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# REVISITING THE ANTISOCIAL PUNISHMENT ACROSS SOCIETIES EXPERIMENT

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## *Abstract*

This paper presents an alternative interpretation of an experimental public goods game dataset, particularly on the understanding of the observed antisocial behaviour phenomenon between subjects around the world. The anonymous nature of contributions and punishments are taken into account to reinterpret the experimental results by analysing dynamic behaviour in terms of mean contributions across societies and their association with antisocial punishment. Thus, by also taking into account the heterogeneity between the experimented cities, the analysis contrasts with the interpretation of one trend across cities, as the findings indicate two opposite trends in different groups of cities.

## **1. Introduction**

Behavioural and experimental economics literature has been steadily providing new insights on the phenomenon of punishment assigned to not only freeloaders, but also to cooperators in public goods experiments. Hermann *et al* (2008a), for example, discuss an experimental setup allowing two types of treatment: with and without punishment amongst individuals. The main argument in it is that “comparable social groups from complex developed societies with the widest possible range of cultural and economic backgrounds” present similar tendencies of antisocial punishment. The paper’s accompanying dataset is comprised of 16 different cities across the world; each presenting some level of punishment towards those who behave pro-socially (i.e. investing in the public good).

Although Hermann *et al* (2008a) aim to study antisocial punishment behaviour across different societies, it is unclear how such heterogeneity has been accounted for or harnessed in the experiment. This is because the employed experimental method implicitly assumes that every society is comparable (i.e. homogenous) in terms of individual characteristics including social, economic and political background. Indeed, Hermann *et al* (2008b)<sup>1</sup> reports country level indicators of these societies including aspects such as: social capital, economic prosperity, law enforcement and democracy, cultural dimensions and value orientations. Wide differences across these societies

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<sup>1</sup> See Table S1, page 6.

are apparent. Thus, accounting for individual-specific characteristics is an important step towards better understanding the antisocial behaviour amongst truly heterogeneous societies.

The aim of this paper is to provide an alternative interpretation of the antisocial punishment in light of the experiments conducted by Hermann et al (2008a). This goal is achieved by accounting for heterogeneity across societies; and identifying clusters of societies with similar behaviour to form homogenous blocks. This approach allows the investigation as to whether the relationship between antisocial punishment and mean contributions, as originally described in the aforementioned paper, holds for every different cluster, or it is in fact a specific feature of certain groups of societies.

## **2. The experimental setup and the analysed data**

The data obtained from Hermann et al (2008a, 2008b) consists mainly of individual contributions and individual punishment, in experiments run with and without the possibility of punishment<sup>2</sup>. The setup consisted of a 10-round game administered in 16 different cities across the world, with varying number of participants. These were anonymously assigned to groups of 4, with the aim of recording the numeric levels of observed cooperation among them. This was done using a zTree Fischbacher (2007) interface designed to collect data from participants regarding contributions and punishments. Each participant received 20 tokens of which they needed to decide how many, per round, would be kept for themselves or otherwise invested in the public good. Each participant earned 0.4 tokens for each token invested, regardless of having contributed or not. Individual decisions were recorded independently and only the anonymised contributions of other group members could be seen after all participants having committed to a contribution amount. If punishments had been enabled, each individual participant would also see the total amount of assigned punishments, but not who in their group has decided to do so. A punishment varies from 0 to 10 points, each reducing the punished member's earnings by 3 tokens. The individual cost of punishing another group member was 1 token, per round in each of the experimental setup.

For the purpose of this paper, we use mean contributions with and without punishment over the ten periods for all 16 cities. We begin by applying the approach proposed by Phillips and Sul (2007), PS hereafter. The approach proposes a simple econometric model, which can be used to cluster the individuals cross sections in clubs of convergence. The model can be expressed as:

$$C_{it} = \delta_{it} \mu_t \tag{1}$$

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<sup>2</sup> Further information are available on Hermann *et al* (2008b).

with  $C_{it}$  is contribution in the  $i$ -th city over the  $t$  periods. The model contains a common factor  $\mu_t$  and an idiosyncratic element  $\delta_{it}$ , which measure the deviation of contribution of the  $i$ -th individual trend over periods  $t$  from the common factor  $\mu_t$ . The latter can be interpreted as a common steady state of contribution in the panel. If individuals in every studied society behave in similar ways, then their contribution over the experimental periods would converge to a common steady state. However since there is evidence that individuals behave differently across societies, we expect that individuals contribute by  $\delta_{it}$  of the total  $\mu_t$ . Therefore, we apply the clustering algorithm proposed by PS to (i) determine whether contributions in all cities follow the same steady state, and (ii) test for the possibility of clusters of contributions across different societies<sup>3</sup>.

