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Emergence of Cooperation in Public Goods Problems

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Abstract

In this paper, we discuss several issues related to public goods problems. Unlike many Austrians, we do not think that the concept of public goods – or of collective action – is an inherently flawed idea, even though we reject the alleged welfare implications of public goods theory, as proposed by orthodox public finance literature. We argue that the structure of a generic public goods problem is a game of Chicken or an Assurance game, rather than a Prisoner's dilemma and that this has important implications with regard to plausibility of cooperative outcomes. Namely, when the public goods problem has the weakest-link structure and can be represented by an Assurance game, then the cooperative outcome will be self-enforcing. In many cases, the public goods problem can be transformed into a weakest-link game or different mechanisms can be found to ensure cooperation. We also discuss the difference between a public goods problem and collusion. We assert that, unlike public goods problems, collusive agreements have the structure of a Prisoner's dilemma. Overall, our paper suggests that there are reasons to be optimistic about stability and efficiency of stateless societal orders.

Keywords: public good, game of Chicken, Assurance game, Prisoner's dilemma, paradox of cooperation

JEL: C72, H41

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1 Introduction

Libertarians are generally optimistic about private provision of public goods. Sometimes this optimism is explained, sometimes it is just assumed. The aim of this paper is to provide a robust explanation why cooperation in public goods problems can arise out self-interested behaviour.

We argue that, in contrast to popular wisdom and in contrast to assumptions made by a large part of the literature, a generic public goods problem has a structure similar to a game of Chicken, rather than to that of a Prisoner's dilemma. This insight has important – and rather optimistic – implications regarding the possibility of voluntary provision of public goods. In this setting, sustainability of cooperation depends on the proportion of individuals that are needed to cooperate. Following Hirshleifer (1983), we posit that the higher the number of individuals required to form a coalition in a public goods game, the higher the degree of cooperation. Cooperation will most easily emerge if the public goods game has the weakest-link structure – i.e. requires all member of the group to cooperate. It is important to note that the weakest-link structure corresponds to a situation in which the provision of the public good is guided by an Assurance game, in which cooperation is self-enforcing.

In many cases, it is conceptually possible to transform the Chicken game into an Assurance game and a part of the success in provision of certain public goods depends on the group's ability to transform the game into an Assurance game. Obviously, there are instances in which it is not possible to change arbitrarily the terms of the public goods game. Thus, we analyze how cooperation could emerge in circumstances in which only a fraction of the group is required to cooperate. Generally speaking, the idea which we put forward in this paper is that provision of public goods may be more self-enforcing than suggested by traditional public finance literature. We should note that our explanation is different from the usual argument using properties of repeated play, even though both explanations are compatible and may be mutually reinforcing.

We also rejoin Caplan and Stringham (2003) in saying that it is incorrect to identify collusion as a public goods problem.[1] Collusion resembles a weakest-link public goods problem only to the extent that it also requires cooperation from all members of the group. Nonetheless, the incentives to defect are of different origin and are much stronger than in a generic public goods problem mainly because collusion possesses the structure of Prisoner's

[1] Cowen and Sutter (1999).

dilemma. This paper subscribes also to earlier literature which pertains to the private provision of public goods[2] and to emergence of cooperation in noncooperative games.[3]

In the following section, we argue that some Austrians may have mistakenly rejected the very notion of strategic behaviour together with the normative implications of orthodox theory of public goods. In Section 3 we show that a generic public goods problem has the structure of a game of Chickens or of an Assurance game. We then discuss possibilities of endogenous emergence of cooperation in such strategic settings and analyze the implications for the debate concerning the stability of a stateless order. Section 4 concludes.

