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ECONOMIC COOPERATION IN TURKISH CULTURE: PUBLIC GOODS GAMES AND LONELY ELEPHANTS

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Abstract

While the public good experiment has been used to analyze cooperation among various groups in Western Europe and North America, it has not been extensively used in other contexts such as Turkey. This project seeks to rectify that and explore how Turkish university students informally self govern. By employing the public good experiment among a cohort of students attending universities in İzmir, Turkey and Adıyaman, Turkey, we hope to quantitatively analyze the factors which lead to altruistic punishment, to antisocial punishment, and ultimately to enhanced cooperation in Turkish society.

JEL Codes: C9
Key Words: Cooperation; Free Riding; Altruism; Punishment; Trust; Experimental Economics; Public Good Experiments

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1. Introduction

Most economic decisions lie beyond the control of just one individual. Rather, a smooth functioning economy requires trust and cooperation between separate individual entities who are often anonymous parties. Traditional economic theory tells us that somehow these individual entities are able to effortlessly make utility-maximizing decisions which are both completely rational and also fully account for all possible externalities. Theory leads us to believe that this alchemy of economic agents seeking their own self-interest ultimately leads to the optimal allocation of scarce resources.

Experimental economics is able to explore trust and cooperation in anonymous economic interactions, as well as the tenuous equilibrium which exists balancing cooperators and noncooperators together. Multilateral cooperation problems can be modeled in public goods games in which participants individually make decisions about their level of cooperation independent of the choices of other participants. Experimental results have identified a variety of factors that enhance and discourage cooperation. These experimental results have helped to distinguish between the behavior of actual human beings and that of idealized human beings found in traditional economic theory.

Further refinement has occurred as economists have broadened the populations included in these experiments. Great variety exists in the ways people of various backgrounds, various positions in society, and various cultures make decisions in these public goods game experiments. One area where this diversity is strongly seen is in the aggregate differences between developed and developing countries including Russia, former Soviet countries, and the countries of the Muslim world.

A few explanations have been given for these differences – weakness of the rule of law, weak norms of civic cooperation, etc – but these differences have not been explored in significant detail (Herrmann et al. 2008). Furthermore, these explanations are limited to exploring the differences in between various societies. An area ripe for exploration is the diversity of behavior within these societies with an emphasis on determining whether there are individual characteristics which distinguish cooperative participants from free loaders. Understanding the diversity of behavior as well as the distinguishing characteristics between cooperative participants and free loaders enables evolutionary economics to further understand the structure and growth of the economy.

The purpose of this thesis is to examine trust and cooperation within Turkey through the public goods game and to attempt to identify individual characteristics which distinguish cooperative participants from free loaders. In order to capture geographical and cultural variations of cooperatıon levels among Turkish university students, two different locations were selected (Izmir in the West and Adiyaman in the East). The fieldwork was completed during May 2010. The project was support by a grant from Izmir University of Economic's Office of Scientific Research.

The structure of the paper is as follows. The second section discusses the related literature. The generality of public goods games, the contributions of experimental economics onto the analysis of public goods games, and the significance of punishment are some of the topics covered by the second section. In the third section the background information and the details of experiments conducted in İzmir and Adıyaman are explained. In the fourth section the empirical results are discussed. The last section concludes.

2. Related Literature

Cooperation and trust are essential components of a healthy, functioning economy. As life becomes more and more interdependent our even seemingly anonymous and trivial interactions with one another increase in significance. On an interpersonal level, cooperation and trust ensure that our business relationships and interactions function. Contracts are unable to contain provisions for every possibility. At some point, one must take a leap of faith and believe that the other party will make good on their commitment. Without this mutual trust and cooperation, individuals in society would be paralyzed and unable to move forward. Nonetheless, examples of broken trust and non-cooperation are unfortunately common. When a system leaves room to be manipulated, people tend to take advantage of it. A question economists and public policy makers seek to answer is how society should best react to and work to reduce these instances of broken trust and non-cooperation.

Beyond the interpersonal level, there are societal and even global issues that require deep levels of cooperation and trust between multiple parties to solve. Examples of multilateral issues requiring trust and cooperation abound and include such issues as global warming, climate change, and environmental protection; public resource management of fisheries, forests, and grazing land; collective action including support of charities, product boycotts, and labor relations including strikes; functional governance including tax compliance, voting, and neighborhood/park safety and cleanliness; teamwork in instances like collective hunting, warfare, and sports; and so on. Each of these instances requires cooperation for progress.

As demonstrated by the recent strikes in Greece over the newly adopted austerity measures, cooperation and trust in our governments is quite important and a lack of it can paralyze a country leading to unfortunate results. Throughout Izmir there are several reminders of the importance of cooperation and trust. Signaling the importance of cooperation on the city level, the Izmir Büyükşehir Belediyesi (the greater Izmir Municipality) put up billboards this spring with the words, "Birlikte Güçlüyüz," which mean "Together We are Strong" and encourage residents of Izmir to cooperate for the good of the community. Likewise, the Izmir building of the Central Bank of Turkey building has the words, "Vergi Kalkınmanın Temelidir," which mean, "Taxes are the Foundation of Development," and is intended to encourage people to support the development of Turkey by paying their taxes. All these examples show that cooperation or lack thereof has significant impact on society for good or for bad.

Having established that cooperation is important on both a micro and a macro level in society in general and in the economy in particular, it is important to study cooperation and trust. What factors facilitate it? What hinders it? What are the economic benefits of cooperation or costs of a lack thereof? Does cooperation look the same everywhere or are there cultural variations to it? How can policy makers encourage cooperation and how can individuals seek it out in their relationships? While it may be easy to solicit opinions about these questions, it's much more difficult to study these questions in an empirical way. Fortunately, for researchers an economic tool exists to study just these issues: the public goods game.

Simply, a public goods game involves a group of people each with his or her own endowment who decide simultaneously to contribute it, or a portion of it, into a group project. Whatever is invested in the group project is multiplied by a fixed growth factor and then returned in equal proportions to all the group members regardless of their initial contribution to the project and added to whatever remains of each member's original endowment. The growth factor is set such that the return from each unit invested in the

group project to the individual is less than one, but the returns to the individual when all group members have invested together into the group project are greater than one. In this way, it is always in one's interest to not contribute to the group project. However, the growth unit is set such that if everyone were to invest into the group project then everyone would receive more than they had put in.

Consider for example the situation when there are four members in a group each of whom receives an endowment of 20 units and the growth factor is set at 0.4. Ayşe could choose to contribute no units to the group project. If her other three group members choose likewise not to contribute to the group project, then Ayşe would receive nothing from the group project and would end the period with the original 20 units left in her endowment (as would the other members of her group). If instead her other three group members were to contribute their entire endowments (a group total of 60 units) to the group project, then Ayşe would receive 24 units from the group project (the group total of 60 units multiplied by the growth factor of 0.4) in addition to the 20 units left in her endowment for a total of 44 units. Her other three group mates having contributed their entire endowments to the group project would receive a total of 24 units each all from the group project.

Now consider the opposite situation where Ayşe contributes all her 20 units into the group project. If no other group members contributes to the group project, then Ayşe would end the period with a total of 8 units all of which she would receive from the group project (the group total of 20 units multiplied by the growth factor of 0.4) having contributed her entire endowment in the group project. In contrast her group members would each add 8 units they received from the group project to the 20 units left in their endowments for a total of 28 units each. Finally, if Ayşe as well as her three other group members each contributed their entire endowments of 20 units to the group project then they would each receive 32 units from the project (the group total of 80 units multiplied by the growth factor of 0.4).

As can be seen in this example, Ayşe is always better not contributing anything to the group project. If no one else contributes, the 20 units Ayşe chooses not to contribute to the group project would be greater than the 8 units she would receive had she fully contributed her entire endowment to the group project. Likewise, if everyone else contributes the maximum amount in the project, the 44 units Ayşe receives by not contributing anything to the project would be greater than the 32 units she would have received had she fully contributed her endowment to the group project. One point to be aware of: while Ayşe's individual total is maximized when everyone else, but her fully contributes to the group project; the groups total is maximized when everyone fully contributes to the group project (116 units vs. 132 units). In this instance of complete group cooperation the maximum wealth is created. Even though the group as a whole does best when everyone invests the maximum amount in the project, Ayşe's dominant strategy, in the language of game theory, is to never contribute in the group project and the Nash equilibrium of a public goods game is for there to be no contributions by any group member to the group project.

The public goods game is able to model multilateral cooperation problems as individuals simultaneously and independently make contribution choices. The public goods game forces participants to act in an entirely self-interest way by keeping one's endowment and not contributing anything to the group project or in a cooperative, group-interested way by contributing from one's endowment to the group project. Through the decisions made in public goods games by participants, experimental economists are able to further study more fully the ephemeral characteristics of trust and cooperation. Researchers are able to explore these characteristics through various modifications to the treatments of these games and through analysis of individual performance together with

survey/questionnaire responses. Public goods games are a tool that enables economists to study trust and cooperation not *in vitro* as is done in theoretical work, but rather *in vivo* in real world performance of participants.

The *in vivo* real world performance of participants has overall proven to be different, at least in initial periods of play, than what the Nash equilibrium for a public goods game implies. General observations are that most people contrary to the dominant strategy choose to contribute a fairly significant portion of their endowment to the group project. While initial contributions to the group project start higher than expected, over time the level of contributions decrease. This decrease in contribution over time has been explained as the response of conditional cooperators to the behavior free riders. Free riders are those participants who do not contribute to the group project, but share in its benefits. In addition to these general observations, a variety of additional studies have identified factors that enhance, discourage, or have no effect on contribution.

Gachter and Herrmann (2008) conducted an extensive review of the literature and identified the factors that most significantly effect contribution levels. Factors that increase contributions to the public goods games are reputation effects, repeated encounters, multiple periods of play with the same group members, communication, and a higher group project growth multiplier (although this change in multiplier does not alter the dominant strategy of non-contribution). Anonymity, one-shot play, perpetually changing group membership, and a lack of communication all tend to discourage contribution. It does not appear that group size has a significant impact on contribution behavior. These findings will be further examined below.

Reputation effects occur when behavior is directly associated with the one who exhibits it. When play is anonymous and group members don't know with whom they are playing, contributions are lower. In contrast, when group member identities are common knowledge, contributions increase (Gachter and Fehr 1999). These reputation effects play out most when there is some degree of group identity which acts "like a 'lubricant' that makes social exchange effective." Reputation effects have also been seen in other research regarding cooperative behavior (even when reputation effect is implied) (Andreoni and Petrie 2004; Haley and Fessler 2005; Semmann et al. 2005; and Milinski et al. 2002).

The frequency of game play – whether the game is a one-shot encounter or a repeated series of encounters – also significantly effects the contribution levels of the participants. The benefits of repeated play are further enhanced when group members remain the same in consecutive rounds of play (Fehr and Gachter 2000; Sonnemens et al. 1999). However, even group composition randomization throughout the successive rounds of play did not entirely negate the positive effects gained by repeated interactions. A somewhat unexpected observation is that contributions are still present beyond a superficial level even in one-shot, non-repeated encounters where there is seemingly no reason for one to cooperate (Gachter and Herrman 2010). In spite of the anonymity of these interactions, reputation effects – even though reputation is only known to one's own self – are nonetheless strong enough to lead to increased contribution levels.

Finally, one of the factors that most significantly increases the level of contribution in public goods games is the ability for group members to communicate with one another during play (Ostrom et al. 1992; Brosig et al. 2003; and Charness and Dufwenberg 2006). As participants communicate with one another, they are able to coordinate their actions before the game begins and express appreciation (or disappointment) after the game concludes. The research implies that individuals in these games tend to prefer the avoidance of guilt to the receipt of praise.

Regardless of the factors that significantly impact contribution levels, research has shown that over additional rounds of anonymous play contributions to the group project often decrease sometimes entirely. This phenomenon has been explained by the theory

that most people are conditional cooperators (Kelley and Stahelski 1970; Dufwenberg et al. 2006; and Gachter and Herrmann 2010). A conditional cooperator is a person who is willing to cooperate – in this case by contributing to a group project – so long as the other participants in the group are also cooperating. When everyone cooperates there is a positive feedback loop which can maintain high levels of contributions. However, when conditional cooperators are in the same group as free loaders, the free loaders lack of contribution (and equal share of the group project benefits) decreases the willingness of conditional cooperators to contribute to the group project.

Fischbacher et al. undertook a study in 2001 to determine what proportion of the population are conditional cooperators versus free riders. According to their study of 44 Swiss university students, the population was made up of roughly half conditional cooperators, a third free riders, and with the remaining classified as nontraditional participants. Whether these proportions are unique to Swiss students or are similar elsewhere is an interesting question for future research. Öneş and Putterman conducted a similar study in 2005 grouping participants by type – top cooperators in one group, free loaders in another, etc – and discovered that indeed group outcomes are predicated on group type and that when grouped together top cooperators achieve near ideal results.

In light of the prevalence of free riders is there then no hope for increasing (or even sustaining) levels of cooperation in public goods games? Research has shown us a potential solution: introducing a punishment treatment. Such a treatment enables group members to punish one another. In a typical punishment treatment, punishment is costly to both the punisher and the punished. The punisher pays a fee for each punishment unit, that is for every punishment unit a punisher gives the total number of his or her own units decrease by one unit. Meanwhile, for each punishment unit the punished person receives, his or her total units are reduced (often by a multiple of the punishment units received). When researchers introduce a punishment treatment to public goods games, they find that cooperation is prevented from deteriorating. Not only is the punishment treatment a stopgap which prevents the deterioration of contribution levels, in certain circumstances over time the punishment treatment even leads to increased levels of contribution (Yamagishi 1986; Ostrom et al. 1992; and Fehr and Gachter 2000).