### 3. Presentation and Discussion of Findings

Figures 1 and 2 illustrate the general trends of contributions with and without punishment and the statistical association between contribution and punishment, respectively. Figures 1A and 1B are replications of the figures 2A and 3 in Hermann et al (2008a) and illustrate the mean contribution before and after punishment to the public good over the 10 periods. These graphs show that (i) individual contributions, in the experiment without punishment declines over the period in all the societies and (ii) when allowing for punishment, contribution becomes almost stable around the constant averages in all societies recording higher contributions in Western societies than that in other societies. Figure 2 shows a statistically significant negative correlation between mean contributions and mean antisocial punishments (-0.90 [ $p$ -value=0.00]<sup>4</sup>). This confirms the two observations above deduced from figures 1A and 1B.

*[Figures 1 and 2 about here]*

Although the aim of the graphs shown above is to compare the contribution across societies, these cannot be interpreted as a reflection of the typical behaviour of a society towards their contribution to the public goods, as the baseline is the average contribution across societies. In other words, the dynamic of contributions presented by these figures are not independently determined by each sample but rather by the aggregation effect caused via the sample selection bias in the form of omitting other societies in the analysis. This is illustrated in Figures 1C and 1D<sup>5</sup>, where we use the

<sup>3</sup> For further details see Phillips and Sul (2007)

<sup>4</sup> The estimate is taken from Hermann et al (2008a).

<sup>5</sup> Relative mean contribution is defined by  $rc_{it} = C_{it} \left( N^{-1} \sum_{i=1}^N C_{it} \right)$  where  $rc_{it}$  is relative mean contribution and

$N^{-1} \sum_{i=1}^N C_{it}$  measures the cross sectional average of the mean contribution  $C$  for  $i$  societies over  $t$  periods.

concept of relative mean contribution. Figure 1C shows a different pattern from its counterpart, Figure 1A. Namely, (i) contribution does not decline in every experimented society and (ii) those societies found to be contributing less (which includes Athens, Dnipropetrovs'k, Istanbul, Minsk, Muscat, Riyadh and Samara) have contributed relatively more –particularly towards the end of the public good experiment. Figure 1D shows a different dynamic, clustered in patterns, when compared to Figure 1B. First the original representation of contribution after punishment seems to start at lower levels, yet there is actually an increase of contributions before it declines. Then the relative contribution depicts those contributions starting at higher levels before declining.

The correlation coefficient and plot shown in Figure 2 is not strongly consistent across all societies. A number of outlier societies are located rather far from the main cluster, including the following cities: Athens, Dnipropetrovs'k, Istanbul, Minsk, Muscat, Riyadh and Samara. Once the dataset is analysed separately according to these two different groups, one can see the different Spearman's correlation coefficients. The new values are inconsistent with the analysis based on all societies and thus it is an insight suggesting the clustering of behaviour:  $-0.58$  [ $p$ -value=0.09] excluding the outliers and  $-0.36$  [ $p$ -value=0.43] when outliers alone are considered.

Table 1 reports clustering based on PS algorithm. In both cases, with and without punishment, contribution does not converge. There are four estimated clusters in the case of contribution without punishment, while two are estimated when punishment is allowed. Figures 3A and 3B illustrate these clusters. Contributions with and without punishment are not identical across societies once society-specific characteristics are accounted for. This suggests the need to review the interpretation that there is a uniform association between mean contributions and antisocial punishments in this particular experimental dataset.

***[Table 1 and Figures 3A-3B about here]***

Figures 4A and 4B illustrate the correlation between mean contribution in clusters 1 and 2 and corresponding punishment, respectively. The result is different and the association depends on the location of cities in either cluster 1 or 2. Figure 4A shows that mean contribution declines with higher punishment. This is evidence of antisocial punishment in cities located in cluster 1, which is consistent with Hermann et al (2008a) (spearman= $-0.62$  [ $p$ -value=0.05]). Nevertheless the association is completely reversed when considering cities of the second cluster with positive correlation (spearman= $0.64$  [ $p$ -value=0.05]), as illustrated in figure 4B.

