN^2(1 - \delta) + qN(1 + \delta)}{qN^2(1 - \delta) + N(2 + q + \delta q - \delta) + \delta}.$$

In the mixed region, as α increases, the proposer *decreases* the amount of resources he takes for himself in terms of private benefits. In other words, the theory predicts a *non monotonic* relationship between the value of the public good and the private good kept by the proposer: as the value of public good decreases (higher α), the private good share for the proposer is first zero, then jumps up, then decreases, and then jumps up again when the value of α becomes so high that no public good is offered anymore. When α is so high that only private goods are offered, the share going to the proposer is predicted to remain constant.

The intuition behind the comparative static result just described for the intermediate region is as follows: when α goes up the payoff for the responders goes down if the offer is the same as the one before α changed; hence, the proposer increases y in order to partially compensate for this, as this is needed for the proposal to be accepted. The offer of any proposer in equilibrium is always predicted to be "just enough" to get the responders to accept it. Thus the comparative static result just described is determined by the effect of a change in α on the responders' margin of acceptance/rejection.[3]

If we believe instead that the proposers don't try to compute the offer that makes the responders just indifferent, then the main effect of a change in α or q may be perceived to be the effect on the proposer's payoff conditional on acceptance, rather than the effect on the probability of acceptance. Taking this idea to its extreme, the alternative hypothesis is that when α goes up in the mixed region, the proposer will skim *more* for himself, because this has a direct, and relatively large, effect on his payoff conditional on acceptance, whereas the effect on the probability of acceptance is of second order importance (or perceived to be small) by proposers who don't think they were making an offer on the margin of acceptable offers.

The higher relative value of private good goes together with a lower total utility to share, so it is like a negative income shock. This negative shock has a direct income effect through the reduction of the value of the big share previously allocated to public goods, hence if the proposer only thinks of his portfolio without thinking much about the risks the income effect alone pushes the skimming to go up. But the alternating offer theory suggests the opposite because in that theory the proposer computes the continuation value and substitutes away from private good skimming in order to make the responders no worse off after the income shock, in order to avoid having the offer rejected.

To formalize briefly the different effects of a change in α on the reduced form decision problem of a selfish proposer, observe that the proposer i wants to maximize $P_i(U(x_i, y)) * U_i(x_i, y)$, where U represents the vector of utilities for every player, which enters the subjective probability of acceptance function (P_i)in multiple ways, given that for each responder both the absolute and the relative payoffs may matter. When x_i increases P_i must (weakly) go down, with potential discontinuities only at the point where the share $1 - x_i$ switches from being public to being private. For low values of α, both dP_i/dx_i and dU_i/dx_i are negative (and the first close to zero even as subjective belief), hence corner solution $x_i = 0$. At α_{cm}, dU_i becomes positive. As α keeps increasing the interior solution is *increasing*, in contrast with the game theoretic prediction, if the elasticity of the probability of acceptance to a change in x_i is perceived

[3] Also the theoretical prediction that the equilibrium public offer y is decreasing in q comes from the same effect on the margin of acceptance.

to be low when computed at low values of x_i.[4] To see this intuitively, note that at $\alpha_{CM} + \epsilon$ (with ϵ very small) the chosen x_i must be quite small, given that the proposer is almost indifferent among all values of x_i; when α jumps up by a non-negligeable amount, on the other hand, the impact on U_i of a higher x_i can be significant, whereas intuitively the jump down in the probability of acceptance should be very small, since the starting and ending point in terms of utility difference is still below, for example, the utility difference between proposer and responders that is observed in the pure private case, which can serve as a benchmark of the utility difference that is considered *tolerable* by responders.

So one of the goals of our experiment will be to contrast the game theoretic effects (like the explicit consideration of the backward induction logic) with the simple decision theoretic effects just mentioned, testing the comparative statics predictions of the game theoretic model .