As is expected, punishment is used across the board to punish free riders. When the punishment treatment is introduced in a common goods game conditional cooperators have an alternative response to free riders (Herrmann et al. 2008). Whereas previously, conditional cooperators could either endure unmerited rewarding of free riders by choosing to continue to contribute to the group project or alternatively they could choose retain more of their endowment by reducing their own contributions to the group project. As was explained above, conditional cooperators in groups containing free riders eventually reduce their contributions to zero. With the introduction of the punishment treatment, conditional cooperators have a new option of continuing to cooperate while at the same time being able to express their dissatisfaction with free riders through costly punishment, which negatively impacts the unmerited returns of free riders.

The punishment treatment increases and/or stabilizes cooperation at higher levels than would be expected in a treatment without punishment (Boyd et al. 2003). This is an especially interesting finding, because evolutionary theorists had previously theorized that such "altruistic punishment" would not be present in large groups of nonrelatives. Whereas one might incur a personal cost for the benefit of a group of one's kin, previous theories concluded that individuals would not choose to engage in similar costly activity when the primary beneficiaries were a large group of nonrelated people. That altruistic punishment exists even in large groups of nonrelatives indicates that something beyond evolutionary self-preservation is at play.

Altruistic punishment is able to create a positive feedback loop whereby punishment of free riders leads to increased contributions over repeated interactions (Fehr and Gachter 2000; Masclet et al. 2003). Wondering whether it was just the adverse monetary consequences of punishment that led to increased contributions, Masclet et al. offered participants in another treatment the opportunity to assign a "non-monetary" punishment unit at no personal cost. They discovered that even a "non-monetary" punishment unit led to an increase in overall group contributions, although, not as significant or lasting an increase as monetary punishment did.

While altruistic punishment looks to be an ideal solution to the free rider problem in public goods games, the reality is more complicated. It is true that punishment treatments lead to stabilized and sometimes increased contributions. However, it is important to remember that punishment is costly, that is punishment comes at a price. Usually public goods games last for no more than ten periods and in that duration the monetary costs of punishments, both the costs incurred by assigning punishment and the punishment costs themselves to received by the punished, are greater than the increased contributions that punishment encourages (Fehr and Gachter 2000). Overall, punishment results in net losses, at least in games with limited numbers of periods, and therefore is not a very efficient way of increasing contributions. Herrmann et al. conducted public goods games in sixteen different countries in a study in 2008 and in thirteen of the sixteen countries participants accumulated less points in the punishment treatment than in the non-punishment treatment. In order for punishment to be an efficient means of increasing group wealth, an important equilibrium needs to be realized between punishment's cooperation enhancing effects and wealth destroying costs.

Over a long enough time frame punishment does become an effective. While punishment is not effective at enhancing cooperation in most public goods games which last for no more than ten periods, as the number of periods of play increase so does the effectiveness of punishment. When the number of periods was expanded to fifty, punishment was found to be an efficient way to enhance participant contributions and overall cooperation increased compared to a non-punishment treatment (Gachter et al 2008). Beyond laboratory experiments, there is no reason to think that in real life situations altruistic punishment, while certainly costly especially at first, wouldn't reap dividends over the long term as well.

A natural question to ask is what exactly is it that punishment is doing. How does altruistic punishment lead to increased contribution and cooperation? Masclet et al. (2003) propose that punishment is effective for two reasons: (1) participants realize that punishment can make free-riding unprofitable and therefore, seeking to maximize their individual payoffs, former free riders increase their contributions in an act of self-interest and/or (2) punishment is a way of communicating in an environment where otherwise communication is not allowed and this communication leads to increased contributions. Participants are able to express through their assignment of punishment points (or lack thereof) their feelings about other group members' levels of participation. This expression of feelings through the assignment of punishment points can in turn cause the recipient to feel of shame for being labeled as a free rider. Those who were shamed through the receipt of punishment points might then be motivated to make larger contributions in the following rounds in an effort to reduce one's shame and increase one's reputation. In a sense, peer pressure is activated through the punishment treatment and this motivates participants to behave more cooperatively (Kandel and Lazear 1992).

While punishment is primarily used altruistically as a tool to punish those who contribute less than average to the group project, group members are not restricted to using punishment in this way. It turns out that punishment is a double-edged sword. Sometimes punishment is used for reasons other than punishing free rider. Consider for

example the situation where one resident of an apartment complex goes above and beyond the call of duty to clean the stairwell. Normally such an individual would be appreciated or even rewarded for her efforts. However, it is conceivable that such an individual would instead be punished. It's not difficult to imagine an especially persnickety resident who in lieu of gratitude creates a mess in front of our good Samaritan's door. Whether out of shame or aggressiveness or something else, this persnickety resident has anti-socially punished the good Samaritan resident.

We see this same phenomenon in public goods games when those who contribute less than average to the group project punish those who contribute more than average. While such behavior might be some sort of non-rational idiosyncrasy, another explanation might be that perhaps the punisher is using punishment as a means to retaliate against previously received punishments (Nikiforakis 2007). While post hoc theories about the motivation of anti-social punishment certainly do exist, an interesting research topic would be to investigate punishment motivations in real time. Whereas the punishment of free riding generally increases cooperation, this anti-social punishment of high contributors generally has the opposite effect and reduces cooperation. Furthermore, when extensive opportunities exist to avenge received sanctions over several rounds of punishment, contributions decrease and there are net losses (Denant-Boemont et al. 2007).

Anti-social punishment was observed prevalently in a cross-cultural study conducted by Herrmann et al. in 16 different participant pools in 2008. Similar levels of altruistic punishment of free riders was observed throughout all the various participant pools. However great diversity existed in the extent to which the various participant pools engaged in anti-social punishment. As was written earlier, punishment didn't always enhance outcomes (in thirteen of the countries in the Herrmann study, participants accumulated less points in the punishment treatment than in the non-punishment treatment). Figure 1 below geographically illustrates the participant pools where anti-social punishment was most prevalent.

Figure 1: Prevalence of Anti-Social Punishment (Herrmann et al. 2008)

This map was created using Google Maps and ZeeMaps.

The blue pins indicate participant pools where punishment was predominantly altruistic with limited amounts of anti-social punishment. The red pins indicate pools where in addition to altruistic punishment, anti-social punishment was observed with significant frequency. It should be noted that the blue pins are located primarily in

developed, western countries home to the majority of public goods games research. Anti-social punishment was much more prevalent in non-Western, developing countries (countries in which previous public goods game research had not been conducted). Potentially, the countries where the majority of public goods game research has been conducted might be the exception and not the norm of typical punishment behavior.

Herrmann et al. went on to econometrically analyze the punishment behavior (both altruistic and anti-social) on a societal level with criteria commonly used by social scientists in the classification of countries. They found that strong norms of civic cooperation in a country are associated with more stringent punishment of free riders and that anti-social punishment was significantly correlated with weak norms of civic cooperation and weakness of the rule of law. Norms of civic cooperation and weakness of the rule of law explain the variations on a cross-cultural level, but variations of punishment behavior on an individual level are left unexplained.

A study conducted in 2004 by Gachter et al. in rural and urban Russia – one of the countries identified in the Herrmann et al. study which had a significant level of anti-social punishment – compared individual participants' socio-economic background as well as certain measurements of trust with their performance in a public goods game. On an individual level, Gachter et al. attempted to see whether these criteria explained contribution behavior in two one-shot public goods games (one with and one without a punishment treatment). They found that contribution behavior was not directly impacted by socio-economic background, but instead was significantly impacted by trust attitudes which were in turn influenced by socio-economic background. Furthermore, three trust attitude variables (*GSS Fair*, *GSS Trust*, and *Trust Strangers, to be explained in more detail later*) were shown to significantly impact contribution behavior.

3. The Background

Cooperation and trust are essential components of a healthy, functioning economy. As life becomes more and more interdependent, our even seemingly anonymous and trivial interactions with one another increase in significance. On an interpersonal level, cooperation and trust ensure that our business relationships and interactions function. Contracts are unable to contain provisions for every possibility. At some point, one must take a leap of faith and believe that the other party will make good on their commitment. Without this mutual trust and cooperation, individuals in society would be paralyzed and unable to move forward. Nonetheless, examples of broken trust and non-cooperation are unfortunately common. When a system leaves room to be manipulated, people tend to take advantage of it. A question economists and public policy makers seek to answer is how society should best react to and work to reduce these instances of broken trust and non-cooperation.

Beyond the interpersonal level, there are societal and even global issues that require deep levels of cooperation and trust between multiple parties to solve. Examples of multilateral issues requiring trust and cooperation abound and include such issues as global warming, climate change, and environmental protection; public resource management of fisheries, forests, and grazing land; collective action including support of charities, product boycotts, and labor relations including strikes; functional governance including tax compliance, voting, and neighborhood/park safety and cleanliness; teamwork in instances like collective hunting, warfare, and sports; and so on. Each of these instances requires cooperation for progress.

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cooperation on the city level, the Izmir Büyükşehir Belediyesi (the greater Izmir Municipality) put up billboards this spring with the words, "Birlikte Güçlüyüz," which mean "Together We are Strong" and encourage residents of Izmir to cooperate for the good of the community. Likewise, the Izmir building of the Central Bank of Turkey building has the words, "Vergi Kalkinmanın Temeldir," which mean, "Taxes are the Foundation of Development," and is intended to encourage people to support the development of Turkey by paying their taxes. All these examples show that cooperation or lack thereof has significant impact on society for good or for bad.

Having established that cooperation is important on both a micro and a macro level in society in general and in the economy in particular, it is important to study cooperation and trust. What factors facilitate it? What hinders it? What are the economic benefits of cooperation or costs of a lack thereof? Does cooperation look the same everywhere or are there cultural variations to it? How can policy makers encourage cooperation and how can individuals seek it out in their relationships? While it may be easy to solicit opinions about these questions, it's much more difficult to study these questions in an empirical way. Fortunately, for researchers an economic tool exists to study just these issues: the public goods game.

Simply, a public goods game involves a group of people each with his or her own endowment who decide simultaneously to contribute it, or a portion of it, into a group project. Whatever is invested in the group project is multiplied by a fixed growth factor and then returned in equal proportions to all the group members regardless of their initial contribution to the project and added to whatever remains of each member's original endowment. The growth factor is set such that the return from each unit invested in the group project to the individual is less than one, but the returns to the individual when all group members have invested together into the group project are greater than one. In this way, it is always in one's interest to not contribute to the group project. However, the growth unit is set such that if everyone were to invest into the group project then everyone would receive more than they had put in.

Consider for example the situation when there are four members in a group each of whom receives an endowment of 20 units and the growth factor is set at 0.4. Ayşe could choose to contribute no units to the group project. If her other three group members choose likewise not to contribute to the group project, then Ayşe would receive nothing from the group project and would end the period with the original 20 units left in her endowment (as would the other members of her group). If instead her other three group members were to contribute their entire endowments (a group total of 60 units) to the group project, then Ayşe would receive 24 units from the group project (the group total of 60 units multiplied by the growth factor of 0.4) in addition to the 20 units left in her endowment for a total of 44 units. Her other three group mates having contributed their entire endowments to the group project would receive a total of 24 units each all from the group project.

Now consider the opposite situation where Ayşe contributes all her 20 units into the group project. If no other group members contributes to the group project, then Ayşe would end the period with a total of 8 units all of which she would receive from the group project (the group total of 20 units multiplied by the growth factor of 0.4) having contributed her entire endowment in the group project. In contrast her group members would each add 8 units they received from the group project to the 20 units left in their endowments for a total of 28 units each. Finally, if Ayşe as well as her three other group members each contributed their entire endowments of 20 units to the group project then they would each receive 32 units from the project (the group total of 80 units multiplied by the growth factor of 0.4).

As can be seen in this example, Ayşe is always better not contributing anything to the group project. If no one else contributes, the 20 units Ayşe chooses not to contribute to the group project would be greater than the 8 units she would receive had she fully contributed her entire endowment to the group project. Likewise, if everyone else contributes the maximum amount in the project, the 44 units Ayşe receives by not contributing anything to the project would be greater than the 32 units she would have received had she fully contributed her endowment to the group project. One point to be aware of: while Ayşe's individual total is maximized when everyone else, but her fully contributes to the group project; the groups total is maximized when everyone fully contributes to the group project (116 units vs. 132 units). In this instance of complete group cooperation the maximum wealth is created. Even though the group as a whole does best when everyone invests the maximum amount in the project, Ayşe's dominant strategy, in the language of game theory, is to never contribute in the group project and the Nash equilibrium of a public goods game is for there to be no contributions by any group member to the group project.

The public goods game is able to model multilateral cooperation problems as individuals simultaneously and independently make contribution choices. The public goods game forces participants to act in an entirely self-interest way by keeping one's endowment and not contributing anything to the group project or in a cooperative, group-interested way by contributing from one's endowment to the group project. Through the decisions made in public goods games by participants, experimental economists are able to further study more fully the ephemeral characteristics of trust and cooperation. Researchers are able to explore these characteristics through various modifications to the treatments of these games and through analysis of individual performance together with survey/questionnaire responses. Public goods games are a tool that enables economists to study trust and cooperation not *in vitro* as is done in theoretical work, but rather *in vivo* in real world performance of participants.