2 Austrian View of Public Goods

We believe that the notion of public goods or collective action is valuable for our understanding of human interaction, political institutions and societal orders. Most Austrian authors deny policy and welfare implications of the theory of public goods and reject the idea that the public goods problem represents reasonable grounds for welfare-improving government action.[4] While this view is entirely correct, Austrian reservations about normative policy implications have lead them to neglect the issue of collective action altogether. We believe that this has not been beneficial for Austrian scholarship and that Austrians now need to assess the fundaments of the theory of collective action and to adopt its healthy elements. By healthy elements we mean mainly the strategic structure of the problem, as treated by tools of game theory. Generally speaking, Austrians have been often very critical and not appreciative of the game theory and our contention is that it has been unduly so.[5] Game theoretical tools, especially when employed to understand conflictual and strategic facets of human interaction, such as Prisoner's dilemmas, Chicken games and Assurance games, yield powerful results that often resonate with Austrian insights, even though they miss insights regarding dynamic properties of markets, their ability of adaptation and ecological rationality.

In orthodox public finance literature, the notion of public goods has been used as a justification for welfare-improving government action. It

[2] See, e.g. Hirshleifer (1983).

[3] Axelrod (1984), Lipman (1986) or Yamagishi (1995).

[4] See, among others Rothbard (1977), Holcombe (1997), Hoppe (1989) or Salin (2000).

[5] For a good assessment of Austrian views on the game theory, see Foss (2000).

is claimed that public goods problem arises when individuals are in a Prisoner's dilemma situation and co-operation cannot be sustained. In such case, it is alleged, coercion, taxation and government spending can be Pareto-improving.

Austrian authors pointed to problems with this reasoning. First of all, public goods problem is not a feature of any particular good or commodity but rather a feature of market relationships which has to be resolved if market in any area is to function. Therefore, no one can say a priori whether a certain good is a public good or not. To some extent, all goods present public characteristics and the genuine question is how these characteristics can be overcome so that the good is supplied. As a result, there is no way how even a benevolent social planner would select goods that should be supplied through government action. Market process is the only way how various modes of production of goods with public characteristics can be discovered. Indeed without having recourse to the market as a discovery procedure, no one would ever be able to know in advance how to overcome the public goods problem. Moreover, public goods problems that cannot be overcome in a voluntary way seem very unlikely to be resolved by coercive government action.

This line of criticism shows that the public goods problem does not constitute a ground for government intervention. While it is true that the existence of public goods problem that remains unresolved may result in a welfare-inferior situation, it is still unclear how government action could remedy such a situation. This is especially true if we theoretise not only about an idealised form of government that is both omniscient and benevolent, but about a government that is composed of individuals who have imperfect knowledge and who are pursuing their own interests. In such a situation, strategic behaviour that lead to welfare inferior equilibria on a free market are reproduced and even worsened by introduction of coercion. Indeed, as classic public choice literature shows, the core of government failure lays in the existence various groups who have various abilities to overcome the public goods problem. The political process tends to reflect the interests of those groups that are more able to overcome this problem than the groups in which benefits of collective action are more dispersed and which are therefore less able to organise themselves.

As a result, it is unclear how government action could make things systematically better. While this view is rather uncontroversial among the Austrians, some take the argument a bit further by claiming that public goods problem is praxeologically irrelevant. Says Hoppe (1989, p. 32):

> In terms of consumer evaluation, however high its absolute level might be, the value of the public goods is relatively lower than that of the competing private goods because if one had left the choice to the consumers (and had not forced one alternative upon them) they evidently would have preferred spending their money differently (otherwise, no force would have been necessary). This proves beyond any doubt that the resources used for the provision of public goods are wasted because they provide consumers with goods or services that at best are only of secondary importance.

We claim that Hoppe is wrong. While we do not dispute the assertion that resources used by governments to provide public goods may well be wasted, we see his praxeological reasoning as flawed. He overlooks precisely the strategic character of behaviour which creating the public goods problem. If he was right, then no public goods problem would ever exist – people would simply act in accordance with their preference scales and bid for goods that they prefer. But the problem arises when one acts strategically and does not demonstrate his preference. It is true that preference scales are unobservable and it is therefore preposterous for an external observer to say when exactly people are engaging in strategic behaviour over public goods provision. But it is equally absurd to deny existence of such situations. Indeed, doing so requires adopting an extreme behaviouralist position, claiming that preference scales do not exist as independent mental phenomena. But what else could they be? When observing any human action, we directly apprehend only its behavioural manifestations. And we cannot strictly deduce anything with regard to its motives without being acquainted with underlying preference scales. To follow up on Hoppe's (2005) example, the distinction between "having a walk in the Hyde Park" and "walking in the general direction of Patagonia" lies precisely in knowing what the intentions and preferences of the individual are. Likewise, to distinguish between "not valuing a good" and "being unwilling to pay – relying on free riding" necessitates knowing the preference scale of the individual in question. There is nothing logically impossible or inherently implausible about the free-riding option.