Another thing that we could verify in the experiment is the efficiency consequences of the deviations from the predicted behavior. The prediction is that when proposer i chooses $y = 0$ then $x_j = 2(1 - x_i)/(N - 1)$ for any j in a randomly chosen set of *relevant* $(N - 1)/2$ other members of the MWC. So, think of the decision of the proposer simply as a decision of (1) some x_i for himself, and (2) a binary choice between using $1 - x_i$ share for public or private offer. More formally, the strategy of proposer i is a pair (x_i, s), with $x_i \in [0, 1]$ and $s \in \{m, g\}$, where $s = m$ means that i chose to use $1 - x_i$ for private good shares (money) and $s = g$ means that he chose to devote $1 - x_i$ to the public good. The cutoff point $\alpha^+ \equiv \frac{q(N-1)}{q(N-1)+2}$ is the one above which, for any given x_i chosen by the proposer, $U_j(x_i, m) \geq U_j(x_i, g) \;\; \forall j : x_j > 0$, i.e., the utility of any responder is higher when receiving a private good offer than when receiving a public good offer.[5] Conditional on acceptance, the utility of a proposer who chose x_i is *always* higher with a public good offer. Thus:

Remark 1 *For any $\alpha < \alpha^+$ it is always* efficient *to offer the public good for every x_i.*

However, the probability of acceptance may also depend on the utility difference, and such a utility difference does depend on x_i in both cases, and is higher with a public good offer for many values of $x_i > 0$. Thus, for any $\alpha \leq \alpha^+$ a proposer may choose to offer private goods together with a value of x_i even though inefficient when the probability of acceptance is very sensitive to utility differences. On the other hand, for $\alpha > \alpha^+$ there is a conflict of interests

[4] Proof: FOC: $\frac{-\frac{\partial P_i}{\partial x_i}}{P_i} U_i(x_i) = (\alpha + \alpha q - q)$; when α increases the RHS goes up, and hence if the elasticity is not that high equality can be re-obtained only if U_i goes up, hence x_i has to go up.

[5] In fact, it is the threshold solving

$$2\alpha(1 - x_i)/(N - 1) = (1 - \alpha)(1 - x_i)q.$$

	Public Good	Proposer		2^{nd} Highest	Lowest
	y	Private Allocation	Payoff	Payoff	Payoff
$\alpha = 0.3$	1	0	$24.50	$24.50	$24.50
$\alpha = 0.45$	0.483	0.517	$20.95	$9.30	$9.30
$\alpha = 0.55$	0.583	0.417	$20.65	$9.20	$9.20
$\alpha = 0.75$	0	0.68	$25.5	$6.00	0

Table 1: Theoretical Predictions

between proposer and responder in terms of private vs. public offer, hence the notion of efficiency is itself potentially ambiguous. But roughly speaking the type of inefficiency could be the opposite: the fact that for a given x_i the responders prefer a private good for $\alpha > \alpha^+$ may make the private good offer the efficient one, but the proposer may still offer the public good if the sensitivity of the acceptance probability is perceived to be low enough, and hence lower than the benefit conditional on acceptance. Thus the inefficiency could be of *too much* public good if the perceived sensitivity of the probability function is very low or *too little public good* if the sensitivity is perceived to be very high.

3 Experimental Design

Each experimental session used a legislature/committee comprised of 5 subjects ($n = 5$), with the value of the public good (q) always $q = 0.7$, and the discount factor $\delta = 0.8$. Thus the range for the mixed region is given by $[\alpha_{CM}, \alpha_{MP}) = [0.41176, 0.59036)$. The different values of α used in experimental treatments were 0.3, 0.45, 0.55, and 0.75. Table 1 gives the equilibrium predictions for each value of α used in the experiment assuming that proposals are passed without delay. The share of tokens devoted to the public good is reported along with the share going to the proposer. Dollar payoffs convert these shares into players' payoffs with the last two columns representing shares to responders. Note that except for the case of pure private goods, shares to responders represent only payoffs from the public good. For the case of pure private goods we assume a minimum winning coalition (MWC).[6]

Between 10 and 20 subjects were recruited for each experimental session, so that there would be a minimum 2 bargaining rounds conducted simultaneously in each session ad a maximum of 4.[7] After each bargaining round, subjects were randomly re-matched in groups. Subject numbers also changed randomly between bargaining rounds (but not between the stages within a given bargaining round).

