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State capacity, stakeholder buy-in, and collective action problems: the budget allocation case

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Weak state capacity can lead to poor economic performance owing to an inability to solve collective action problems associated with lumpy but highly productive infrastructure projects. We formulate a stakeholder buy-in game where two players (regions) must unanimously approve a lumpy infrastructure program in which one region first gets the total budget in period one to finance a lumpy and productive project and the other region gets all the budget generated in period two. The program involves the state undertaking several tax-and-transfer steps in the implementation phase. Both would be better off if the program succeeds. But weak capacity is reflected in the probability that the state fails to deliver at each step. If either player rejects the program, the default allocation is "divide-by-*N*", where each player gets an *N*th part of the given budget, which can finance only small and less productive projects. When state capacity exceeds a certain threshold, unanimous approval is a unique evolutionarily stable strategy. If not, the "divide-by-*N*" rule dominates. A higher return on lumpy projects reduces the hurdle probability and improves the likelihood of stakeholder buy-in. A higher degree of myopia among the players has the opposite effect.

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1. Introduction

In the first decade of the 21st century, poor economic performance has become increasingly associated with weak state governance. The mantra of "governance matters" and its flip side, "institutions matter", have numerous corroborating cross-country studies establishing their claim as the dominant development orthodoxy, weaning conviction away from the older twin mantras that "policies matter" and "prices matter" (Rodrik, Subramanian, and Trebbi [2004]; Easterly and Levine [2003]; Acemoglu, Johnson, and Robinson [2001]).

The association of good governance and good economic performance can take many paths. An important one goes through the failure to provide public goods, which are collective action challenges (e.g., Keefer [2011]). Superior economic performance is, to a great extent, a manifestation of superior capacity for collective action. Traffic lights that prevent traffic snarls are a simple example of collective provision. The famous Seoul-Pusan Highway completed in South Korea in the late 1960s is another. The construction of the Three Gorges Dam, which exacted huge up-front sacrifices from some private agents in consideration of substantial future payoffs to society as a whole, demonstrates a tremendous capacity for collective action in China, which underpins its present progress. Weak states are, by contrast, unable to marshal the collective commitment to carry out such highly remunerative mega-projects.

The capacity for collective action is normally tenuous because cooperation is readily subject to shirking or free riding by private agents largely motivated by private gains (Olson [1965]; Hardin [1982]). Collective action challenges, such as the management of a common resource, are defined by incentives that are incompatible with public welfare enhancement, resulting in the "tragedy of the commons" [Hardin 1968]. All public goods are at bottom collective action challenges.

Collective action is, thus, typically the charge of a third party called the state, whose role as collective-action broker is to tilt the balance of incentives in favor of the provision of public goods [Smith 1994(1776)]. Samuelson [1954, 1955] formally implemented Adam Smith's view and famously appealed to the notion of a "benevolent central planner" to solve the problem of public goods provision. One problem with this solution, however, is that developing-country governments are seldom benevolent central planners. As a consequence, state intervention can lead to bad outcomes instead.

The state's capacity to broker collective action is partly determined by the trust it inspires among its stakeholders. Trust in turn is molded by the state's performance as manager and honest broker of past endeavors. Fukuyama [1995] considers this trust the lodestone of prosperity making for a "frictionless economy". Arrow identifies trust as an externality that lowers the transaction costs of exchange. Such capacity can also be identified with *social capital* (Hardin [1999]; Knack and Keefer [1997]). In this paper, the nexus between state capacity and collective action outcomes is explored as a game—the stakeholder buy-in game—involving a two-period state infrastructure budget allocation program.

In section 2, we formulate a two-player strategic game in which two regions must unanimously approve the state's two-period budget allocation program designed to maximize the public benefit from lumpy investment in two regions. The budget in any period can finance only one lumpy project or many small ones. The state's program entails only one region getting the total budget in the first period; the proceeds from this lumpy investment, however, bankroll the lumpy investment in the next period. The state must accomplish certain tax-and-transfer steps for the program to proceed. State capacity being weak, there is a risk that the state will fall short in each step. The two players (here, regions) must approve the state program unanimously, given the state's perceived capacity to deliver. If either one rejects it, a default allocation, called "divide-by-*N*", comes into play, in which each region gets an *N*th part of the budget each period. The *N*th part is insufficient for the lumpy project and thus only finances less productive endeavors, such as outright consumption.