The *in vivo* real world performance of participants has overall proven to be different, at least in initial periods of play, than what the Nash equilibrium for a public goods game implies. General observations are that most people contrary to the dominant strategy choose to contribute a fairly significant portion of their endowment to the group project. While initial contributions to the group project start higher than expected, over time the level of contributions decrease. This decrease in contribution over time has been explained as the response of conditional cooperators to the behavior free riders. Free riders are those participants who do not contribute to the group project, but share in its benefits. In addition to these general observations, a variety of additional studies have identified factors that enhance, discourage, or have no effect on contribution.

Gachter and Herrmann (2008) conducted an extensive review of the literature and identified the factors that most significantly effect contribution levels. Factors that increase contributions to the public goods games are reputation effects, repeated encounters, multiple periods of play with the same group members, communication, and a higher group project growth multiplier (although this change in multiplier does not alter the dominant strategy of non-contribution). Anonymity, one-shot play, perpetually changing group membership, and a lack of communication all tend to discourage contribution. It does not appear that group size has a significant impact on contribution behavior. These findings will be further examined below.

Reputation effects occur when behavior is directly associated with the one who exhibits it. When play is anonymous and group members don't know with whom they are playing, contributions are lower. In contrast, when group member identities are common knowledge, contributions increase (Gachter and Fehr 1999). These reputation effects play out most when there is some degree of group identity which acts "like a 'lubricant' that

makes social exchange effective." Reputation effects have also been seen in other research regarding cooperative behavior (even when reputation effect is implied) (Andreoni and Petrie 2004; Haley and Fessler 2005; Semmann et al. 2005; and Milinski et al. 2002).

The frequency of game play – whether the game is a one-shot encounter or a repeated series of encounters – also significantly effects the contribution levels of the participants. The benefits of repeated play are further enhanced when group members remain the same in consecutive rounds of play (Fehr and Gachter 2000; Sonnemens et al. 1999). However, even group composition randomization throughout the successive rounds of play did not entirely negate the positive effects gained by repeated interactions. A somewhat unexpected observation is that contributions are still present beyond a superficial level even in one-shot, non-repeated encounters where there is seemingly no reason for one to cooperate (Gachter and Herrman 2010). In spite of the anonymity of these interactions, reputation effects – even though reputation is only known to one's own self – are nonetheless strong enough to lead to increased contribution levels.

Finally, one of the factors that most significantly increases the level of contribution in public goods games is the ability for group members to communicate with one another during play (Ostrom et al. 1992; Brosig et al. 2003; and Charness and Dufwenberg 2006). As participants communicate with one another, they are able to coordinate their actions before the game begins and express appreciation (or disappointment) after the game concludes. The research implies that individuals in these games tend to prefer the avoidance of guilt to the receipt of praise.

Regardless of the factors that significantly impact contribution levels, research has shown that over additional rounds of anonymous play contributions to the group project often decrease sometimes entirely. This phenomenon has been explained by the theory that most people are conditional cooperators (Kelley and Stahelski 1970; Dufwenberg et al. 2006; and Gachter and Herrmann 2010). A conditional cooperator is a person who is willing to cooperate – in this case by contributing to a group project – so long as the other participants in the group are also cooperating. When everyone cooperates there is a positive feedback loop which can maintain high levels of contributions. However, when conditional cooperators are in the same group as free loaders, the free loaders lack of contribution (and equal share of the group project benefits) decreases the willingness of conditional cooperators to contribute to the group project.

Fischbacher et al. undertook a study in 2001 to determine what proportion of the population are conditional cooperators versus free riders. According to their study of 44 Swiss university students, the population was made up of roughly half conditional cooperators, a third free riders, and with the remaining classified as nontraditional participants. Whether these proportions are unique to Swiss students or are similar elsewhere is an interesting question for future research. Öneş and Putterman conducted a similar study in 2005 grouping participants by type – top cooperators in one group, free loaders in another, etc – and discovered that indeed group outcomes are predicated on group type and that when grouped together top cooperators achieve near ideal results.

In light of the prevalence of free riders is there then no hope for increasing (or even sustaining) levels of cooperation in public goods games? Research has shown us a potential solution: introducing a punishment treatment. Such a treatment enables group members to punish one another. In a typical punishment treatment, punishment is costly to both the punisher and the punished. The punisher pays a fee for each punishment unit, that is for every punishment unit a punisher gives the total number of his or her own units decrease by one unit. Meanwhile, for each punishment unit the punished person receives, his or her total units are reduced (often by a multiple of the punishment units received). When researchers introduce a punishment treatment to public goods games, they find that cooperation is prevented from deteriorating. Not only is the punishment treatment a

stopgap which prevents the deterioration of contribution levels, in certain circumstances over time the punishment treatment even leads to increased levels of contribution (Yamagishi 1986; Ostrom et al. 1992; and Fehr and Gachter 2000).

As is expected, punishment is used across the board to punish free riders. When the punishment treatment is introduced in a common goods game conditional cooperators have an alternative response to free riders (Herrmann et al. 2008). Whereas previously, conditional cooperators could either endure unmerited rewarding of free riders by choosing to continue to contribute to the group project or alternatively they could choose retain more of their endowment by reducing their own contributions to the group project. As was explained above, conditional cooperators in groups containing free riders eventually reduce their contributions to zero. With the introduction of the punishment treatment, conditional cooperators have a new option of continuing to cooperate while at the same time being able to express their dissatisfaction with free riders through costly punishment, which negatively impacts the unmerited returns of free riders.

The punishment treatment increases and/or stabilizes cooperation at higher levels than would be expected in a treatment without punishment (Boyd et al. 2003). This is an especially interesting finding, because evolutionary theorists had previously theorized that such "altruistic punishment" would not be present in large groups of nonrelatives. Whereas one might incur a personal cost for the benefit of a group of one's kin, previous theories concluded that individuals would not choose to engage in similar costly activity when the primary beneficiaries were a large group of nonrelated people. That altruistic punishment exists even in large groups of nonrelatives indicates that something beyond evolutionary self-preservation is at play.

Altruistic punishment is able to create a positive feedback loop whereby punishment of free riders leads to increased contributions over repeated interactions (Fehr and Gachter 2000; Masclet et al. 2003). Wondering whether it was just the adverse monetary consequences of punishment that led to increased contributions, Masclet et al. offered participants in another treatment the opportunity to assign a "non-monetary" punishment unit at no personal cost. They discovered that even a "non-monetary" punishment unit led to an increase in overall group contributions, although, not as significant or lasting an increase as monetary punishment did.

While altruistic punishment looks to be an ideal solution to the free rider problem in public goods games, the reality is more complicated. It is true that punishment treatments lead to stabilized and sometimes increased contributions. However, it is important to remember that punishment is costly, that is punishment comes at a price. Usually public goods games last for no more than ten periods and in that duration the monetary costs of punishments, both the costs incurred by assigning punishment and the punishment costs themselves to received by the punished, are greater than the increased contributions that punishment encourages (Fehr and Gachter 2000). Overall, punishment results in net losses, at least in games with limited numbers of periods, and therefore is not a very efficient way of increasing contributions. Herrmann et al. conducted public goods games in sixteen different countries in a study in 2008 and in thirteen of the sixteen countries participants accumulated less points in the punishment treatment than in the non-punishment treatment. In order for punishment to be an efficient means of increasing group wealth, an important equilibrium needs to be realized between punishment's cooperation enhancing effects and wealth destroying costs.

Over a long enough time frame punishment does become an effective. While punishment is not effective at enhancing cooperation in most public goods games which last for no more than ten periods, as the number of periods of play increase so does the effectiveness of punishment. When the number of periods was expanded to fifty, punishment was found to be an efficient way to enhance participant contributions and

overall cooperation increased compared to a non-punishment treatment (Gachter et al 2008). Beyond laboratory experiments, there is no reason to think that in real life situations altruistic punishment, while certainly costly especially at first, wouldn't reap dividends over the long term as well.

A natural question to ask is what exactly is it that punishment is doing. How does altruistic punishment lead to increased contribution and cooperation? Masclet et al. (2003) propose that punishment is effective for two reasons: (1) participants realize that punishment can make free-riding unprofitable and therefore, seeking to maximize their individual payoffs, former free riders increase their contributions in an act of self-interest and/or (2) punishment is a way of communicating in an environment where otherwise communication is not allowed and this communication leads to increased contributions. Participants are able to express through their assignment of punishment points (or lack thereof) their feelings about other group members' levels of participation. This expression of feelings through the assignment of punishment points can in turn cause the recipient to feel of shame for being labeled as a free rider. Those who were shamed through the receipt of punishment points might then be motivated to make larger contributions in the following rounds in an effort to reduce one's shame and increase one's reputation. In a sense, peer pressure is activated through the punishment treatment and this motivates participants to behave more cooperatively (Kandel and Lazear 1992).

While punishment is primarily used altruistically as a tool to punish those who contribute less than average to the group project, group members are not restricted to using punishment in this way. It turns out that punishment is a double-edged sword. Sometimes punishment is used for reasons other than punishing free rider. Consider for example the situation where one resident of an apartment complex goes above and beyond the call of duty to clean the stairwell. Normally such an individual would be appreciated or even rewarded for her efforts. However, it is conceivable that such an individual would instead be punished. It's not difficult to imagine an especially persnickety resident who in lieu of gratitude creates a mess in front of our good Samaritan's door. Whether out of shame or aggressiveness or something else, this persnickety resident has anti-socially punished the good Samaritan resident.

We see this same phenomenon in public goods games when those who contribute less than average to the group project punish those who contribute more than average. While such behavior might be some sort of non-rational idiosyncrasy, another explanation might be that perhaps the punisher is using punishment as a means to retaliate against previously received punishments (Nikiforakis 2007). While post hoc theories about the motivation of anti-social punishment certainly do exist, an interesting research topic would be to investigate punishment motivations in real time. Whereas the punishment of free riding generally increases cooperation, this anti-social punishment of high contributors generally has the opposite effect and reduces cooperation. Furthermore, when extensive opportunities exist to avenge received sanctions over several rounds of punishment, contributions decrease and there are net losses (Denant-Boemont et al. 2007).

Anti-social punishment was observed prevalently in a cross-cultural study conducted by Herrmann et al. in 16 different participant pools in 2008. Similar levels of altruistic punishment of free riders was observed throughout all the various participant pools. However great diversity existed in the extent to which the various participant pools engaged in anti-social punishment. As was written earlier, punishment didn't always enhance outcomes (in thirteen of the countries in the Herrmann study, participants accumulated less points in the punishment treatment than in the non-punishment treatment). Figure 1 below geographically illustrates the participant pools where anti-social punishment was most prevalent.

Figure 2: Prevalence of Anti-Social Punishment (Herrmann et al. 2008)

This map was created using Google Maps and ZeeMaps.

The blue pins indicate participant pools where punishment was predominantly altruistic with limited amounts of anti-social punishment. The red pins indicate pools where in addition to altruistic punishment, anti-social punishment was observed with significant frequency. It should be noted that the blue pins are located primarily in developed, western countries home to the majority of public goods games research. Anti-social punishment was much more prevalent in non-Western, developing countries (countries in which previous public goods game research had not been conducted). Potentially, the countries where the majority of public goods game research has been conducted might be the exception and not the norm of typical punishment behavior.

Herrmann et al. went on to econometrically analyze the punishment behavior (both altruistic and anti-social) on a societal level with criteria commonly used by social scientists in the classification of countries. They found that strong norms of civic cooperation in a country are associated with more stringent punishment of free riders and that anti-social punishment was significantly correlated with weak norms of civic cooperation and weakness of the rule of law. Norms of civic cooperation and weakness of the rule of law explain the variations on a cross-cultural level, but variations of punishment behavior on an individual level are left unexplained.

A study conducted in 2004 by Gachter et al. in rural and urban Russia – one of the countries identified in the Herrmann et al. study which had a significant level of anti-social punishment – compared individual participants' socio-economic background as well as certain measurements of trust with their performance in a public goods game. On an individual level, Gachter et al. attempted to see whether these criteria explained contribution behavior in two one-shot public goods games (one with and one without a punishment treatment). They found that contribution behavior was not directly impacted by socio-economic background, but instead was significantly impacted by trust attitudes which were in turn influenced by socio-economic background. Furthermore, three trust attitude variables (*GSS Fair*, *GSS Trust*, and *Trust Strangers, to be explained in more detail later*) were shown to significantly impact contribution behavior.