Procedures for each bargaining round were as follows: First all subjects

[6] To be clarified: We have to give $$ amts in the table along with share of tokens.

[7] Our intention was to have a minimum of 15 subjects in each session, but if enough extras showed up to run to be able to run with four bargaining groups we were prepared to do so. Two sessions fell short of the desired 15 subjects, so were run with 10 subjects each (see Table xx below).

entered a proposal (on how to allocate the 50 tokens). Then one proposal was picked randomly to be the standing proposal. This proposal was posted on subjects' screens giving the token amounts allocated to each subject along with the dollar shares implied by the givne allocation. Proposals were voted up or down, with no opportunity for amendment. If a simple majority accepted the proposal the payoff was implemented and the bargaining round ended. If the proposal was rejected, the process repeated itself (hence initiating a new stage of the same bargaining round). Complete voting results were posted on subjects' screens, giving the dollar amount allocated by subject number along with the tokens allocated to the public good, whether that subject voted for or against the proposal, and whether the proposal passed or not.[8]

A total of 8 sessions, all with inexperienced subjects, were conducted. Table xx lists the values of α along with the number of subjects in each session. Sessions 1-6 all employed 12 bargaining rounds, with one of the rounds, selected at random, to be paid off on.[9] Sessions 7 and 8 employed a cross-over design with an initial set of 12 bargaining rounds with values of α equal to .45 and .55 in sessions 7 and 8, respectively. These were followed by another 8 bargaining rounds in which the value of α was changed from .45 to .55 in session 7 and from .55 to .45 in session 8. These cross-over sessions were conducted as the between session results from sessions 3 and 4 failed to show the predicted increase in the share of tokens allocated to the public good. These cross-over sessions were employed to enable us to use own subject control to test this sensitive comparative static prediction of the model in the mixed public and private good region, and to provide subjects with the most striking contrast in terms of their own payoffs for the failure to increase (decrease) the public good allocation along with the increase (decrease) in α that the theory predicts. In both of these sessions, subjects were paid on the basis of one random draw from each of the two sets of bargaining rounds. However, these draws were made only *after* both sets of bargaining rounds had been completed, while the planned cross-over in the value α, along with the extra set of 8 bargaining rounds, was only announced at the end of the first set of 12 bargaining rounds.[10]

Subjects were recruited through e-mail solicitations from students enrolled in economics classes at the Ohio State University. This resulted in recruiting a broad cross-section of undergraduates and an occasional graduate student. All subjects received a participation fee of $8 along with whatever montary allocation they obtained from the randomly selected bargaining rounds. Sessions lasted between an hour and fifteen minutes and an hour and forty five minutes.

[8] Screens also displayed the proposed shares and votes for the last three bargaining rounds as well as the proposed shares and votes for up to the past three stages of the current bargaining round. Other general information such as the number of votes required for a proposal to be accepted were also displayed.

[9] These cash bargaining rounds were preceded by a bargaining round in which subjects were "walked through" the various contingencies resulting from, for example, accepting or rejecting offers.

[10] That is, instructions for the first 12 bargaining rounds were in all respects the same as the instructions for the corresponding sessions without the change in the value of α.

	Number of Subjects Offered Private Allocations					
	0	1	2	3	4	5
$\alpha = 0.3$	**0.73**	0.01	0.00	0.08	0.03	0.15
$\alpha = 0.45$	0.55	**0.30**	0.01	0.04	0.01	0.09
$\alpha = 0.55$	0.37	**0.39**	0.01	0.09	0.04	0.10
$\alpha = 0.75$	0.03	0.01	0.00	**0.65**	0.04	0.26
	Periods 10 and Above					
$\alpha = 0.3$	**0.75**	0.03	0.00	0.08	0.03	0.12
$\alpha = 0.45$	0.57	**0.36**	0.01	0.02	0.00	0.05
$\alpha = 0.55$	0.36	**0.51**	0.01	0.06	0.01	0.05
$\alpha = 0.75$	0.05	0.02	0.00	**0.76**	0.02	0.15

Equilibrium Type Offers are in Bold.