We understand that there is no direct way of ascertaining preferences of a fellow human being. This creates an empirical problem with regard to identifying whether we are in a situation of a public goods problem or simply in a situation when individuals simply do not value the good in question to the extent that they would be willing to pay for it. But still,

this does not jeopardise our claim that public goods can and do exist. In the following section, we thus proceed from the assumption that public goods problem is a meaningful concept characterizing important aspects of human conduct and that it is a major intellectual challenge – especially for Austrian authors – to derive solutions to this problem. Our endeavour in this paper has been indeed motivated by finding non-coercive solutions to these social dilemmas. The one that we put forward in the following sections is based on the observation that, although the public goods problems exist, their structure can lead to self-enforcing cooperative solutions.

Moreover, we have to maintain that the theory of public goods helps us understand some issues that are of interest to Austrian and libertarian authors alike. The problem of collective action constitutes, from our perspective, one of the reasons for government failure. Moreover, in current debates, many different instances of strategic behaviour are pooled under the heading of public good and we suspect that the recent discussion over the stability of anarcho-capitalism and the paradox of cooperation is in part a by-product of this confusion. We think that this misunderstanding can be partly resolved by looking at the sources of strategic behaviour and analyzing the incentives to defect.

3 Public Goods Games: Chickens and Assurance Games

In the usual public good setting, there is an indivisible good to be produced. Once produced, this good will bring benefits to all members of a given group. A certain number of individuals are required to contribute so that the good can be produced. The act of contribution can be imagined in a very abstract way: On the one hand, the individual may be required to observe some rules of conduct - such as decency, trustworthiness and so forth – or he may be simply required to contribute by some pecuniary amount. In our discussion, we assume that the action required from an individual to cooperate is clearly delimited from the outset by a predetermined contribution rule. This rule can be thought of as a technology of production of the good in question. To produce a generalised sentiment of trust and security, a critical mass of individuals is required to behave in a certain way. To supply a tangible public good, certain number of individuals are each required to contribute a certain amount of money.

It is clear that in all of these situations, incentive of an individual not to contribute comes from two sources. First, the individual may think that even

if he contributes, there will not be enough of other individuals contributing and thus the good will not be produced. Second, the individual may want to free ride. He may think that enough of other people will contribute and therefore that his contribution will be unnecessary. He will thus attempt to enjoy the good for free.

It is interesting to note that a large part of the literature, implicitly or explicitly assumes that a public goods problems have a structure of Prisoner's dilemma. Dowes and Messick (2003, p. 111) assert that

> [s]ocial dilemmas are situations in which each member of a group has a clear and unambiguous incentive to make a choice that – when made by all members – provides poorer outcomes for all than they would have received if none had made the choice.
>
> (...)
>
> Examples of social dilemmas include the problems associated with the provision of public goods.

Likewise, Axelrod's (1984) study of emergence of cooperative behaviour, which has been often used as an argument for private provision of public goods, relies on iterating Prisoner's dilemmas. Also Hirshleifer and Rasmusen (1989) focus exclusively on Prisoner's dilemmas. However, we think that this emphasis on Prisoner's dilemma as the most common form of social dilemma is unwarranted. Even though there empirically clearly exist situations of strategic interaction which resemble Prisoner's dilemmas, we believe that Chicken games and Assurance games deserve at least as much attention, particularly when it comes to the issue of public goods. It is thus paradoxical that many authors associate public goods games with games in which defection is the dominant strategy.[6]

Following Nunn and Watkins (1978), let us consider this public goods problem. In a group of n persons, each person decides whether to contribute by an amount r for a public good. If k of the players contribute, the public good will be provided, bringing a benefit b to each of the players.[7] If X_j is the contribution of j-th player. Then the pay-off function of the j-th player is:

- b if $X_j = 0$ and $\sum_{i=1}^{n} X_i > kr$

[6] See Andreoni (1995' who tries to explain how experimentally observed cooperation arises in such settings. He ends up distinguishing between "kindness" and "confusion" as two main driving forces of cooperation. We do not want to belittle importance of these two but we still believe that cooperation can arise simply out of self-interest.