4. Analysis and Results

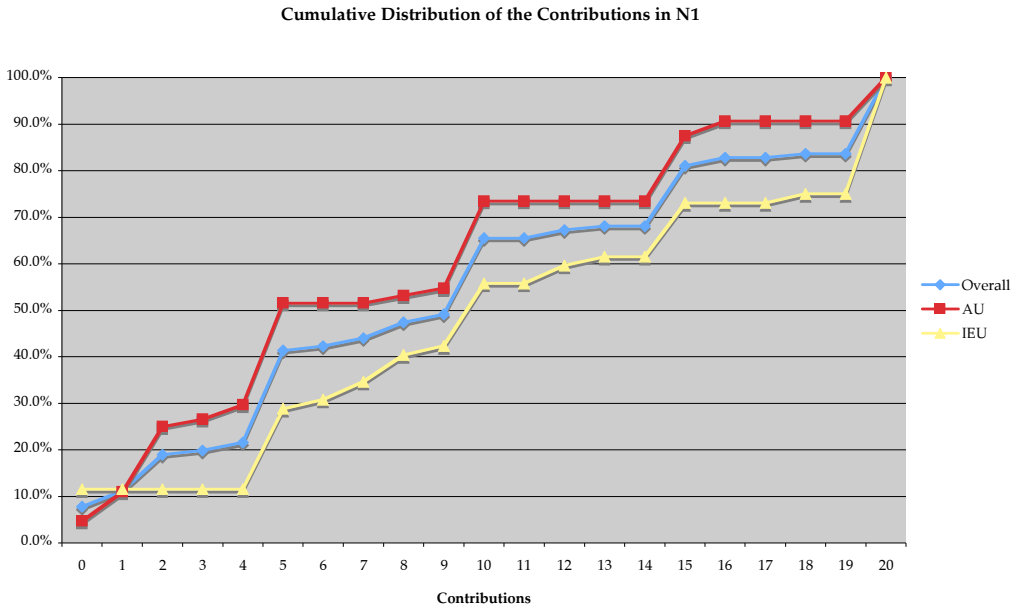
This results and analysis section will look at three specific behaviors: contribution behavior, response to punishment behavior, and punishment behavior. The contribution behavior will examine first period contributions, overall contributions in the N-experiment, the period effect in the N-experiment, the changes in contribution between N- and P-experiments, the period effect in the P-experiment, and average earnings in the N- and P-experiments.

The response to punishment behavior will examine the mean contributions per subject pool to the N- and P-experiments, the relative earnings in the P- and N-experiments over time, punishment's effect on next round contribution if the person who received the punishment's contribution was below group average, and likewise if the punished person's contribution was above group average. Finally, punishment behavior itself will be analyzed including the mean punishment expenditures, the punishment frequencies, the effects of game play on the punishment of free riding and on anti-social punishment, and the effects of trust measures, nationalism, and self-described religiosity on free riding punishment and on anti-social punishment.

4.1 Contribution Behavior

Participants had the option of contributing between 0 and 20 points to the group project. The cumulative distribution of actual contributions in period N1 are shown in Graph 1. The N1 period is the first period of play and so it serves as a base level of contribution. We observe very few people choosing the dominant strategy of no contributions (less than 10% overall). Contributions break along the expected boundaries of 0, 5, 10, 15, and 20. It's interesting to note that contributions in Izmir were significantly higher than contributions in Adiyaman. The participants in Adiyaman more fully were playing the dominant strategy. In contrast, the participants in Izmir exhibited more conditional cooperative behavior (that is, they were more trusting).

Graph 1: Cumulative Distribution of the Contributions in N1



But to more fully understand the contribution behavior it would be helpful to compare N1 contribution to the trust attitudes discussed earlier. The results of this analysis are shown in Table 5 on the following page.

Table 5: The effects of trust attitudes, nationalism, and self described religiosity as well as socio-economic characteristics on N1 contribution

	Dependent Variable N1 Contribution										
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	**Model 8**	*Model 11*	*Model 12*	*Model 13*	*Model 14*
GSS Trust (Insignificant)		*0.42 (0.825)*									
GSS Fair (Insignificant)			*1.072 (0.824)*								
GSS Help (Insignificant)				*0.436 (0.800)*							
GSS Index (Insignificant)					*0.792 (0.822)*						
Trust Strangers (Insignificant)						*-0.969 (0.804)*					
Door unlocked (Insignificant)											
Lend Money							**-1.308 (0.779)***				
Lend Possessions (Insignificant)											
Trust Index (Insignificant)											
Trustworthiness (Insignificant)								*-0.058 (0.806)*			
Nationalism (Insignificant)									*-0.13 (1.022)*		
Against Turban (Insignificant)										*0.231 (1.825)*	
Self Described Religiousity (Insignificant)											*-1.088 (0.998)*
Female	2.869 (1.568)*	2.645 (1.618)*	2.944 (1.654)*	2.675 (1.630)*	2.301 (1.709)	2.579 (1.569)*	2.423 (1.57)	2.878 (1.573)*	3.676 (1.783)**	2.859 (1.57)*	2.284 (1.266)*
Age	0.816 (0.564)	0.887 (0.578)	0.958 (0.62)	0.958 (0.572)*	1.051 (0.63)*	0.781 (0.559)	0.795 (0.557)	0.809 (0.572)	0.965 (0.627)	0.803 (0.573)	0.655 (0.459)
Ethnicity	-4.128 (1.796)**	-4.124 (1.86)**	-4.414 (1.928)**	-4.347 (1.846)**	-4.3 (1.955)**	-4.12 (1.778)**	-3.601 (1.801)**	-4.16 (1.849)**	-4.086 (2.113)**	-4.151 (1.805)*	-3.135 (1.438)**
Only Child	-4.705 (2.889)*	-4.368 (3.138)	-6.367 (3.254)**	-5.519 (3.000)*	-6.767 (3.416)**	-5.093 (2.879)*	-5.326 (2.88)*	-4.726 (2.904)*	-5.49 (3.134)*	-4.745 (2.905)*	-3.649 (2.373)
Eldest Child	-0.791 (1.94)	-0.613 (1.984)	-0.606 (2.055)	-0.890 (2.002)	-0.393 (2.079)	-0.955 (1.926)	-0.917 (1.918)	-0.805 (1.95)	1.031 (2.257)	-0.788 (1.939)	-0.25 (1.57)
Urban Background	-0.22 (0.569)	-0.242 (0.602)	-0.277 (0.63)	-0.063 (0.582)	-0.139 (0.645)	-0.285 (0.566)	-0.215 (0.563)	-0.226 (0.576)	0.058 (0.705)	-0.227 (0.572)	-0.139 (0.463)
Middle Class	-0.358 (0.819)	-0.26 (0.858)	-0.146 (0.86)	-0.337 (0.828)	-0.088 (0.884)	-0.35 (0.811)	-0.502 (0.814)	-0.361 (0.82)	-0.164 (1.093)	-0.372 (0.826)	-0.222 (0.671)
Religious Practice	0.17 (0.297)	0.237 (0.31)	0.278 (0.318)	0.046 (0.305)	0.236 (0.328)	0.229 (0.298)	0.173 (0.294)	0.172 (0.298)	0.454 (0.355)	0.184 (0.316)	0.256 (0.302)
Memberhip Index	-0.021 (0.223)	-0.011 (0.228)	-0.114 (0.242)	-0.065 (0.236)	-0.106 (0.244)	-0.068 (0.224)	-0.01 (0.221)	-0.023 (0.225)	-0.244 (0.308)	-0.02 (0.223)	-0.055 (0.186)
Adiyaman	-7.552 (2.472)***	-7.651 (2.561)***	-7.593 (2.654)***	-7.741 (2.516)***	-7.82 (2.614)***	-7.443 (2.447)***	-7.092 (2.457)***	-7.612 (2.61)***	-7.497 (3.312)**	-7.503 (2.501)***	-5.459 (1.984)***
Number Known	0.08 (0.078)	0.09 (0.08)	0.1 (0.084)	0.092 (0.079)	0.118 (0.083)	0.095 (0.078)	0.07 (0.077)	0.081 (0.08)	0.11 (0.107)	0.081 (0.078)	0.048 (0.064)
C	13.866 (4.865)***	12.984 (5.095)***	12.77 (5.159)***	13.669 (4.959)***	11.907 (5.341)**	13.974 (4.816)***	14.042 (4.812)***	13.956 (5.024)***	9.96 (6.404)	13.768 (4.925)***	13.89 (4.222)***
Observations	116	113	108	111	103	116	116	116	96	116	116
R^2	0.15	0.15	0.18	0.16	0.18	0.17	0.17	0.16	0.16	0.15	0.16

Notes: All trust variables are normalized and resigned such that higher coefficients indicate more trust. The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Female, Ethnicity, Only Child, and Eldest Child are dummies. Urban Background, Middle Class, Religious Practice, and Membership Index are integer values. Adiyaman is a dummy for the corresponding city. Number known refers to the number of other participants in the session.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

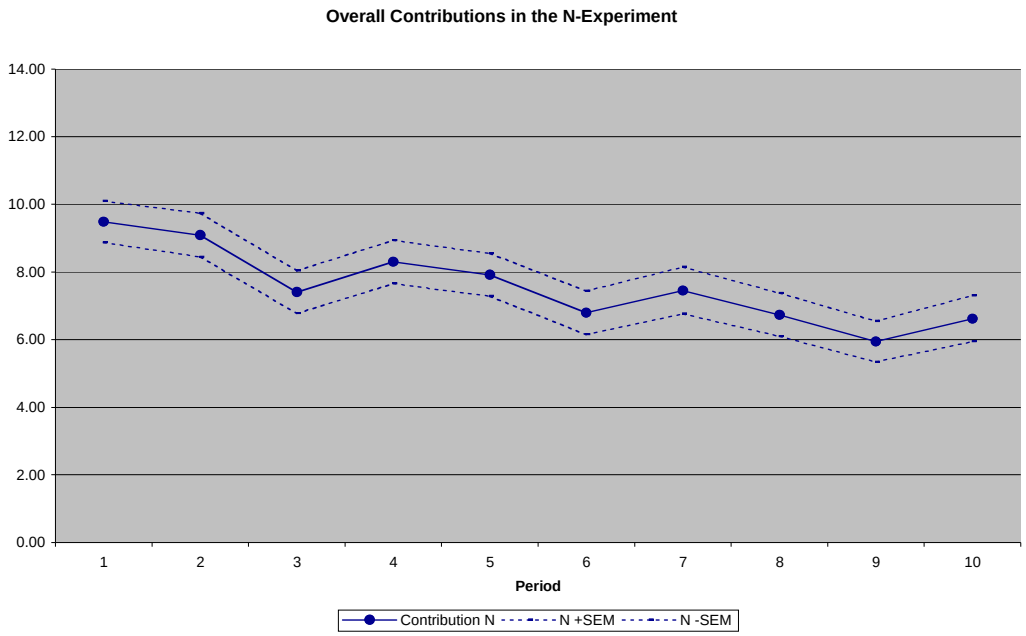
****Denotes significance at 1 percent.*

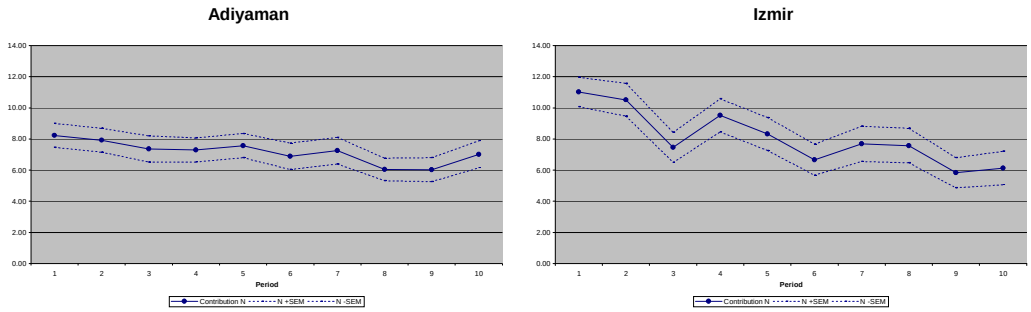
As shown in Table 5, there are several socio-economic characteristics that effected N1 contribution, but only one trust attitude (all the trust attitudes previously discussed were tested but only selected ones were listed). The only socio-economic factor that increased one's N1 contribution was gender. Females made higher N1 contributions than males. They exhibited greater trust being more willing to take a risk than men were. Two socio-economic factors led to decreased N1 contributions. These were ethnicity and whether or not one was an only child. According to our results, Turks and only children made smaller N1 contributions than non-Turks and participants with siblings. Furthermore, there were significant differences in the N1 contribution levels between Adiyaman and Izmir. Participants in Adiyaman contributed some 7.5 less points in the N1 round to the public project than did their Izmir counterparts.

The one trust attitude which was significant was Lend Money. Participants who more frequently gave monetary loans to their friends *contributed 1.3 points less* that others in the N1 round. This finding had a significance level of 10%. This result seems a bit counter-intuitive, but the trust attitude question asked loaning money to friends and not about contributing anonymously to a group project with strangers. Obviously these participants viewed the group project differently than they viewed loaning friends money.

Graph 2 shows the contributions to the N-experiment over time. From this graph one can easily see that contributions decreased across the board over time. The effect is especially pronounced in the Izmir group. The Izmir group began contributing an average of 11 points in the N1 period and finished the N10 period contributing about 6 points. The Adiyaman group began contributing less, around 8 points in the N1 period, and experienced a less steep decline in contributions ending up contributing around 6.5 points in the N10 period. The Adiyaman participants seem to be playing the game in a rather tempered way.

Graph 2: Contributions to the N-Experiment





The performance of the Adiyaman group is unexpected. The participants in Adiyaman were not as significantly discouraged by the free rider effects as participants in Izmir or in other populations have been. This unique finding indicates that perhaps the conditional cooperators of Adiyaman have a higher tolerance for the inequity of free riding than participants elsewhere.