Table 2: Number of Subjects Allocated Private Benefits (Frequencies)

4 Results

The first encouraging result for the theory is that most bargaining rounds have only 1 stage. More specifically, 89% of bargaining rounds end in stage 1, 10% in stage 2, and 1% in stage 3. The number of rounds ending in stage 1 increases to 92% for the periods 10 and above.

Conclusion 2 *The vast majority of bargaining rounds ends in stage 1 as the theory predicts, with only 1% of all bargaining rounds extending beyond sstage 2.*

The number of subjects included in proposals is reported in Table 2.[11] For 3 of the 4 values of α the modal offer yields private benefits to as many subjects as the equilibrium predicts. The exception is for $\alpha = .45$ where the modal proposal involves all public goods. Similarly with $\alpha = .55$, there is a large cluster of all public good offers: 37% of all such proposals versus the 39% where the proposer takes something extra for himself with all public goods to others (as the theory predicts). That is, in both cases there are way too many allocations of the more efficient, all public goods, option. However, in both cases when private benefits are provided in addition to public goods, the frequency with which the proposer skims benefits for only himself clearly dominates. Experience tends to move behavior closer to the predicted outcome for all values of α as there are more equilibrium type proposals after period 9 for all treatments.[12]

Two other factors are worth pointing out in Table 2. First the frequency of MWCs in the $\alpha = 0.75$ treatment (offering private benefits to 3 subjects) is very similar to results from prior experiments on multilateral bargaining with

[11] Table 7 in the appendix separates the different conditions by treatment.

[12] For the cross-over sessions we include data for all 8 bargaining round after the change in α when characterizing experienced play (periods 10 and above). We do so on the grounds that subjects are already quite familiar with the structure of the game. Results for experienced play are robust to limiting the cross-over data to the last 3 bargaining periods as well.

	All Rounds	Rounds >9
$\alpha = 0.3$	0.910	0.953
$\alpha = 0.45$	0.915	0.939
$\alpha = 0.55$	0.832	0.866
$\alpha = 0.75$	0.104	0.069

Table 3: Average Proposed Provision of Public Good

only particularistic goods. For instance FKM (2005a) report between 61% and 90% MWCs, depending on the treatment, with committees/legislatures of 3 subjects, and FKM (2005b) report between 63% and 83% MWCs, depending on the treatment, with committees/legislatures of 5 subjects.

Second, the $\alpha = 0.3$ condition reveals some inefficiencies in choices as 25% of all proposals involve some private allocations. In that treatment, not only is this not equilibrium behavior, it is dominated by allocating to all public goods. However, as we will see below, these misallocations are relatively small in magnitude as the average share of tokens allocated to the public good in this treatment is 91.0% over all periods (95.3% for periods 10 and above).[13] The appendix contains an equivalent table that only applies to accepted offers.

Conclusion 3 *The modal offer yields benefits to as many subjects as the theory predicts for 3 out of 4 values of α. The exception is for $\alpha = .45$ where the modal offer involves all public goods. There is a much higher frequency of all public good offers than the theory predicts in the mixed public and private goods region, but when private benefits are offered in the mixed public and private region, they typically go only to the proposer as the theory predicts.*

Table 3 gives the average proposed share of tokens allocated to public goods by treatment.[14] Averaged over all bargaining rounds slightly less tokens are allocated to the public good with $\alpha = 0.3$ than with $\alpha = 0.45$, contrary to the theory's prediction. However, this difference is not statistically significant (ranksum test p-value > 0.1 using subject averages as the unit of observation). This situation is reversed for later bargaining rounds (10 and above), but the difference is still not statistically significant. All of the other differences are statistically significant. In particular there is a statistically significant *decrease* in the level of public goods allocation with $\alpha = 0.55$ versus $\alpha = 0.45$, contrary to what the theory predicts.[15] This difference, although relatively small is quite

[13] This misallocation is similar to the finance literature finding that when offered a variety of 401K retirement options people tend to allocate money equally to all the options, including money market funds, even though the latter are clearly dominated. **(reference needed).** The *relative* magnitude of the misallocation here is not nearly as large as in the retirement fund case.

[14] Average accepted shares are quite similar to proposed shares.