[7] The good is therefore indivisible.

- $b - r$ if $X_j = r$ and $\sum_{i=1}^{n} X_i > kr$
- 0 if $\sum_{i=1}^{n} X_i < kr$

When confronted with this game, we should observe that there are $\binom{n}{k}$ pure strategy Nash equilibria. Any time when k players contribute, the other $n-k$ should not contribute to behave optimally. All of these pure strategy Nash equilibria are Pareto optimal, however, which goes a bit against the common wisdom concerning public goods. Of course, the question is how focal are these equilibria, given that in large groups their number grows in an important manner. It is perhaps for this reason that economists have focused more on characteristics of mixed strategy Nash equilibria. In this game, if the individual contributes with probability p his expected utility is

$$Eu = (b-r)p\left[\sum_{q=k-1}^{n-1} P'(q)\right] + b(1-p)\left[\sum_{q=k}^{n-1} P'(q)\right].$$

Where $P'(q)$ is the probability that q contributions are made by the $n-1$ other players. It can be shown that under general conditions, the public good will be provided with probability $(p + b/r)P'(k-1)$.

The general n-person version of this game does not bring us many insights. To facilitate our discussion The easiest way to demonstrate our arguments is to look at this game when $n = 2$. On a pairwise level, this game can be analyzed in its reduced form. Let us start by considering that $k = 1$. The reduced form of the game is

	Contribute	Don't
Contribute	$b-r, b-r$	$b-r, b$
Don't	$b, b-r$	$0, 0$

This game of Chicken has two pure strategy Nash equilibria *Contribute, Don't* and *Don't, Contribute*. Good news is that both of them are efficient. Bad news is that it can be problematic to achieve any of them. In the case that both sides irrevocably commit not to cooperate, the outcome may happen to be the least desirable one *Don't, Don't*. Without any communication, both players will be playing mixed strategies and the outcome will not be the worst possible but still will be suboptimal.

It can also be the case, however, that $k = 2$. Then we speak about the weakest-link public goods problem. Surprisingly, the game now becomes an Assurance game. The reduced form is:

	Contribute	Don't
Contribute	$b-r, b-r$	$-r, 0$
Don't	$0, -r$	$0, 0$

Here we find two pure strategy Nash equilibria *Contribute, Contribute* and *Don't, Don't*, out of which *Contribute, Contribute* is welfare superior. Mixed strategy would lead us to less than optimal mixture of outcomes. Yet the equilibrium *Contribute, Contribute* represents a Schelling point and there can be little doubt that both players will aim at it. It should be noted that this result is robust with regard to the number of players. As a result, whenever a public goods problem has the weakest-link structure, there is one self-enforcing and efficient solution to it.

What can be an example of the weakest-link setting? When certain conduct is expected from all members of a group so that a public good can be provided, then everyone will just do his duty. Chamlee-Wright (2006) observed that in the aftermath of the Hurricane Katrina, there was a massive response of the civil society. Churches, private firms and individuals organised in a spectacular way at a time when government failed to deliver the necessary assistance. The post-Katrina situation can well be thought of as a weakest-link form of public goods game, in which cooperation is self-enforcing. Within New Orleans religious and civil communities, there was a solid understanding of the fact that if the crisis is to be overcome, then everyone – or nearly everyone – must behave in a certain cooperative way.