It is possible to see the average period effects in the N-experiment by performing a Tobit estimation. Using this test, the effects of each successive period on contribution levels can be teased out. Table 6 shows the results of this analysis.

Table 6: Period effects on contribution in the N-Experiment

	Dependent Variable Contribution		
	Overall	Adiyaman	Izmir
Period	-0.551 (0.119)***	-0.34 (0.128)***	-0.883 (0.237)***
Final Period	1.292 (1.148)	1.608 (1.233)	0.682 (2.3)
C	10 (0.667)***	8.55 (0.72)***	12.144 (1.324)***
Observations	1160	640	520
R^2	0.02	0.01	0.03

Notes: The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Final Period is a dummy value.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

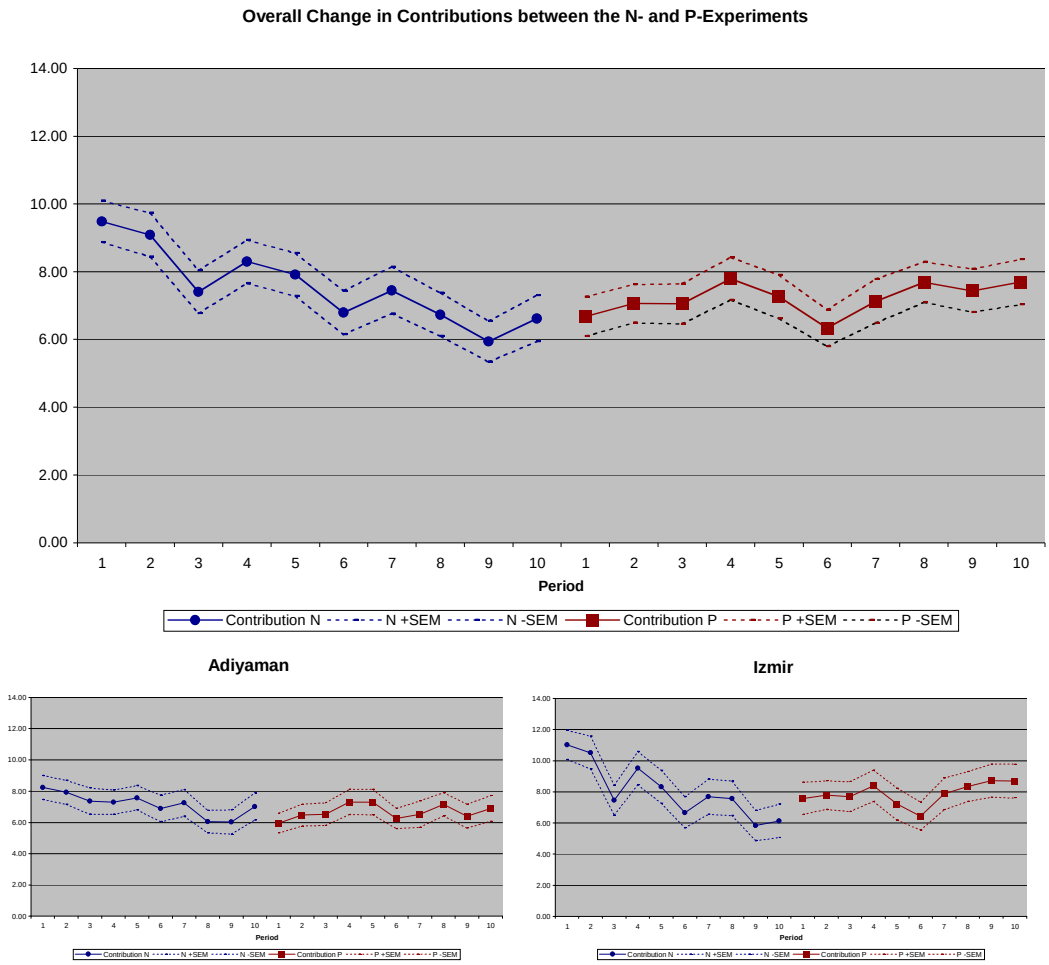
****Denotes significance at 1 percent.*

The period effect is obviously very significant (at a level of 1 %) in our data for both Adiyaman and Izmir. For every passing period, contributions decreased by 0.34 points in the Adiyaman group. An even more pronounced effect is seen in the Izmir group. For each passing period contributions decrease by 0.88 points (nearly a point a period) in the Izmir group. From this analysis the substantial deterioration of contribution levels over time in this the non-punishment treatment is seen.

What is the effect on contribution levels when punishment is introduced? As has been demonstrated elsewhere, punishment stabilizes the contribution levels in both Adiyaman and Izmir. In Adiyaman contribution levels in period P1 were just about 6 points. By period P10, contribution levels had increased to nearly 7 points. In Izmir we saw an even more pronounced effect. Contribution levels began around 7.5 points in period P1 for the Izmir group and finished period P10 at approximately 9 points.

Graph 3, below, illustrates the changes in contribution between the N- and the P-experiments overall and for both Adiyaman and Izmir individually.

Graph 3: Change in Contributions between N- and P- Experiments



Punishment appears to stabilize contribution levels and even slightly increase these levels in the Izmir population. However, significant increases in contribution levels are not seen. An area of interest for future study would be the longer-term effect of punishment. Perhaps over a long enough time frame punishment might induce increased overall contribution levels.

In a way similar to Table 6, what the period effects on contribution were in the P-experiment can be investigated. Remember that in each successive period in the N-experiment treatment the level of contributions significantly decline by 0.55 point on average. What effect doest the introduction of punishment have on this deteriorating period effect in the P-experiment? The analysis is shown in Table 7.

Table 7: Period effects on contribution in the P-Experiment

	Dependent Variable Contribution		
	Overall	Adiyaman	Izmir
Period	0.058 (0.109)	0.05 (0.119)	0.059 (0.213)
Final Period	0.519 (1.049)	0.146 (1.138)	1.131 (2.046)
C	6.29 (0.615)***	5.979 (0.668)***	6.69 (1.197)***
Observations	1160	640	520
R^2	0.00	0.00	0.00

Notes: The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Final Period is a dummy value.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

****Denotes significance at 1 percent.*

As can be seen in Table 7, the period effect has disappeared. Where as the overall loss of 0.55 points per period was significant at 10 percent, there is no significant period effect in the P-experiment. Introduction of punishment has completely eliminated the deteriorating period effect and solved, to some extent, the free rider problem. As noted above though, it does not appear that punishment significantly increases contribution level. Rather, punishment is more a stabilizer of contributions and means of preventing further contribution deterioration.

So if contribution level has been effectively stabilized, does that mean that the average earnings in the P-experiment increased? Average earnings are total points received at the end of each period, i.e. the sum of the points distributed from the group project and points retained from the initial endowment. Table 8 shows the answer to that question by comparing the average earnings in the N-experiment and the P-experiment.

Table 8: Average Earnings in the N- and P-Experiments

	Average earnings in		Percentage change
	N-experiment	P-experiment	relative to N-experiment
Overall	24.54	10.58	-56.88%
Adiyaman	24.30	12.45	-48.75%
Izmir	24.85	8.28	-66.66%

Average earnings in the P-experiment were much lower than average earnings in the N-experiment. Overall there was a 57% decrease in earnings in the P-experiment. The Izmir group experienced the largest percent decline seeing a 67% reduction in average earnings from nearly 25 points to nearly 8 points. As to why earnings were so much lower in the P-experiment than in the N-experiment, it is important to remember that punishment is costly. It consumes resources to punish someone while punishment itself is a destruction of resources. Although contribution levels have stabilized in the P-experiment, the costs of that stabilization through punishment are greater than the costs of the free-riding problem at least in the short term of this 10 period experiment.

Furthermore, at this point it is well worth remembering the dominant strategy in a public goods game. As elaborated above, the dominant strategy in a public good game is for each individual to not contribute any points from his or her endowment into the group project. When punishment is introduced, the dominant punishment strategy is never to exercise any punishment. Had the participants in the P-experiment strictly followed the dominant strategy, they would have earned nearly twice as many points as they actually did.

4.2 Response to Punishment

We've seen so far that punishment, at significant costs, prevents the deteriorating period effect and stabilizes contributions in this experiment. Let's look more deeply as to what it is that punishment is doing. Table 9 summarizes the mean contributions in the N- and the P-experiments both in period 1 and over all the periods.

Table 9: Mean contributions per subject pool in the N- and P-Experiments

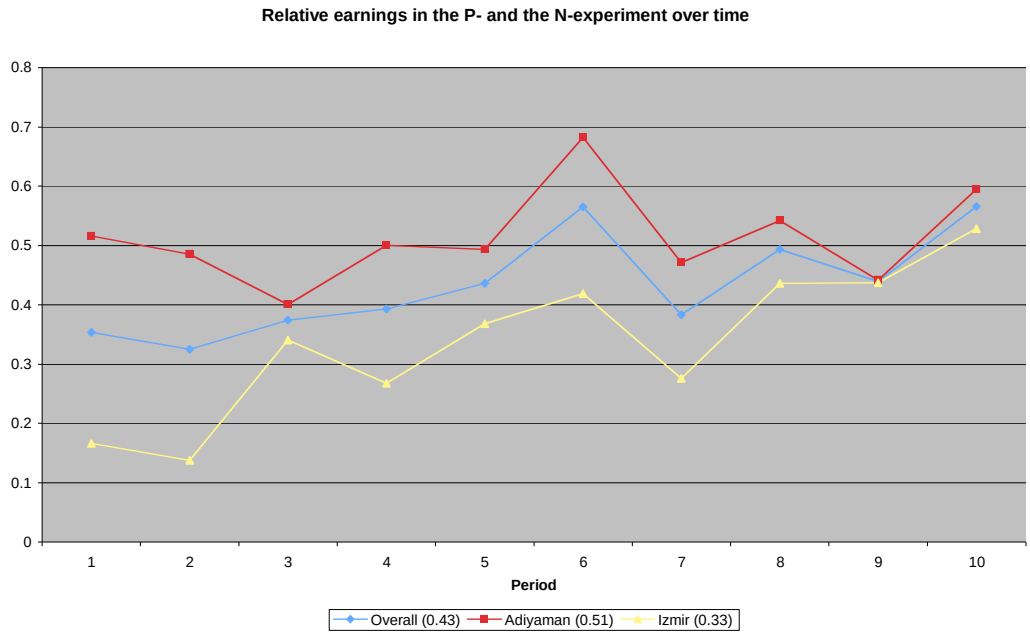
	Contribution in period 1			
	N-Exp	P-Exp	Percentage Change	p-value
Overall	9.5	6.7	-29.55%	0.000
AU	8.2	6.0	-27.70%	0.009
IEU	11.0	7.6	-31.24%	0.000
	Contribution over all periods			
	N-Exp	P-Exp	Percentage change	p-value
Overall	7.6	7.2	-4.73%	0.002
AU	7.2	6.7	-6.74%	0.319
IEU	8.1	7.9	-2.52%	0.073

Notes: The p-values were determined by a Wilcoxon signed-rank test.

As can be see above, punishment leads to significant differences in contribution levels. The differences in period one contributions between the N- and the P-experiments are stark. There was a 30% decline in contributions from the N- to the P-experiment in period one. When this is compared with the mean contributions over all periods, we see that the negative percent change has decreased. The changes in contributions from the N- to the P-experiments in Izmir were the most dramatic. In period one, there was a 31% decrease in contributions between the N- and P-experiments; whereas, when all periods were considered the mean contribution saw only a 2.5% decrease. If the experiment would have run for a few more periods, it's quite possible that the percentage changes could have become positive indicating increased giving in the P-experiment.

Graph 4 visually illustrates this idea comparing the relative earnings over time in both Adiyaman and Izmir. When this number is equal to zero then it means that the costs of the punishment treatment have been covered by the corresponding gains in efficiency.

Graph 4: Relative earnings in the P- and the N-experiment over time



While the relative earnings in the P- and the N-experiment do not reach zero in the 10 periods of this experiment – they reach just under 0.6 – there is a definite positive trend that given enough time would likely reach the zero mark and potentially progress to positive efficiency.

So what effect does punishment have on various contributors? In any punishment circumstance the punished person could have contributed in one of two ways. They could have contributed bellow the group average or they could have contributed equal to or above the group average. The effects of punishment on both of these cases will now be investigated.

In the first case, the punished person contributed less than the group average, that is the person was a free rider. We looked to see what the effect of altruistic punishment would be on a free riders' contribution in the next round. In this analysis a positive change in contribution means that the punished person increased their contributions in the next round, while a negative change in contribution means that the punished person decreased their contribution. Table 10 summarizes our findings.

Table 3: Punishment's effect on next round contribution if present contribution was below average

	Dependent Variable Change in Contribution		
	Overall	Adiyaman	Izmir
Reduction	-0.077 (0.016)***	-0.082 (0.021)***	-0.064 (0.026)***
Period	-0.079 (0.096)	-0.151 (0.12)	0.015 (0.158)
Final Period	0.344 (0.781)	1.735 (0.986)*	-1.442 (1.259)
C	1.35 (0.538)***	1.433 (0.649)**	1.394 (0.931)
Observations	542	307	235
R^2	0.04	0.06	0.04

Notes: The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Final Period is a dummy value.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

****Denotes significance at 1 percent.*

As can be seen in Table 10, altruistic punishment overall increased contributions in the next round. The constant term indicates that those who contributed less than average would increase their contributions by 1.35 on average following punishment (with significance at 1 percent for the overall group and significance at 5 percent for the Adiyaman group). Interestingly, the greater the amount of altruistic punishment (represented as reduction in the table) was, the smaller the increase in contribution. This trend was significant at 1 percent across the board. It's as if the punished party while recognizing his or her need to increase contributions did not respond particularly well to receiving punishment, especially punishment of significant size.