[15] This is established two ways, both using subject averages as the unit of observation. One way is using the ranksum test for all rounds except those after round 12. The other is using the Wilcoxon matched-pairs signed-ranks test using data from the cross-over sessions. In both cases we can reject a null hypothesis of no difference in favor of a smaller allocation with $\alpha = .55$ at the 0.01 level or better.

robust. For example suppose that we drop all the subjects who always propose only public goods ($y = 1$) with $\alpha = .45$ on the grounds that they are simply miscalibrated as this can bias the average allocation against what the theory predicts.[16] Then looking at the cross-over sessions, the average share of the budget allocated to public goods for all proposals for all rounds is .88 with $\alpha = .45$ versus .77 with $\alpha = .55$, and .89 versus .83 looking at later rounds (rounds 10 or more), with both these differences statistically significant at the .02 level using subject averages as the unit of observation.

The flip side of this, is that if we look at the share of the private goods that proposers allocate to themselves, conditional on only proposing a private share for themselves, as the theory predicts, the average private share (for accepted offers) goes from 0.098 to 0.138 for $\alpha = .45$ versus $\alpha = .55$ (p-value < 0.05 for the ranksum test excluding observations after the cross over and p-value < 0.1 for the Wilcoxon matched-pairs signed-ranks test using data from the cross over treatments). This doesn't go away over time either; looking at the later bargaining rounds (10 and higher) shares are .101 and 0.148, so that the difference is even greater, and still in the wrong direction (however there aren't enough observations in this case to establish statistical significance).

Conclusion 4 *Public good provision decreases monotonically between broad treatment categories - only public goods, mixed public and private goods, and only private goods - as the theory predicts. However, public goods provision decreases* also within *the mixed public and private region going from $\alpha = .45$ to $\alpha = .55$ contrary to the model's non-monotonic prediction.*

Table 4 shows the returns on accepted offers of different types. The row labeled "Private to Proposer" shows the share of tokens allocated to the proposer, with the row labeled "Public" shows the share of tokens allocated to the public good. These data are computed over all allocations, whether completed in stage 1 or later. The row labeled "Payoff to Proposer" gives the dollar payoffs to the proposer for the different possible allocations, assuming the proposal passes in round 1. Thus, for example, with $\alpha = .75$ allocating private shares to three subjects yields \$15.70 on average for accepted proposals, almost twice as much to the proposer as an allocation with all public goods, and close to 50% more than proposals with private benefits allocated to more than 4 subjects. For both $\alpha = 0.45$ and $\alpha = 0.55$ the situation where the proposer takes some private good for himself is the one with the highest return to the proposer. But in the case of $\alpha = 0.45$ it is followed very closely by the option of only offering the public good.

Table xx gives the frequency with which each proposal type passes given that it has been voted on. For all values of α proposals with all public goods *always* pass, and typically pass unanimously. In the mixed public and private good region proposals in which only the proposer gets a private share pass around 90% of the time for both values of α. Not surprisingly, those proposals that

[16] This accounts for 9 out of 25 subjects for all rounds and 11 out of 25 for rounds 10 or more.

	Number of Subjects Offered Private Allocations:					
	0	1	2	3	4	5
$\alpha = 0.3$						
Private to Proposer	0.000	0.020		0.106	0.100	0.053
Public	1.000	0.980		0.696	0.800	0.750
Payoff to Proposer	$24.5	$24.3		$19.2	$21.1	$18.8
$\alpha = 0.45$						
Private to Proposer	0.000	0.098		0.173	0.080	0.061
Public	1.000	0.902		0.645	0.800	0.839
Payoff to Proposer	$19.3	$19.6		$16.3	$17.2	$17.6
$\alpha = 0.55$						
Private to Proposer	0.000	0.138	0.080	0.144	0.100	0.080
Public	1.000	0.856	0.900	0.668	0.700	0.793
Payoff to Proposer	$15.8	$17.2	$16.4	$14.5	$13.8	$14.3
$\alpha = 0.75$						
Private to Proposer	0.000			0.400	0.270	0.248
Public	1.000			0.040	0.170	0.175
Payoff to Proposer	$8.8			$15.7	$11.6	$11.05

Payoff to Proposer assumes allocation in stage 1..