We show that there is a threshold capacity below which the program will be unanimously rejected in favor of "divide-by-*N*". Above this threshold, the allocation game has a unique evolutionarily stable strategy in cooperation. In section 3, we show that where state capacity is weak, the greater the productivity of its portfolio of projects and the more likely it can procure the political buy-in by stakeholders. In section 4, we show that myopia among players makes it harder for the state to broker cooperation.

2. The investment budget allocation game

2.1. The state's budget allocation program and default program

Consider an economy in which the state must allocate a fixed investment budget between two regions for two periods. There are two types of projects, X and Y, in each region. X is a large lumpy project needing all of B to finance it. For simplicity, we assume that X and Y are engendered and remain productive in only one period.At the end of the period, X generates the revenue $B(1 + r) > 0$ where $r > 0$ is the social rate of return. Y, on the other hand, is a collection of small projects that can be financed at less than B with rate of return $q < r$.

The state proposes the following state allocation program: allocate all of B to at first one region, say, F (= first) at t_1 where it produces $B(1 + r)$ at the end of t_1. The state then taxes away $B + (Br/2)$ of the proceeds from F and transfers this to the other region, say, S (= second) at end of t_1, leaving $(Br/2)$ to be consumed by F. An equal amount, $(Br/2)$, can also be consumed by S in t_1. In period t_2, B is invested by S in X where it again produces $B(1 + r)$; of this $(B/2)(1 + r)$ is taxed away and transferred by the state to F to finance consumption by F in t_2; which region gets to be F is determined by a toss of a fair coin. Whichever region becomes S, however, runs the risk of being shortchanged if the state is unable to deliver.

Precisely because it is weak,the state cannot unilaterally impose this allocation program. The two regions must unanimously approve the state's proposal for it to proceed. If at least one rejects the proposal, the default allocation is equal division—that is, $(B/2)$ to each region. We call this the "divide-by-*N*" rule. Let d be the discount factor common to the state and the two regions, with $0 < d < 1$. The net social benefit W generated by the state proposal is

$$W = Br + B(1+ r)d > 0. \tag{1}$$

Under the "divide-by-*N*"rule, on the other hand, F and S each gets $(B/2)$ which, when invested in Y, generates the welfare

$$W_i = (B/2)(1 + q),\ i = \text{F, S}.$$

The regions consume the whole revenue in t_1. The aggregate benefit W^0 of the default allocation is the sum for both regions:

$$W^O = (W_F + W_S) = B(1 + q). \tag{2}$$

Since clearly $W > W^0$, social welfare is served by the state's proposal. Thus, the default rule "divide-by-*N*" represents a collective action failure since it squanders $W - W^0$.

2.2. State capacity

Several steps are required for the state program to be accomplished. The state is sure to deliver B to F or $(B/2)$ to F and S in t_1. But the delivery of $B + Br/2$ to S under the state program is uncertain—that is, only up to some probability P, with $0 \leq P \leq 1$.

First, the state must tax away $(B + Br/2)$ from F and transfer this to S. Then the state has to tax and transfer $(B/2)(1 + r)$ to F from S at the end of period t_2. These steps are attended with many problems in a state where the ability to collect and to safeguard tax revenues from leakage, if not plunder, is weak. The state's capacity to deliver is attended with uncertainty. We say the state is weak if $P < 1$.

2.3. Period and present value payoffs

Below is the consumptionper period of F and S under the state program.

TABLE 1. Period consumption

	t_1	t_2
C_F	$Br/2$	$(B/2)(1 + r)P$
C_S	$(Br/2)P$	$(B/2)(1 + r)P$

The present value payoff of each region can also be compared. A region has a 50 percent chance of being either F or S. The expected utility EU_i, i = F, S under the state program is

$$EU = EU_i = (1/2)[(Br/2) + (B/2)(1 + r)Pd] + (1/2)[Br/2)P + (B/2)(1 + r)Pd]. \quad (3)$$

Under the default allocation $U_i = U^0$, i = F, S:

$$U^0 = (B/2)(1+q). \quad (4)$$

Expressions (3) and (4) form the payoffs of the allocation game. Note that U^0 prevails if at least one region rejects the state program.