Table 11 investigates the opposite case where anti-social punishment as opposed to altruistic punishment is employed. The effects are what might be expected. In general, anti-social punishment decreases the future contribution of conditional cooperators. Strangely the magnitude of punishment had a highly significant, but unexpected result for the overall group and the Izmir group. For each anti-social punishment point received, conditional cooperators from those two locations actually reduced the size of their contribution reduction (that is, a conditional cooperator who was punished more severely reduced his or her future contribution ***less*** than a one who was punished less severely). This phenomenon is quite unexpected and may be some form of opposite spite.

Table 4: Punishment's effect on next round contribution if present contribution was above average

	Dependent Variable Change in Contribution		
	Overall	Adiyaman	Izmir
Reduction	0.075 (0.021)***	-0.028 (0.038)	0.126 (0.026)***
Period	0.099 (0.119)	-0.033 (0.166)	0.253 (0.168)
Final Period	0.003 (0.988)	-0.137 (1.359)	0.122 (1.411)
C	-1.767 (0.656)***	-1.866 (0.898)**	-1.925 (0.95)**
Observations	502	269	233
R^2	0.03	0.00	0.11

Notes: The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Final Period is a dummy value.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

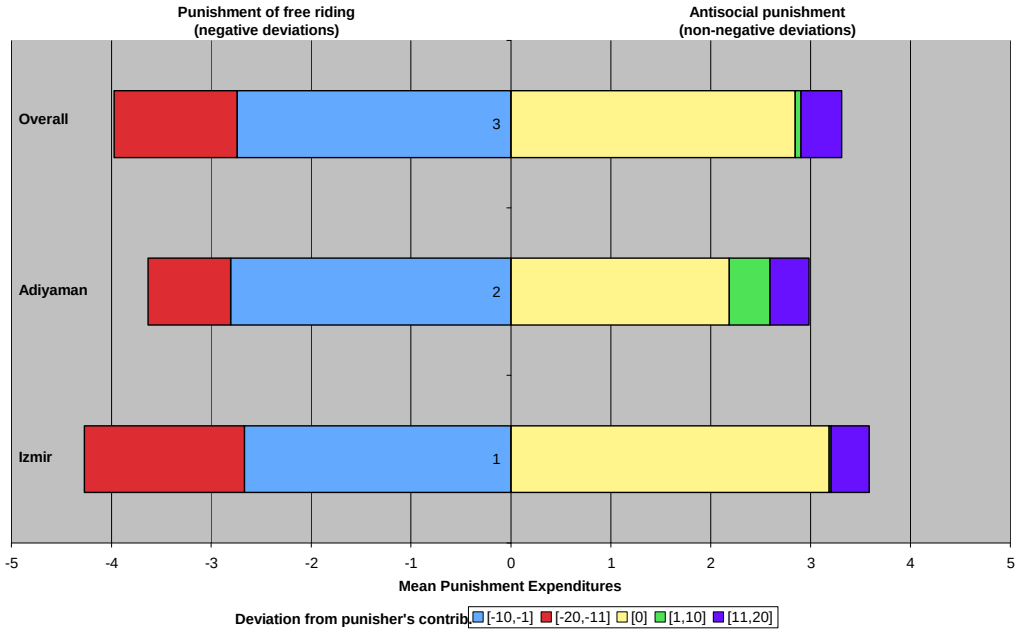
****Denotes significance at 1 percent.*

As you can see, punishment – both altruistic and anti-social – has significant effects on next round contribution behavior in of this population. One further area to investigate is that of punishment behavior.

4.3 Punishment Behavior

The mean punishment expenditures are show in Graph 5. The left side of this graph represents altruistic punishment or the punishment of free riders. The right side of this graph in contrast represents anti-social punishment or the punishment of participants who are contributing more than the punishers. The various colors represent the size of deviation between the punisher and the punished party.

Graph 5: Mean Punishment Expenditures

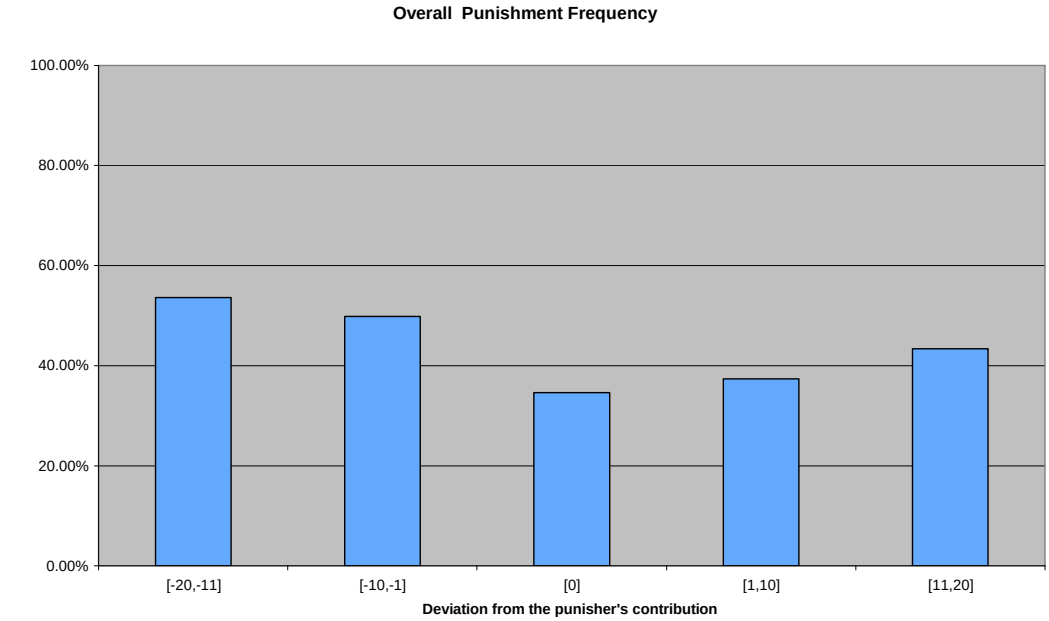


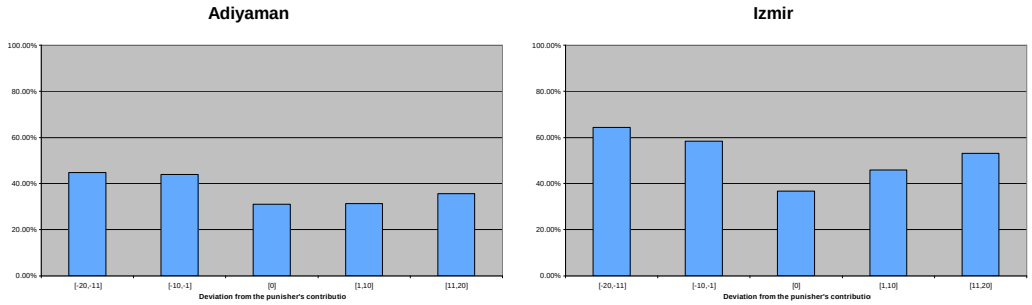
Notes: Participants in the P-experiment had the option of punishing their other group members. This is a graph of mean punishment expenditures for those who exercised that option and it excludes those who chose not to exercise punishment in order to emphasize the amount of punishment exercised.

It can be seen here that altruistic punishment was generally more severe than anti-social punishment. However, anti-social punishment was very present. These results are very similar to those reached by Herrmann et al. in their experiment in their experiments at Boğaziçi University in Istanbul, Turkey (2008). One observation to note is that in Adiyaman there was less of both altruistic punishment and anti-social punishment (just as there were less contributions overall).

If these are the mean punishments when punishment was exercised, then at what frequency was punishment exercised? Graph 6 shows the punishment frequencies.

Graph 6: Punishment Frequencies





Overall altruistic punishment was exercise more often than anti-social punishment. In Izmir, altruistic punishment was exercised approximately 60% of the time. In contrast, altruistic punishment was only exercised approximately 45% of the time in Adiyaman. In both Izmir and Adiyaman, anti-social punishment was exercised less frequently than altruistic punishment, but it was still significantly present. Interestingly punishment on the extremes of maximum variation was practiced more frequently than in cases of less variation. This would be expected for altruistic punishment, but is somewhat surprising for anti-social punishment.

Table 12: Free Riding Punishment Explained by Game Play

	Dependent Variable Punishment					
	Overall Pooled		Overall		Adiyaman	Izmir
Punished Contribution	-0.079 (0.03)***	-0.078 (0.03)***	-0.138 (0.032)***	-0.061 (0.03)**	-0.195 (0.05)***	0.022 (0.039)
Punishers' Contribution	0.024 (0.02)	0.025 (0.02)	0.084 (0.022)***	-0.009 (0.022)	-0.041 (0.033)	0.021 (0.03)
Other Group Members Contrib.	0.104 (0.022)***	0.107 (0.022)***	0.048 (0.024)**	0.09 (0.023)***	0.132 (0.035)***	0.029 (0.029)
Received Punishment T-1		0.017 (0.028)	-0.131 (0.027)***	0.038 (0.029)	0.043 (0.044)	0.041 (0.036)
Period	0.245 (0.043)***	0.257 (0.048)***	-0.101 (0.046)**	0.208 (0.05)***	0.481 (0.081)***	0.036 (0.063)
Final Period	-0.665 (0.419)	-0.681 (0.42)	-0.336 (0.445)	-0.396 (0.423)	-0.472 (0.612)	-0.253 (0.575)
Accumulated Earnings	-0.029 (0.002)***	-0.029 (0.003)***		-0.032 (0.003)***	-0.049 (0.005)***	-0.024 (0.003)***
Adiyaman	-0.015 (0.216)	-0.005 (0.217)				
C			-0.634 (0.347)*	1.061 (0.347)***	1.236 (0.501)***	1.568 (0.486)***
Observations	1490	1490	1490	1490	865	625
Log Likelihood	-2491.92	-2491.74				
R^2			0.05	0.15	0.14	0.18

Notes: The pooled estimates were conducted using OLS estimation. The remaining estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Final Period is a dummy value. Adiyaman is a dummy value for the corresponding city.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

****Denotes significance at 1 percent.*

Table 13: Anti Social Punishment Explained by Game Play

	Dependent Variable Punishment					
	Overall Pooled		Overall		Adiyaman	Izmir
Punished Contribution	0.029 (0.02)	0.036 (0.021)*	0.057 (0.024)**	0.046 (0.022)**	0.036 (0.03)	0.042 (0.032)
Punishers' Contribution	-0.042 (0.028)	-0.047 (0.028)*	-0.052 (0.03)*	-0.044 (0.028)	0.01 (0.042)	-0.074 (0.039)*
Other Group Members Contrib.	0.048 (0.022)**	0.058 (0.023)***	0.053 (0.026)**	0.074 (0.024)***	0.077 (0.034)**	0.073 (0.034)**
Received Punishment T-1		0.064 (0.029)**	-0.19 (0.029)***	0.047 (0.031)	0.048 (0.046)	0.07 (0.042)*
Period	0.239 (0.043)***	0.294 (0.05)***	-0.081 (0.051)	0.345 (0.055)***	0.339 (0.08)***	0.299 (0.077)***
Final Period	0.184 (0.441)	0.049 (0.446)	-0.069 (0.488)	-0.111 (0.46)	-0.43 (0.605)	0.308 (0.681)
Accumulated Earnings	-0.034 (0.002)***	-0.037 (0.003)***		-0.037 (0.003)***	-0.03 (0.004)***	-0.042 (0.004)***
Adiyaman	-0.689 (0.224)***	-0.667 (0.224)***				
C			-2.573 (0.376)***	-0.914 (0.353)***	-1.609 (0.455)***	-0.004 (0.547)
Observations	1990	1990	1990	1990	1055	935
Log Likelihood	-2712.523	-2710.15				
R^2			0.03	0.16	0.10	0.17

Notes: The pooled estimates were conducted using OLS estimation. The remaining estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Final Period is a dummy value. Adiyaman is a dummy value for the corresponding city.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

****Denotes significance at 1 percent*

Tables 12 and 13 look at punishment in light of game play. Table 12 shows that free riding punishment is consistently and highly significantly related to the contribution of the punished participant. The more the punished participant contributed, the lower the free riding punishment they received. The contributions of the other two group members, the period, and the accumulated earnings of the punisher were also significant factors. Interestingly, one of the most significant factors across the board was the amount of accumulated earnings. The greater one's total profit from all the previous rounds, the less one was likely to punish free riders. The wealthy were less likely to engage in the refereeing and disciplining of free riders and instead either ignored free riding or relied on others to carry out the job of policing the group.