Table 4: Approved Allocations Conditional on Shares Distributed

fail to pass typically involve the proposer allocating a larger share to themselves (see Table 5 below as well).[17] Thus, payoff wise equilibrium type proposals that pass for $\alpha = .45$ (where the proposer takes a share for himself and otherwise provides only public goods) yield little more ($0.30 on average) for the proposer than a proposal with only public goods. While taking much more than this ups the rejection rate. As such the high frequency of all public good allocations is not surprising with $\alpha = .45$. In contrast, in terms of payoffs, proposers do better with equilibrium type proposals with $\alpha = .55$ compared to a proposal with all public goods, earning $1.40 more on average, consistent with the higher frequency of equilibrium type proposals in this case. Here too proposers who take much more than this for themselves (no less taking the SSPE share) find their proposals being rejected.

Note that with $\alpha = .75$ proposals which involve essentially MWCs are approved at the rate of 87.8% so that even though the proposer does not take the very large shares predicted under the SSPE these proposals clearly dominate what proposers got on average for an all public good allocation or a private allocation with shares for everyone. Further, in this case the average difference in payoffs between proposers and their coalition partners in MWCs is over $4.00, well above what we see in the mixed region, where such difference would be likely to be rejected, even though mean coalition members payoffs are lower with $\alpha = .75$ than with equilibrium type proposals in the mixed public and pri-

[17] An average proposer share of 0.165 for the two proposals that fail to pass for $\alpha = .45$ and 0.230 for the five proposals of this type that fail for $\alpha = .55$.

	$\alpha = 0.3$	$\alpha = 0.45$	$\alpha = 0.55$	$\alpha = 0.75$
Payoff	62.326***	11.720	27.174***	21.380***
	(22.459)	(11.616)	(7.489)	(2.052)
Public Tokens	-27.826**	7.898*	3.644*	-0.415
	(12.026)	(4.450)	(2.050)	(0.459)
Payoff to the Proposer	12.021	-22.558***	-17.003***	-0.425
	(8.958)	(7.795)	(4.639)	(1.387)
Constant	-6.781***	-0.365	-3.396***	-2.665***
	(2.173)	(2.171)	(1.255)	(0.587)
ρ	$0.235^{\S\S}$	$0.598^{\S\S\S}$	$0.553^{\S\S\S}$	0.000
	(0.134)	(0.114)	(0.118)	(0.000)
Observations	240	336	400	336
Number of subjects	25	40	45	35

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
§ significant at 10%; §§ significant at 5%; §§§ significant at 1% using a likelihood ratio test

Table 5: Random Effects probit Estimates of the Determinants of Vote

vate region. Part of the reason for this likely has to do with the fact that if you are a member of the MWC, to reject such an offer exposes you to the distinct possibility of being left out of the MWC in the next round, whereas this is quite unlikely to happen in the mixed region. Hence, a greater tolerance for income inequality within the MWCs of equilibrium type proposals with $\alpha = .75$.

Conclusion 5 *All public good allocations are always approved for all values of α. The relatively higher frequency of all public good allocations as opposed to equilibrium type allocations with $\alpha = .45$ versus $\alpha = .55$ is associated with a relatively higher rate of return to proposers for equilibrium type (versus all public good) allocations with $\alpha = .55$. Relatively higher payoffs for proposers seem to be better tolerated with $\alpha = .55$ versus $\alpha = .45$. Private good allocations with MWCs for $\alpha = .75$ yield substantially higher payoffs to proposers than any of the alternatives, while getting almost as high approval rates as providing all public goods or an all inclusive private allocation.*