2.4. The game in normal form

The present-value payoff table of the budget allocation game with strategy set for i:s_i = (Accept, Reject) = (A, R), i = F, S is as follows:

TABLE 2. Present value payoff table of the budget allocation game

Action	A	R
A	(EU, EU)	(U^o, U^o)
R	(U^o, U^o)	(U^o, U^o)

EU and U^0 are as in (2) and (3), respectively. Table 2 is not strictly a coordination game since (R, R) is not a strict Nash equilibrium. We have the following:

Lemma 1: Let $P > P^0 = [2(1 + q) - r][2(1 + r)d + r]^{-1}$. Then
(i) (A, A) is the unique evolutionarily stable strategy (ESS) and vice versa.
(ii) (R, R) is a Nash equilibrium but is not ESS.
(iii) $(f_A, f_R) = (1, 0)$ is a (degenerate) mixed strategy Nash equilibrium and is the unique "trembling-hand perfect" equilibrium (THPE).
Proof: See Appendix.

Lemma 2: Let $P < P^0$. Of the three pure strategy Nash equilibria (A, R), (R, A) and (R, R), only (R, R) is ESS.
Proof: See Appendix.

The following is obvious:

Claim 1: If $P > P^0$, the welfare-enhancing state budget allocation program dominates the default allocation in the sense of being supported by a unique ESS (A, A).

Thus, if $P > P^0$, the collective action problem is solved. $W^* = B(1 + r) + B(1 + r)$ d is supported by an ESS and "trembling hand perfection".

Claim 2: If $P \leq P^0$, the "divide-by-*N*" rule dominates the welfare-enhancing state infrastructure budget allocation program in the sense of being supported by a unique ESS (R, R).

3. Project productivity and state capacity

Note that the threshold probability, $P^0 = [2(1 + q) - r][2(1 + r)d + r]^{-1}$, decreases with r. The higher the productivity r of project X, the lower is the hurdle probability P^0 that has to be exceeded for collective action to proceed. This has an object lesson for weakly credible states. Their capacity to broker collective action is enhanced by choice of projects. The weaker the state credibility, P, the higher should be the productivity of its portfolio of projects for increased likelihood of collective buy-ins. Projects of dubious social productivity only enhance the likelihood of the "divide-by-*N*" rule. This means that weak states in general should studiously limit the span of their programs to ensure the highest productivity and collective buy-in.

In the real world (though not in this model), state capacity P itself is endogenous. It can be raised by improving performance in state-sponsored programs. If the state already suffers from program overload and failures, a retreat from less productive ones will improve perception of capacity, facilitating stakeholder buy-in in future projects. Likewise, if state capacity is stronger in some areas than in others, the state can be more ambitious in those areas.

4. Myopia

We know from the folk theorem (e.g., Osborne and Rubinstein [1994]) that a favorable regard for future flows helps sustain cooperation in the super-game version of the prisoner's dilemma game. In this model, a high d means a large weight given to payoffs in the second period. The feature of the government program here is the contribution of future consumption. A low d is therefore the operational definition of *myopia*. How does d affect the likelihood of collective action? It is obvious that P^0 falls as d rises. That is, as the players become more farsighted, the more likely that $P > P^0$, or collective action, will push through. The opposite is also obvious. Greater myopia among the players (lower d) raises P^0 and makes it less likely for collective action to push ahead. As in the supergame version of the prisoner's dilemma game, infinite repetition still does not work if the players are sufficiently shortsighted and heavily discount future payoffs. We now have the following claim:

> **Claim 3**: The likelihood of the "divide-by-N" rule, i.e., the failure to get a buy-in into the state allocation program, is lower: (a) the higher is the productivity r of the state selected project X, and/or (b) the higher is d, that is, the more far-sighted the players are.