Table 13 shows that there is less anti-social punishment in Adiyaman than in Izmir. In Izmir, a slightly increased amount of punishment was consistently and significantly associated with the punishment received in the previous round. Punishment received in the previous period slightly increased the amount of anti-social punishment given for the participants in Izmir indicating that revenge could have been a factor for anti-social punishment. Another observation was that greater contributions to the group project by punishers led to smaller amounts of anti-social punishment for the Izmir participants. Furthermore, in both Adiyaman and Izmir, greater contributions by the other group members' led to increased anti-social punishment. Unexpectedly, anti-social punishment was only slightly related to the level of contribution to the group project by the person receiving the punishment. Also, interesting was the increase of both free riding and anti-social punishments in the later periods. Perhaps the most influential variable effecting anti-social punishment behavior was the punishers' accumulated earnings. The more one accumulated, the less inclined they were to punish anti-socially. This confirms what was observed above in regards to free riding punishment. It turns out that wealth and its preservation, especially over time, trumps other motivating factors.

Beyond the game play explanations, Tables 14 and 15 explore the effects of socio-economic characteristics, trust attitudes, nationalism, and self-described religiosity on both free riding punishment and anti-social punishment through Tobit estimations.

According to our analysis certain socio-economic traits influence the punishment of free riders. The following effects were observed at a high level of statistical significance (significance at 1 percent). Older participants assigned free riders fewer punishment points, as did only children. People from larger cities punish free riders less severely, as did those who had higher levels of religious practice. Participants knew more people in the experiment assigned fewer punishment points to free riders. Also, female participants and members of civic groups punished free riders with fewer punishment points than did male partcipants (at a significance level of 5%).

Several factors from our trust survey effected the punishment of free riders. Participants who scored highly on the GSS Fair, GSS Help, GSS Index, and/or Trust Strangers, categories punished free riders less stringently. In contrast, participants who scored high on the GSS Trust and/or Trustworthiness categories assigned free riders more punishment points. All of these relationships are significant at 1 percent. Participants who scored highly on the IAT country test, that is more nationalistic participants, were also more likely to assign free riders more punishment points than others (at a level of 10 percent). In contrast, participants who supported the law banning headscarves in public places were less likely to assign punishment points to free riders (at a level of 10 percent) as were participants with a high self-described level of religiosity (at a level of 1 percent).

Considering the socio-economic make up of anti social punishers, we see that female participants and Turks (at a 1 percent level of significance), and voluntary group members (at a 5 percent level of significance) all assigned more anti-social punishment

Table 14: The effects of trust attitudes, nationalism, and self-described religiosity as well as socio-economic characteristics on free riding punishment

Dependent Variable Free-Riding Punishment

	Model 1	Model 1.5	Model 2	Model 3	Model 4	Model 5	Model 6	*Model 7*	*Model 8*	Model 11	Model 12	Model 13
GSS Trust			**0.289 (0.119)****									
GSS Fair				**-0.507 (0.119)*****								
GSS Help					**-0.39 (0.118)*****							
GSS Index						**-0.393 (0.12)*****						
Trust Strangers							**-0.25 (0.116)****					
Door unlocked (Insignificant)								*0.086 (0.121)*				
Lend Money (Insignificant)									*0.166 (0.113)*			
Lend Possessions (Insignificant)												
Trust Index (Insignificant)												
Trustworthiness										**0.427 (0.117)*****		
Nationalism											**0.287 (0.156)***	
Against Turban												**-0.664 (0.265)*****
Self Described Religiosity (Insignificant)												
Punished Contribution		-0.078 (0.03)***	-0.065 (0.031)**	-0.079 (0.031)***	-0.078 (0.03)***	-0.065 (0.031)**	-0.077 (0.03)***	-0.079 (0.03)***	*-0.08 (0.03)****	-0.086 (0.03)***	-0.094 (0.032)***	-0.08 (0.03)***
Punisher Contribution		0.022 (0.022)	0.021 (0.023)	0.04 (0.023)*	0.028 (0.022)	0.036 (0.024)	0.019 (0.023)	0.021 (0.022)	*0.024 (0.023)*	0.019 (0.022)	0.041 (0.024)*	0.016 (0.023)
Others Average Contribution		0.072 (0.023)***	0.08 (0.023)***	0.079 (0.023)***	0.074 (0.023)***	0.081 (0.023)***	0.072 (0.023)***	0.07 (0.023)***	*0.071 (0.023)****	0.064 (0.023)***	0.089 (0.025)***	0.071 (0.023)***
Received Punishment T-1		0.041 (0.028)	0.06 (0.029)*	0.051 (0.03)*	0.027 (0.028)	0.045 (0.03)	0.036 (0.028)	0.04 (0.028)	*0.042 (0.028)*	0.035 (0.028)	0.067 (0.03)**	0.04 (0.028)
Period		0.166 (0.049)***	0.186 (0.05)***	0.173 (0.05)***	0.161 (0.049)***	0.197 (0.051)***	0.161 (0.049)***	0.167 (0.049)***	*0.166 (0.049)****	0.157 (0.049)***	0.196 (0.055)***	0.171 (0.049)***
Final Period		-0.309 (0.416)	-0.29 (0.418)	-0.334 (0.435)	-0.484 (0.415)	-0.502 (0.44)	-0.299 (0.416)	-0.299 (0.416)	*-0.29 (0.416)*	-0.27 (0.415)	-0.178 (0.435)	-0.311 (0.415)
Accumulated Earnings		-0.028 (0.003)***	-0.028 (0.003)***	-0.028 (0.003)***	-0.025 (0.003)***	-0.027 (0.003)***	-0.027 (0.003)***	-0.028 (0.003)***	*-0.028 (0.003)****	-0.027 (0.003)***	-0.028 (0.003)***	-0.028 (0.003)***
Female	-0.534 (0.246)**	-0.455 (0.233)**	-0.569 (0.234)**	-0.584 (0.24)**	-0.598 (0.241)***	-0.591 (0.245)**	-0.515 (0.235)**	-0.429 (0.236)*	*-0.402 (0.236)**	-0.555 (0.234)**	-0.728 (0.265)***	-0.509 (0.233)**
Age	-0.414 (0.093)***	-0.426 (0.087)***	-0.417 (0.088)***	-0.501 (0.091)***	-0.449 (0.085)***	-0.501 (0.091)***	-0.445 (0.088)***	-0.418 (0.087)***	*-0.424 (0.087)****	-0.379 (0.087)***	-0.479 (0.088)***	-0.391 (0.088)***
Ethnicity	-0.356 (0.277)	-0.385 (0.258)	-0.683 (0.266)***	-0.472 (0.274)*	-0.259 (0.258)	-0.623 (0.273)**	-0.391 (0.258)	-0.396 (0.258)	*-0.476 (0.266)**	-0.173 (0.263)	-0.54 (0.286)*	-0.268 (0.261)
Only Child	-2.979 (0.517)***	-2.299 (0.484)***	-1.146 (0.533)**	-1.129 (0.581)**	-2.147 (0.48)***	-1.202 (0.577)**	-2.326 (0.487)***	-2.297 (0.483)***	*-2.243 (0.485)****	-2.021 (0.486)***	-2.618 (0.478)***	-2.132 (0.488)***
Eldest Child	-0.08 (0.307)	-0.004 (0.285)	0.034 (0.283)	-0.106 (0.287)	0.098 (0.284)	-0.002 (0.284)	-0.054 (0.286)	0.026 (0.287)	*0.003 (0.284)*	-0.007 (0.283)	0.459 (0.313)	-0.025 (0.284)
Urban Background	-0.42 (0.087)***	-0.303 (0.082)***	-0.202 (0.086)**	-0.213 (0.087)**	-0.344 (0.082)***	-0.284 (0.089)***	-0.323 (0.083)***	-0.299 (0.082)***	*-0.312 (0.082)****	-0.258 (0.083)***	-0.423 (0.098)***	-0.289 (0.082)***
Middle Class	0.095 (0.124)	0.001 (0.116)	-0.124 (0.122)	-0.09 (0.121)	-0.012 (0.113)	-0.112 (0.122)	0.02 (0.116)	0.027 (0.122)	*0.023 (0.117)*	-0.022 (0.116)	0.109 (0.144)	0.048 (0.117)
Religious Practice	-0.174 (0.047)***	-0.146 (0.044)***	-0.158 (0.046)***	-0.16 (0.045)***	-0.097 (0.045)**	-0.143 (0.047)***	-0.138 (0.044)***	-0.142 (0.045)***	*-0.146 (0.044)****	-0.162 (0.044)***	-0.176 (0.05)***	-0.186 (0.047)***
Membership Index	-0.048 (0.034)	-0.065 (0.032)**	-0.061 (0.032)*	-0.055 (0.034)*	-0.049 (0.033)	-0.041 (0.033)	-0.08 (0.033)**	-0.071 (0.033)**	*-0.064 (0.032)***	-0.046 (0.033)	-0.031 (0.043)	-0.068 (0.032)**
Adiyaman	-1.075 (0.376)***	-0.256 (0.356)	-0.451 (0.356)	-0.522 (0.359)	-0.308 (0.355)	-0.353 (0.355)	-0.176 (0.358)	-0.22 (0.359)	*-0.353 (0.362)*	0.013 (0.361)	0.038 (0.471)	-0.376 (0.359)
Number Known	-0.031 (0.012)***	-0.028 (0.011)***	-0.029 (0.011)***	-0.027 (0.012)**	-0.029 (0.011)***	-0.032 (0.012)***	-0.025 (0.011)**	-0.03 (0.012)***	*-0.027 (0.011)****	-0.037 (0.012)***	-0.023 (0.015)	-0.028 (0.011)**
C	5.117 (0.787)***	5.214 (0.799)***	5.433 (0.82)***	5.495 (0.816)***	4.891 (0.789)***	5.55 (0.823)***	5.255 (0.8)***	5.116 (0.809)***	*5.235 (0.799)****	4.925 (0.799)***	4.473 (0.962)***	5.547 (0.809)***
Observations	1490	1490	1424	1398	1420	1304	1490	1490	*1490*	1490	1198	1490
R^2	0.06	0.17	0.17	0.19	0.19	0.18	0.17	0.17	*0.17*	0.18	0.15	0.18

Notes: All trust variables are normalized and resigned such that higher coefficients indicate more trust. The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Female, Ethnicity, Only Child, and Eldest Child are dummies. Urban Background, Middle Class, Religious Practice, and Membership Index are integer values. Adiyaman is a dummy for the corresponding city. Number known refers to the number of other participants in the session.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

****Denotes significance at 1 percent.*

Table 15: The effects of trust attitudes, nationalism, and self-described religiosity as well as socio-economic characteristics on anti-social punishment