Table 5 reports the random effects probit estimates of the effect of how much one is offered (payoff), how many tokens were devoted to the public good, and how much the proposer is taking for himself on votes. In theory, all that should matter is Payoff, and in 3 of the 4 treatments that regressor is statistically significant. The exception here is for $\alpha = .45$ ..... Payoff to the proposer has a negative and statistically significant impact on votes for both values of αin the mixed public and private region. That could be a form of envy which has been reported in prior legislative bargaining experiments with only particularistic goods (FKL 2003 and FKM 2005b). It also helps to explain why proposers do not take anything approaching the high levels predicted under the SSPE for these treatments. Note that we do not see this same negative effects for comparable or larger differences between proposers and coalition partners within MWCs in the $\alpha = .75$ treatment. As already noted, this probably reflects the fact that in this case the next best alternative responders can get if they reject a proposal is another one with an MWC in which they might be excluded from the winning coalition! The results for the effect of the amount of tokens allocated to the public good are statistically significant in all three treatments where the equilibrium prediction include positive provision of the public good, but the sign is negative for $\alpha = 0.3$. The proximate cause for this strange result seems to be multicollinearity between own payoffs and share allocated to the public good. The correlation between these two variables is 0.9965, making it very difficult to seperately identify the impact of these two parameters. Another indication of this is that dropping only the first 2 periods is enough to to make all regressors statistically insignificant in that case ($\alpha = 0.3$).

Table 6 reports the expected payoff for different types of proposals given the voting behavior. These are computed using the regressions reported in Table 5 to obtain the probability that a subject would accept or reject a given proposal. Then expected payoff is obtained as $u_i(x, y)\, pr(x, y) + 0.8cv$ where $u_i(x, y)$ is the payoff to the proposer of the proposal allocating x and y, $pr(x, y)$ is the probability of such a proposal being accepted and this is obtained as the square of the predicted acceptance probability from the random-effects probits, cv is the continuation value obtained as the average payoff, and it is multiplied by the discount factor 0.8.[18] The allocations considered are the following: $\alpha = 0.3$ NE which is the equilibrium (x, y) for the case of $\alpha = 0.3$, similarly the equilibria (x, y) for α 0.45, 0.55, and 0.75 are considered. Three more allocations are considered. In the $\alpha = 0.45$ treatment, most allocations have $y = 1$, but this is closely followed by allocation giving some private allocation to the proposer (and only him), thus we take the average (x, y) in that case and this is what is referred to as $\alpha = 0.45$ 2^{nd} most pop. Similarly, the average (x, y) for the case where only the proposer is allocated private benefits in treatment $\alpha = 0.55$ and where 3 subjects receive private benefits in the $\alpha = 0.75$ treatment are considered. Those averages are reported in Table 4. The expected payoff for each of these 7 proposals are computed for each treatment. The Table reports the following. The first column reports the payoff such a proposal would give the proposer if it was accepted. This is followed by what share of tokens the proposal allocates to the public good, and what share of tokens it allocates to the proposer. The fourth column gives the payoff this proposal implies for a responder (if some responders are offered private allocations, this reports the payoff to those responders), followed by the predicted probability a voter would accept such a proposal. The last column is the expected payoff.

[18] For these calculations we are assuming that the probability of acceptance is the square of the probability a subject would accept. For proposals where only 3/5 subjects are offered money this is correct. But when they are all offered money, there we want the probability that 2 out 4 will accept. We will use this measure as well in the next version.