3.1 Cooperation in Non-Weakest-Link Public Goods Games

While relatively optimistic predictions concerning cooperation can be pronounced when it comes to a weakest-link situation, should one not get more skeptical when considering a standard collective action problem, requiring a coalition of $k \leq n$ members either to contribute or to adhere to a certain conduct? Obviously, in larger groups there are impressive numbers of pure strategy Nash equilibria, some of them more advantageous than others for some individuals. Here, the free rider problem arises in the sense that everyone will prefer an equilibrium in which he does not have to contribute. In the 2-person game the same conflict arises over who contributes. We see three main ways of resolving this problem. First, repeated play may create ways of sharing the burden of contributions over time. Second, certain public good games can be transformed into a weakest-link setting which is essentially self-enforcing. And third, of the myriads of equilibria, some may be more focal than others.

Repeated play creates opportunities for minimizing the extent of free riding, as in Axelrod (1984). Lipman (1986) shows that strong forces will push players towards optimal outcome. He adds that the "state of nature" (i.e. the uncooperative outcome) can be overcome more easily in Games of Chicken than in Prisoner's Dilemmas. The problem, of course, is that mutual cooperation is inefficient and there arises a problem of choosing between the two optimal equilibria. In the pairwise public goods game, flipping a coin may be a way of determining which equilibrium is to be played in each round. Alternatively, players can alternate between the two equilibria evenly. This certainly becomes more complicated when we enter the realm of games with many players. But still, in each round, a lottery could select k players who are to form the coalition or certain predetermined rule could stipulate who will be contributing in each round. Once $n - k$ players credibly commit to not cooperating, the remaining k players will contribute. Repeated play provides one additional mechanism for maintaining cooperation: population clustering. As Rigdon, McCabe and Smith (2007) show, population clustering enhances cooperation in games of trust, which are conceptually similar to public goods problems presented here. While their result demonstrates beneficial effects of exogenous clustering done within an experimental setting, repeated play together with learning would create mechanisms for distinguishing those who cooperate from chronic defectors. As a result, an endogenous form of social ostracism could take place, promoting mutual cooperation.

Moreover, there often exists the possibility of transforming the game into the weakest-link form. Many collective action problems possess such structure from the outset. Post-Katrina situation in religious communities can be a good example. Other public good games do not have an exogenously determined contribution structure and can be modified relatively easily into a weakest-link form. When one speaks about a public good for which certain amount of money must be raised, then there are obviously many different ways of setting the contribution rule. In a 2-person contribution game, it is possible to set the rule so that the cost is split between the two individuals, in which case we obtain a weakest-link situation. If raising an amount of money is all that is required to produce the good in question, then contribution rule is completely flexible. Nothing prevents the supplier of the public good to define $k = n$. In that, space for free-riding would be eliminated, as negative decision of anyone of the concerned individuals would result in the good's not being produced.

There are obviously situations when properties of the public good preclude arbitrary changes in the contribution rule, particularly when the char-

acter of the public good is such that a certain threshold of individuals must adhere to certain conduct. In that case, it is difficult to guarantee the optimal outcome, unless we have recourse to some external remedies. Still, some of the equilibria are more focal than others. For instance, to make a town a decent place to live (if we assume decency to be a lumpy good), it is necessary that certain minimum number of individuals behave courteously in public. It is not necessary that everyone behaves so and it would indeed be sub-optimal. Now, who should become the illustrious example of courtesy and good manners? It seems to us as focal that people of greatest cognitive abilities and highest levels of education will commit to being polite, regardless of what the rest of the population does. Why would they do so? We certainly admit that we are obliged to have recourse to an extra-economic argument for it, but still it is an argument that has support in a rich tradition of Western thought. Ortega y Gasset (1994) thusly defines elites:

> We distinguish the excellent man from the common man by saying that the former is the one who makes great demands on himself, and the latter who makes no demands on himself.

We may be accused of introducing unwarranted value judgments into our analysis but we believe, together with Ortega y Gasset that a human society, insofar as it is civilised, must remain aristocratic. Thus, even in a stateless order, there would be a crucial role for the excellent men to commit themselves to provision of certain public goods. In other words, *noblesse oblige*. Would elites be willing to do so? We can never know for sure but it strikes us as evident that without elites that commit themselves to provision of ethical behaviour, trust and respect of individual rights, no civilised society is possible, regardless of whether there exists a central government or not.