[Figures 4A-4B about here]

#### **4. Concluding Remarks**

In this paper we have investigated the extent to which the conclusions discussed in Herrmann *et al* (2008) are robust with regards to a different data analysis approach. We find that the dynamics of contributions and its relation with antisocial punishment depends on (i) the behaviour in each pool of the experimented social groups and (ii) the particular characteristics of each studied society. When simultaneously accounting for these, the antisocial punishment behaviour is interpreted differently from the original discussion of this dataset. The experimental setup has no parallel with an actual public good setup, so the analysed results cannot provide empirical insights (Weisberg (2004) and Guala and Salanti (2001)). This is because nowhere individuals can pay for anonymous and direct punishments of other beneficiaries of a public good. Accordingly, one cannot determine whether the original interpretation of the dataset depends on the analytical methodology or on the assumptions of the experimental design itself (Levins, 1996). The alternative analysis proposed in this paper provides another interpretation to the experimental data, which takes into account the experimental design, focusing on describing the antisocial punishment phenomenon.

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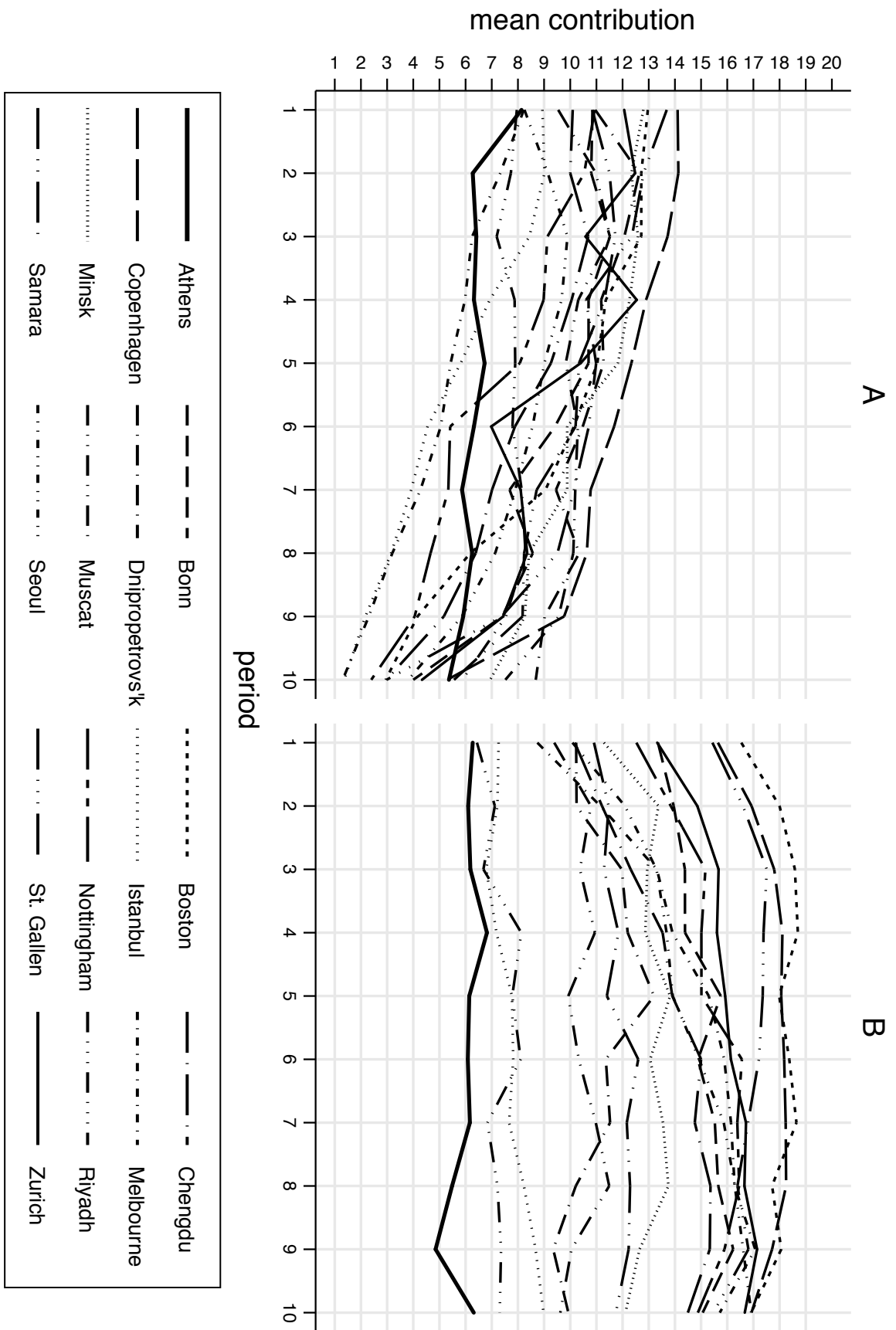
Tables and Figures