	Proposer			Responder		Proposal
	Payoff	y	x	Payoff	Prob.	Exp. Payoff
			$\alpha = 0.3$			
$\alpha = 0.3$ NE	0.49	1	0	0.49	1	0.863
$\alpha = 0.45$ NE	0.392	0.483	0.517	0.237	0.257	0.400
$\alpha = 0.55$ NE	0.411	0.583	0.417	0.286	0.565	0.504
$\alpha = 0.75$ NE	0.204	0	0.68	0.048	0	0.373
$\alpha = 0.45$ 2^{nd} most pop.	0.464	0.865	0.135	0.424	0.993	0.831
$\alpha = 0.55$ most pop.	0.456	0.841	0.145	0.412	0.992	0.823
$\alpha = 0.75$ most pop.	0.143	0.039	0.414	0.107	0	0.373
			$\alpha = 0.45$			
$\alpha = 0.3$ NE	0.385	1	0	0.385	1	0.677
$\alpha = 0.45$ NE	0.419	0.483	0.517	0.186	0	0.292
$\alpha = 0.55$ NE	0.412	0.583	0.417	0.224	0.054	0.294
$\alpha = 0.75$ NE	0.306	0	0.68	0.072	0	0.292
$\alpha = 0.45$ 2^{nd} most pop.	0.394	0.865	0.135	0.333	1	0.686
$\alpha = 0.55$ most pop.	0.389	0.841	0.145	0.324	1	0.681
$\alpha = 0.75$ most pop.	0.201	0.039	0.414	0.147	0	0.292
			$\alpha = 0.55$			
$\alpha = 0.3$ NE	0.315	1	0	0.315	1	0.566
$\alpha = 0.45$ NE	0.436	0.483	0.517	0.152	0	0.251
$\alpha = 0.55$ NE	0.413	0.583	0.417	0.184	0.012	0.251
$\alpha = 0.75$ NE	0.374	0	0.68	0.088	0	0.251
$\alpha = 0.45$ 2^{nd} most pop.	0.347	0.865	0.135	0.272	1	0.597
$\alpha = 0.55$ most pop.	0.345	0.841	0.145	0.265	0.998	0.594
$\alpha = 0.75$ most pop.	0.240	0.039	0.414	0.173	0	0.251
			$\alpha = 0.75$			
$\alpha = 0.3$ NE	0.175	1	0	0.175	0746	0.215
$\alpha = 0.45$ NE	0.472	0.483	0.517	0.085	0.101	0.123
$\alpha = 0.55$ NE	0.415	0.583	0.417	0.102	0.183	0.132
$\alpha = 0.75$ NE	0.51	0	0.68	0.12	0.349	0.180
$\alpha = 0.45$ 2^{nd} most pop.	0.253	0.865	0.135	0.151	0.562	0.196
$\alpha = 0.55$ most pop.	0.256	0.841	0.145	0.147	0.528	0.189
$\alpha = 0.75$ most pop.	0.317	0.039	0.414	0.227	0.977	0.420

Table 6: Expected Payoff Given Voting Behavior

5 Conclusions

A Additional Estimation Results

	Number of Subjects Offered Private Allocations					
	0	1	2	3	4	5
$\alpha = 0.3$						
	0.73	0.01	0.00	0.08	0.03	0.15
$\alpha = 0.45$						
	0.43	**0.37**	0.01	0.05	0.01	0.13
x-over from	0.73	**0.09**	0.01	0.06	0.01	0.10
x-over to	0.57	**0.39**	0.01	0.02	0.00	0.02
$\alpha = 0.55$						
x-over from	0.62	**0.27**	0.00	0.09	0.00	0.02
x-over to	0.28	**0.41**	0.01	0.12	0.08	0.10
	0.35	**0.40**	0.01	0.08	0.02	0.13
$\alpha = 0.75$						
	0.03	0.01	0.00	**0.65**	0.04	0.26

Equilibrium Type Offers are in Bold.

Table 7: Number of Subjects Allocated Private Benefits (Frequencies)

	Number of Subjects Offered Private Allocations					
	0	1	2	3	4	5
$\alpha = 0.3$	**0.83**	0.02	0.00	0.07	0.2	0.07
$\alpha = 0.45$	0.57	**0.25**	0.00	0.07	0.01	0.10
$\alpha = 0.55$	0.43	**0.41**	0.01	0.07	0.01	0.07
$\alpha = 0.75$	0.01	0.00	0.00	**0.69**	0.02	0.27
	Periods 10 and Above					
$\alpha = 0.3$	**0.8**	0.07	0.00	0.07	0.00	0.07
$\alpha = 0.45$	0.62	**0.28**	0.00	0.03	0.00	0.08
$\alpha = 0.55$	0.32	**0.62**	0.00	0.03	0.00	0.03
$\alpha = 0.75$	0.05	0.00	0.00	**0.71**	0.00	0.24

Equilibrium Type Offers are in Bold.

Table 8: Number of Subjects Allocated Private Benefits (Frequencies) in Accepted Proposals

	All Rounds	Rounds >9
$\alpha = 0.3$	0.959	0.973
$\alpha = 0.45$	0.932	0.960
$\alpha = 0.55$	0.899	0.890
$\alpha = 0.75$	0.092	0.072

Table 9: Average Proposed Provision of Public Good for Accepted Proposals