3.1.1 Collusion and stability of a stateless order

The question of cooperation in public goods problems has been associated with the issue of stability of a society without territorial monopoly of power. If collective action problem can be overcome, would a stateless order not degenerate into formation of one monopoly of power? Couldn't private law enforcement agencies collude to set higher prices and exploit their customers? Cowen and Sutter (1999, 2005) argue that such risk would be imminent if we accept existence of voluntary solutions to collective action problems. If cooperation can be sustained in voluntary production of private goods, then

it can also be sustained in creating and maintaining a cartel. Caplan and Stringham's (2003) rebuttal is organised around the distinction between a public goods problem which has a Prisoner's dilemma structure and a Coordination game in which cooperation is self-enforcing. To agree on a system of mutual clearing and mitigation of disputes means resolving an Assurance game. On the other hand, establishing a collusive agreement necessitates overcoming a Prisoner's dilemma situation.

Our treatment of the issue of cooperation in public goods experiments provides additional support to Caplan and Stringham's (2003) argument. We have argued that the public goods problems occupy the continuum of games of Chicken and Assurance games, the latter being close relatives of Coordination games. Superficially, collusion can resemble the weakest-link public goods game and it is indeed often the case in the literature (reference) that it is pooled together with other, conceptually different, problems and denoted simply as a public good or a collective action problem. Yet to rely on this resemblance is erroneous. The fundamental difference between a weakest-link public goods problem and collusion is that, on a pairwise level, collusion can be represented - as Caplan and Stringham (2003) show - as a Prisoner's dilemma and not as an Assurance game. The optimism expressed by this paper with regard to public goods problems cannot be extended to Prisoner's dilemmas because avenues through which cooperation can emerge in games which we describe are unique to Chicken games and Assurance games.

4 Conclusions

From our perspective, investigating the game theoretical nature of public goods games provides support to libertarian optimism concerning voluntary provision of public goods. It also provides arguments against the concern that a stateless order would degenerate rapidly into a collusive organization and ultimately into a territorial monopoly of power.

Whenever it is necessary to raise a certain amount of money to finance a public good, it is possible to adjust the contribution rule to minimise the extent of strategic behaviour. This means transforming the game into a simple, focal and self-enforcing weakest-link Assurance game. As a result, there is large space for voluntary supply of goods with public characteristics. Our analysis resembles the argument proposed by Bliss and Nalebuff (1984) who argue that public goods problem may be structurally similar to Chicken games. They also demonstrate that when the number of individuals within

the group increases, first-best outcome takes place. While they consider only situations in which only one individual is required to contribute, our approach is more general by considering problems which require cooperation from part of different fractions of the group.

Our optimistic conclusions are not universal, however. There are lumpy public goods which do not require individuals to contribute to their financing in pecuniary terms but which rather require them to adhere to certain conduct. And provision of these goods may have the structure of a game of Chicken that cannot be transformed into the weakest-link form. As an example, we could mention such public goods as courtesy, atmosphere of trust and mutual respect or safe driving. Their production certainly requires a critical mass of individuals to cooperate, regardless of what the others do. Although we cannot provide a definitive proof that such goods would always be provided in optimum quantities, we suggest that they are provided even nowadays and that they are not provided by the public sector. For us, this demonstrates that there exists ways of overcoming the problem of strategic behaviour. Furthermore, we assert that in many instances, these solutions rely on presence of elites which commit themselves to cooperative behaviour.

Finally, our paper compares the generic public goods problem with collusion. We find that collusion – which can be represented as a Prisoner's dilemma – does not fit well into our description of public goods problems which can be represented rather as games of Chicken or Assurance games. We therefore subscribe to the idea put forward by Caplan and Stringham (2003) who pointed out that cooperation is more difficult to sustain in Prisoner's dilemmas than in Assurance games. By showing that public goods problems – about which libertarians remain optimistic – have structures which are different from that of collusion, we believe that we may contribute to the resolution of the alleged paradox of cooperation.