	Dependent Variable Anti-Social Punishment											
	Model 1	**Model 1.5**	**Model 2**	**Model 3**	*Model 4*	*Model 5*	**Model 6**	**Model 7**	**Model 8**	**Model 11**	**Model 12**	**Model 13**
GSS Trust			**0.561 (0.129)*** **									
GSS Fair				**-0.275 (0.135)** **								
GSS Help (Insignificant)					0.159 (0.128)							
GSS Index (Insignificant)						0.097 (0.131)						
Trust Strangers							**-0.483 (0.132)*** **					
Door unlocked								**0.245 (0.122)** **				
Lend Money									**-0.491 (0.123)*** **			
Lend Possessions (Insignificant)												
Trust Index (Insignificant)												
Trustworthiness										**0.497 (0.135)*** **		
Nationalism											**0.237 (0.14)***	
Against Turban												**0.475 (0.287)***
Self Described Religiosity (Insignificant)												
Punished Contributions		0.036 (0.022)*	0.028 (0.022)	0.03 (0.023)	0.026 (0.022)	0.023 (0.023)	0.037 (0.022)*	0.033 (0.022)	0.03 (0.022)	0.029 (0.022)	0.065 (0.023)***	0.035 (0.022)*
Punisher Contributions		-0.041 (0.028)	-0.042 (0.028)	-0.054 (0.029)*	-0.036 (0.028)	-0.056 (0.029)*	-0.047 (0.028)*	-0.039 (0.028)	-0.037 (0.028)	-0.037 (0.028)	-0.041 (0.029)	-0.041 (0.028)
Others Average Contribution		0.04 (0.024)*	0.033 (0.024)	0.038 (0.026)	0.063 (0.025)***	0.062 (0.026)**	0.042 (0.024)*	0.035 (0.024)	0.034 (0.024)	0.035 (0.024)	0.052 (0.026)**	0.043 (0.024)*
Received Punishment T-1		0.024 (0.03)	0.023 (0.031)	0.015 (0.033)	0.018 (0.03)	0.016 (0.032)	0.025 (0.03)	0.026 (0.03)	0.019 (0.03)	0.021 (0.03)	0.029 (0.031)	0.024 (0.03)
Period		0.308 (0.054)***	0.31 (0.055)***	0.308 (0.058)***	0.292 (0.054)***	0.305 (0.057)***	0.306 (0.054)***	0.315 (0.054)***	0.317 (0.054)***	0.314 (0.054)***	0.287 (0.058)***	0.308 (0.054)***
Final Period		-0.042 (0.448)	-0.044 (0.447)	-0.072 (0.469)	-0.047 (0.443)	-0.201 (0.463)	-0.019 (0.447)	-0.05 (0.447)	0.015 (0.448)	-0.056 (0.447)	-0.232 (0.468)	-0.04 (0.448)
Accumulated Earnings		-0.033 (0.003)***	-0.032 (0.003)***	-0.033 (0.003)***	-0.032 (0.003)***	-0.031 (0.003)***	-0.033 (0.003)***	-0.034 (0.003)***	-0.034 (0.003)***	-0.033 (0.003)***	-0.03 (0.003)***	-0.033 (0.003)***
Female	1.101 (0.261)***	0.903 (0.247)***	0.781 (0.25)***	0.797 (0.261)***	0.763 (0.255)***	0.614 (0.259)**	0.723 (0.251)***	0.955 (0.249)***	0.695 (0.252)***	0.873 (0.247)***	0.818 (0.265)***	0.87 (0.248)***
Age	-0.253 (0.094)***	-0.235 (0.087)***	-0.239 (0.087)***	-0.287 (0.098)***	-0.247 (0.085)***	-0.244 (0.094)***	-0.238 (0.087)***	-0.21 (0.087)**	-0.246 (0.087)***	-0.183 (0.088)**	-0.284 (0.088)***	-0.259 (0.088)***
Ethnicity	1.067 (0.313)***	1.221 (0.291)***	1.28 (0.293)***	1.388 (0.311)***	1.14 (0.29)***	1.231 (0.304)***	1.166 (0.291)***	1.185 (0.291)***	1.378 (0.293)***	1.574 (0.308)***	0.984 (0.322)***	1.186 (0.292)***
Only Child	-2.872 (0.495)***	-1.136 (0.472)**	-0.714 (0.483)	-1.753 (0.526)***	-1.353 (0.486)***	-2.17 (0.545)***	-1.546 (0.487)***	-1.149 (0.469)***	-1.379 (0.475)***	-1.073 (0.47)**	-1.283 (0.474)***	-1.165 (0.472)***
Eldest Child	0.559 (0.305)*	0.234 (0.285)	0.058 (0.288)	0.349 (0.302)	0.048 (0.282)	0.235 (0.297)	0.126 (0.286)	0.255 (0.284)	0.225 (0.284)	0.45 (0.29)	0.693 (0.303)**	0.199 (0.286)
Urban Background	-0.651 (0.098)***	-0.421 (0.091)***	-0.37 (0.093)***	-0.465 (0.102)***	-0.425 (0.092)***	-0.457 (0.101)***	-0.488 (0.094)***	-0.428 (0.091)***	-0.408 (0.091)***	-0.381 (0.092)***	-0.503 (0.107)***	-0.43 (0.092)***
Middle Class	-0.141 (0.153)	-0.301 (0.144)**	-0.248 (0.146)*	-0.29 (0.149)**	-0.332 (0.142)**	-0.264 (0.147)*	-0.333 (0.144)**	-0.247 (0.146)*	-0.33 (0.143)**	-0.237 (0.145)*	-0.333 (0.164)**	-0.324 (0.145)**
Religious Practice	0.041 (0.048)	0.042 (0.046)	0.055 (0.046)	0.091 (0.05)*	0.052 (0.046)	0.099 (0.049)**	0.072 (0.046)	0.048 (0.046)	0.056 (0.046)	0.033 (0.046)	0.137 (0.049)***	0.07 (0.049)
Membership Index	0.073 (0.039)*	0.08 (0.037)**	0.11 (0.037)***	0.096 (0.04)**	0.117 (0.038)***	0.093 (0.039)**	0.049 (0.038)	0.072 (0.037)**	0.083 (0.037)**	0.106 (0.037)**	0.13 (0.048)***	0.08 (0.037)**
Adiyaman	-1.869 (0.427)***	-0.848 (0.404)**	-1.158 (0.409)***	-1.148 (0.434)***	-0.995 (0.4)***	-1.102 (0.411)***	-0.929 (0.403)**	-0.858 (0.404)**	-0.599 (0.406)	-0.271 (0.43)	-1.152 (0.489)**	-0.707 (0.412)*
Number Known	-0.006 (0.014)	-0.007 (0.013)	0.004 (0.013)	0.003 (0.014)	-0.012 (0.012)	-0.001 (0.013)	0.002 (0.013)	-0.008 (0.013)	-0.01 (0.013)	-0.014 (0.013)	0.009 (0.015)	-0.006 (0.013)
C	1.2 (0.799)	1.025 (0.788)	0.75 (0.794)	1.017 (0.828)	1.327 (0.784)*	0.977 (0.82)	1.397 (0.793)*	0.889 (0.79)	1.026 (0.785)	0.052 (0.831)	-0.055 (0.92)	0.768 (0.804)
Observations	1990	1990	1966	*1843*	*1910*	*1786*	1990	1990	1990	1990	*1990*	*1990*
R^2	0.08	0.20	0.21	*0.21*	*0.22*	*0.22*	0.21	0.21	0.21	0.2	*0.21*	*0.2*

Notes: All trust variables are normalized and resigned such that higher coefficients indicate more trust. The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Female, Ethnicity, Only Child, and Eldest Child are dummies. Urban Background, Middle Class, Religious Practice, and Membership Index are integer values. Adiyaman is a dummy for the corresponding city. Number known refers to the number of other participants in the session.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

****Denotes significance at 1 percent.*

points than their counterparts. Older participants and those from urban backgrounds (at a 1 percent level of significance) and only children, participants from the middle class, and participants from Adiyaman (at a 5 percent level of significance) all assigned fewer anti-social punishment points.

Looking to the effects of items from the trust survey, a few measures were significant in regards to anti-social punishment. Those who scored higher on the GSS Fair item (at a 5 percent level of significance) and the Trust Strangers and the Lend Money items (at a 1 percent level of significance) assigned fewer anti-socially punishment points. Those who scored higher on the GSS Trust and the Trustworthiness items (at a 1 percent level of significance), the door unlocked item (at a 5 percent level of significance), and the nationalism and against turban items (at a 1 percent level of significance) assigned more anti-social punishment points.

5. Conclusion

The first aim of this study was to compare the similarities and differences between the performance of public goods games in the West and in a country of the Muslim world. In contrast to Gachter et al's 2004 study of Russian students, Turkish participants' contributions were not significantly increased in response to higher scores on the GSS Fair, GSS Help, GSS Index, or Trust Strangers measures. In fact, higher scores on the Trust Strangers measure was insignificantly associated with *lower* contributions. One trust measure that was significant in the Turkish population, but not the Russian population was the Loan Money measure. Counter intuitively the greater the frequency Turkish participants loaned money to their friends, the lower their N1 contributions.

An additional area of contrast was the effect of socio-economic background on contributions. Gachter et al. (2004) found no effect of socio-economic background on contributions in their study of Russian participants whereas we found significant effects in this study of Turkish participants. According to the results of our study, females made higher N1 contributions whereas Turks, only children, and participants from Adiyaman made lower N1 contributions. Overall, N1 contribution levels were higher in Turkey than in Russia (13.866 points and 8.308, respectively). However, higher N1 contributions have been observed in other countries as well (Herrmann et al. 2008). Furthermore, this study confirms the phenomenon observed by Herrmann et al. (2008). There is a substantial degree of both altruistic, but also anti-social punishment in Turkey. There is significantly more anti-social punishment here in Turkey than in other Western countries. While, this study quantitatively observes this to be the case and describes the trust attitudes and socio-economic characteristics of those who punish anti-socially, it did not explore these participants' motives. An interesting question for additional research would be to investigate the thought processes and motivations of those who punish anti-socially contrasted with those who choose not to punish in this way.

A second aim of this study was to analyze both contribution behavior and also punishment behavior in light of socio-economic and various trust measures. The results of this analysis are shown below in Table 16.

Certain trends are observed in this table. From the N1 contributions perspective, a higher Female variable increases contributions while higher Turk, Only Child, Adiyaman, and Lend Money variables decrease contributions. From the punishment perspective, higher Trustworthiness, Nationalism, and GSS Trust variables increase punishment across the board. Likewise, the higher the GSS Fair, Trust Strangers, Accumulated Earnings, Age, Only Child, and Urban Background variables the lower the punishment was across the board. High scores on the Female, Membership, and Against Turban variables were the worst variables from the punishment perspective because they each decreased altruistic punishment and increased anti-social punishment. Higher GSS Help, GSS Index, Religious Practice, and Number Known variables all decreased altruistic punishment. Higher Lend Money, Middle Class, and Adiyaman variables all decreased anti-social punishment wheras higher Door Unlocked and Turk variables increased it.

Table 16: The effects of trust attitudes, nationalism, and self-described religiosity as well as socio-economic characteristics on participant behavior

1. N1 Contribution Behavior (C = 13.866***)	
Increased Contributions (Positive)	*Decrease Contributions (Negative)*
o Female (2.869*)	o Turk (4.128**) o Only Child (4.705*) o Adiyaman (7.552***) o *Lend Money (1.308***)*
2. Free Riding Punishment (C = 5.214***)	
Increased Punishment (Positive)	*Decreased Punishment (Negative)*
o Others' Contribution (0.072***) o Period (0.166***) o *GSS Trust (0.289***)* o *Trustworthiness (0.427***)* o *Nationalism (0.287*)*	o Punished Contribution (0.078***) o Accumulated Earnings (0.028***) o Female (0.455**) o Age (0.4276***) o Only Child (2.299***) o Urban Background (0.303***) o Religious Practice (0.146***) o Membership (0.065**) o Number Known (0.028***) o *GSS Fair (0.507***)* o *GSS Help (0.390***)* o *GSS Index (0.393***)* o *Trust Strangers (0.250***)* o *Against Turban (0.664*)*
3. Anti-Social Punishment	
Increased Punishment (Negative)	*Decreased Punishment (Positive)*
o Punished Contribution (0.036*) o Others' Contribution (0.040*) o Period (0.308***) o Female (0.903***) o Turk (1.221***) o Membership (0.080**) o *GSS Trust (0.561***)* o *Door Unlocked (0.245**)* o *Trustworthiness (0.497***)* o *Nationalism (0.237*)* o *Against Turban (0.475*)*	o Accumulated Earnings (0.033***) o Age (0.235***) o Only Child (1.136**) o Urban Background (0.421***) o Middle Class (0.301**) o Adiyaman (0.848**) o *GSS Fair (0.275**)* o *Trust Strangers (0.483***)* o *Lend Money (0.491***)*

Notes: All trust variables are normalized and resigned such that higher coefficients indicate more trust. The estimations were conducted using censored Tobit estimation. Robust standard errors are given in parenthesis. Female, Ethnicity, Only Child, and Eldest Child are dummies. Urban Background, Middle Class, Religious Practice, and Membership Index are integer values. Adiyaman is a dummy for the corresponding city. Number known refers to the number of other participants in the session. Italicized results are trust attitudes, nationalism, and self-described religiosity variables which are not associated with the C terms or socio-economic terms given in Table 16. For the relevant terms, see Tables 5, 14, and 15.

** Denotes significance at 10 percent.*

*** Denotes significance at 5 percent.*

****Denotes significance at 1 percent.*

The third aim of this study was to compare the effects of development on the cooperative behavior of Turkish students. Using the natural laboratory provided by the differing levels of development in Adiyaman and Izmir, we were able to examine the effects development had on both

N1 contributions as well as altruistic and anti-social punishment. Several trends were identified in both contribution behavior and punishment behavior.

In regards to contribution behavior, the participants in Izmir contributed significantly more in the N1 period (12.144*** in Izmir versus 8.55*** in Adiyaman). These differences are more striking when you compare the frequencies of certain N1 contributions. In the N1 period, 50% of Adiyaman students contributed 5 points or less compared with only 29% of Izmir students. Likewise, 25% of Izmir students contributed a full 20 points in the N1 period compared with only 10% of Adiyaman students.

Izmir participants were significantly more sensitive to free riders than were Adiyaman participants. During the N-experiment, the contributions of Izmir participants decreased by 0.833*** points per period whereas the contributions of Adiyaman participants decreased by less than half that amount (only 0.34*** points per period).

In regards to punishment, several observations can be made. Altruistic punishment led to greater next round contributions for both Adiyaman and Izmir. Interestingly, the greater the punishment received was, the smaller the next round increased contribution. Similarly, anti-social punishment led to decreased next round contributions for both Adiyaman and Izmir, but oddly the greater the punishment was for Izmir, the smaller the next round decrease. Both altruistic punishment and anti-social punishment were of greater frequency in Izmir compared to Adiyaman. While there weren't significant differences in the magnitude of altruistic punishment between Adiyaman and Izmir, anti-social punishment was 0.667*** points lower in Adiyaman compared to Izmir. Finally, comparing the average earnings change from N- to P-experiments, Adiyaman's average earnings decrease is less than Izmir's average earnings decrease (48.75% and 66.67% respectively) reflecting lower levels of resource destruction through anti-social punishment.

These observations paint a picture of Adiyaman as a more temperate place than Izmir. Both contributions and punishment were less frequent and less severe (at least anti-social punishments were) in Adiyaman than they were in Izmir. These findings contrast with the previous observations that more Western, developed places are associated with lower incidence of ant-social punishment. Within Turkey, in this study, the opposite was found: mainly, that more Western and developed Izmir exhibited greater amounts of anti-social punishment.

When people take a risk for the benefit of the community, whether in contributions to a public goods game or in discussions with authorities regarding elephant problems, a certain level of reciprocity is expected. A lack of this reciprocity often leads to decreased risk taking in the group and/or self-regulation. However, self-regulation in the form of punishment contains the risks of a double-edged sword. While it can be used for good to punish free riders, it can also be used anti-socially to punish the cooperators as well. This study has confirmed both of these phenomena to be present in Turkey.

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