5. Conclusion

This paper has investigated the role of state credibility in the emergence of a collective action failure, the "divide-by-N" rule, in the state budget allocation process. The state has no more than budget $B > 0$ for two periods in two regions, F and S. There are two types of projects: X, which is financing-intensive (requires all of B) but has a higher return r; and Y, which consists of small projects, requires less financing but has an inferior return $q < r$. The state proposes a welfare-enhancing sequential budget program in which region F gets the whole budget B in t_1, and region S gets B in t_2. Project X returns $B(1 + r)$. The state taxes away part of the return from X—namely, $B + Br/2$—at the end of t_1, which it then transfers to S. Thus, $Br/2$ is consumed by F and $Br/2$ is consumed by S in t_1. In t_2, S invests B in X to return $B(1 + r)$ of which $(B/2)(1 + r)$ is returned to F for consumption in t_2. Each region has an equal chance of being either F or S. The state's capacity P to deliver its part of the bargain is imperfect—that is, $0 < P < 1$. Because the state is weak, it cannot impose its program. The regions must instead approve the state's program unanimously; otherwise, the default allocation "divide-by-N" kicks in: each region then gets $B/2$.

This game is formulated as a strategic game with an identical action set (A, R) = (Approve, Reject) for each region. We showed that for P exceeding a threshold P^0, the unique ESS is (A, A) and the state program is viably supported. For P falling below P^0, the unique ESS is (R, R) while (A, R) and (R, A) are Nash equilibria. Thus, the "divide-by-N" rule is the equilibrium outcome when state credibility is wanting.

The state can enhance its capacity for collective action by pulling down the credibility-hurdle rate, P^0. This can be done by choosing projects with the highest social productivity r. This lowers the hurdle probability P^0 and increases the likelihood of a collective-action success. This means that, in theory, the weaker the state, the more productive the portfolio of projects it must choose; in other words, the more limited should its compass be. State overreach has led to massive waste and collective-action failures.

Finally, myopia (a smaller *d*) on the part of the players raises the hurdle probability P^0 and lowers the likelihood of a cooperative outcome. Electoral democracies with short electoral cycles are particularly vulnerable to shortsightedness and may thus be deprived of more productive but long-horizon projects.

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Appendix

Proof of (i) of Lemma 1:

(If) If $P > P^0$, then $P[2(1 + r)d + r] > (2(1 + q) - r)$.Thus $(1/2)[r + P[2(1 + r)d + r] > (1 + q)$. Multiplying both sides by $(B/2)$ gives $EU > U^0$. Thus, A is the unique best reply to itself, making (A, A) an evolutionarily stable strategy. Suppose (A, A) is not a unique ESS. Then (R, R) is also ESS. Since from (3) $U^0(R, R) = U^0(A, R) = U^0(R, A)$, then $EU(A, A) < U^0(A, R) = U^0(R, A)$. The latter implies that $P < P^0$, a contradiction.

(Only if) Suppose (A, A) is a unique pure strategy ESS. Then, either $EU(A, A) > U^0(A, R) = U^0(R, A)$ or if $EU(A, A) = U^0(A, R) = U^0(R, A)$, then $U^0(R, R) < U^0(A, R) = U^0(R, A)$. The first implies $P > P^0$. The second implies $P = P^0$. But $U^0(R, R) = U^0(R, A) = U^0(A, R)$. Thus (A,A) is not an ESS, a contradiction.

Proof of (iii) of Lemma 1.

Note that (A, R), (R, A), and (R, R) are all weakly dominated strategies. Since $P > P^0$, (A, A) is not a dominated strategy. Thus, the mixed strategy Nash equilibrium that uses no weakly dominated strategy is $(f_S, f_R) = (1, 0)$. This makes it a trembling-hand perfect equilibrium. It is unique since the only other mixed strategy Nash equilibrium is $(f_S, f_R) = (0, 1)$, which uses (R, R), a weakly dominated strategy.

Proof of Lemma 2.

Suppose $P < P^0$: That (A, R), (R, A), and (R, R) are Nash equilibria is obvious. Among these, only (R, R) is symmetric and thus the only possible ESS. Note that $U^0(R, R) = U^0(A, R) = U^0(R, A)$. But if $P < P^0$, $U^0(A, R) = U^0(R, A) > EU(A, A)$. Thus (R, R) is the unique ESS.