**Table 1: Clusters of contribution**

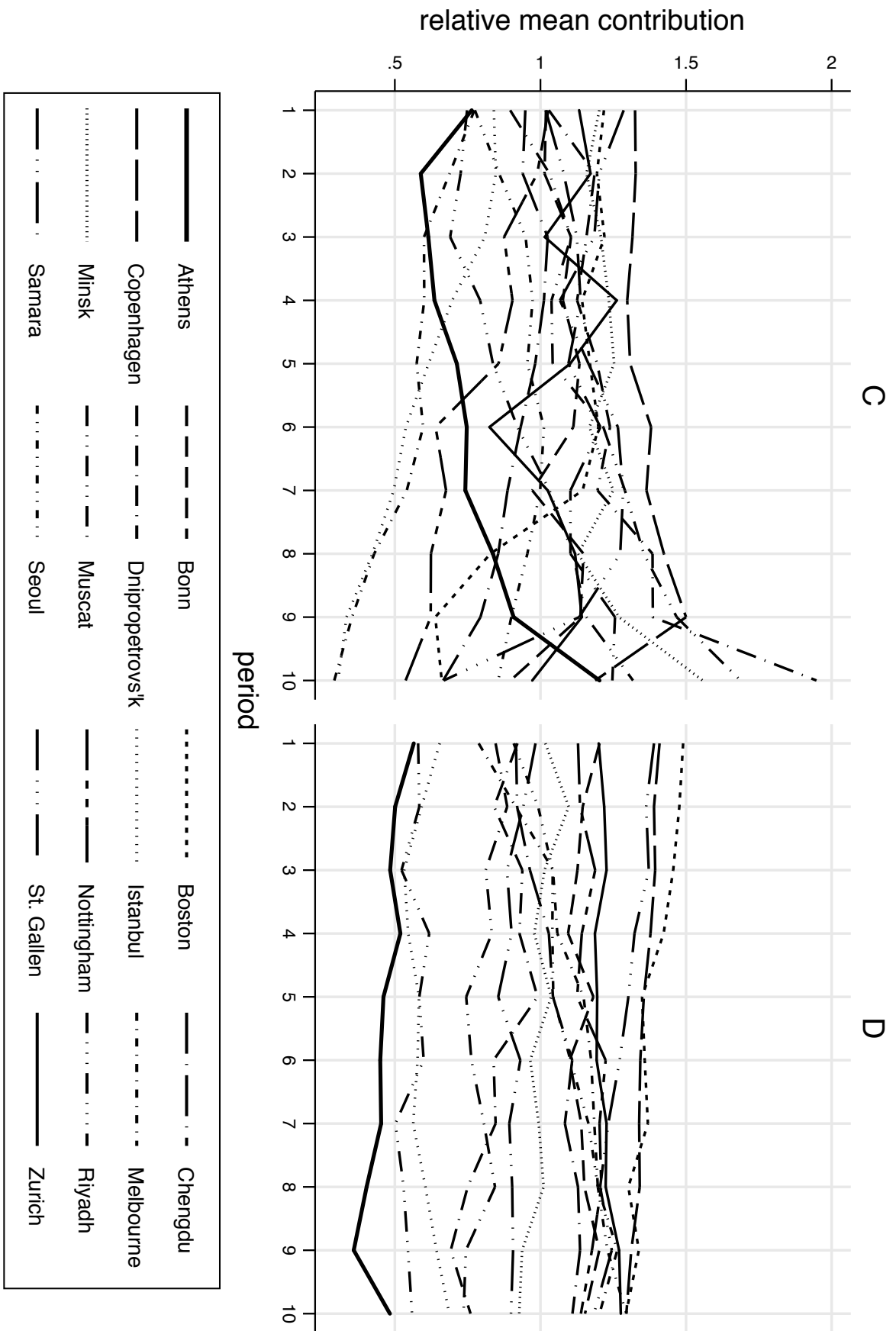
	<b>Mean Contribution</b>	
	<b>Without Punishment</b>	<b>With Punishment</b>
<b>Overall Convergence</b>	<b>-11.542*</b>	<b>-2.275*</b>
<b>Cluster 1</b>	<b>-1.112</b> [Dnipropetrovs'k, Muscat]	<b>4.572</b> [Bonn, Boston, Chengdu, Copenhagen, Istanbul, Melbourne, Nottingham, Seoul, St. Gallen, Zurich]
<b>Cluster 2</b>	<b>2.667</b> [Athens, Copenhagen, Minsk, Riyadh, Samara]	<b>-0.113</b> [Athens, Dnipropetrovs'k, Minsk, Muscat, Riyadh, Samara ]
<b>Cluster 3</b>	<b>-1.505</b> [Bonn, Seoul, Zurich]	<b>N.A.</b>
<b>Cluster 4</b>	<b>-0.539</b> [Boston, Chengdu, Istanbul, Melbourne, Nottingham, St. Gallen]	<b>N.A.</b>