This topic opens important empirical research agenda – that of finding concrete examples (or counterexamples) of overcoming the collective action problem. If Austrians are to spread their optimism about private provision of public goods, then they must be able to find persuasive examples of situations when this problem has been overcome. Such examples can speak more strongly than theorizing about the benefits of repeated play, reputation and game-theoretical structure of the game.

5 References

1. Andreoni, James: Cooperation in Public-Goods Experiments: Kindness or Confusion?, *American Economic Review*, Vol. 85, No. 4. (1995), pp. 891-904.

2. Axelrod, Robert: *The Evolution of Cooperation*, Basic Books, New York(1984)

3. Bliss, Christopher and Barry Nalebuff: Dragon-Salying and Ballroom Dancing: The Private Supply of a Public Good, *Journal of Public Economics*, Vol. 25, Nos 1-2 (1984), pp. 1-12

4. Caplan, Bryan and Edward Stringham: Networks, Law and the Paradox of Cooperation, *Review of Austrian Economics*, Vol. 16, No. 4 (2003), pp. 309-326

5. Chamlee-Wright, Emily: *After the Storm: Social Capital Regrouping in the Wake of Hurricane Katrina*, Working Paper, Mercatus Center (2006)

6. Cowen, Tyler and Daniel Sutter: Conflict, Cooperation and Competition in Anarchy, *Review of Austrian Economics*, Vol. 18, No. 1 (2005), pp. 109-115

7. Cowen, Tyler and Daniel Sutter: The Costs of Cooperation, *Review of Austrian Economics*, Vol. 12 (1999), pp. 161-173

8. Dowes, Robyn M and David M Messick: Social Dilemmas, *International Journal of Psychology*, Vol. 35, No. 2, pp. 111-116

9. Foss, Nicolai: Austrian Economics and Game Theory: a Stocktaking and an Evaluation, *Review of Austrian Economics*, Vol. 13, No. 1 (2000), pp. 41-58

10. Hirshleifer, David and Eric Rasmusen: Cooperation in a Repeated Prisoner's Dilemma with Ostracism, *Journal of Economic Behavior and Organization*, Vol. 12, No. 1 (1989), pp. 87 - 106

11. Hirshleifer, Jack: From weakest link to best shot: The voluntary provision of public goods, *Public Choice* 41 (1983), pp. 371 - 386

12. Holcombe, Randall G: A Theory of the Theory of Public Goods, *Review of Austrian Economics*, Vol. 10, No. 1 (1997), pp. 1 - 22

13. Hoppe, Hans-Hermann: Fallacies of the Public Goods Theory and the Production of Security, *Journal of Libertarian Studies*, Vol. 9, No.1 (1989), pp. 27 - 46

14. Hoppe, Hans-Hermann: A Note on Preference and Indifference in Economic Analysis, *Quarterly Journal of Austrian Economics*, Vol. 8, No. 4 (2005), pp. 87 – 91

15. Lipman, Barton L: Cooperation Among Egoists in Prisoner's Dilemma and Chicken Games, *Public Choice* 51 (1986), pp. 315 - 331

16. Nunn, Geoffrey E and Thayer H Watkins: Public Goods Games, *Southern Economic Journal*, Vol. 45, No. 2 (1978), pp. 598 - 606

17. Ortega y Gasset, Jose: *Revolt of Masses*, W.W. Norton & Company (1994)

18. Rigdon, Mary L, Kevin A McCabe and Vernon L Smith: Sustaining Cooperation in Trust Games, *Economic Journal*, Vol. 117, No. 522 (July 2007), pp. 991 - 1007

19. Rothbard, Murray N: *Power and Market*, Sheed Andrews and Mcmeel, Kansas City (1977)

20. Salin, Pascal: *Libéralisme*, Editions Odile Jacob, Paris (2000)

21. Yamagishi, Toshio: Social Dilemmas, In: Karen S Cook, Gary A Fine and James S House (eds): *Sociological Perspectives on Social Psychology*, Allyn & Bacon (1995), pp. 311 - 335