**Overall test:** The null states convergence to the common steady state.. All numbers reported are the estimated  $t$  statistics. The null cannot be rejected as long as estimated one tail  $t$  statistic is larger than the critical value  $t_c = -1.65$  at 5% level of significance \* indicates significance at 5% level, or the rejection of the null.

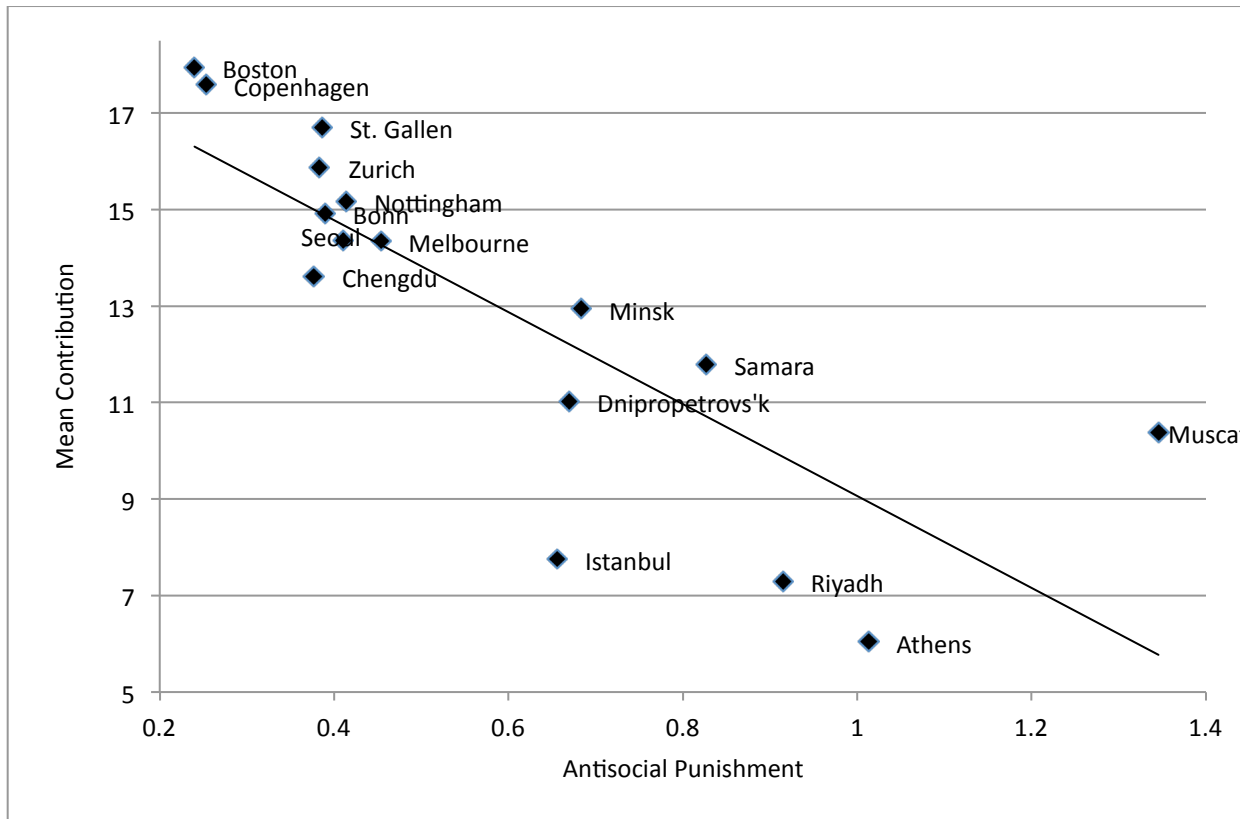




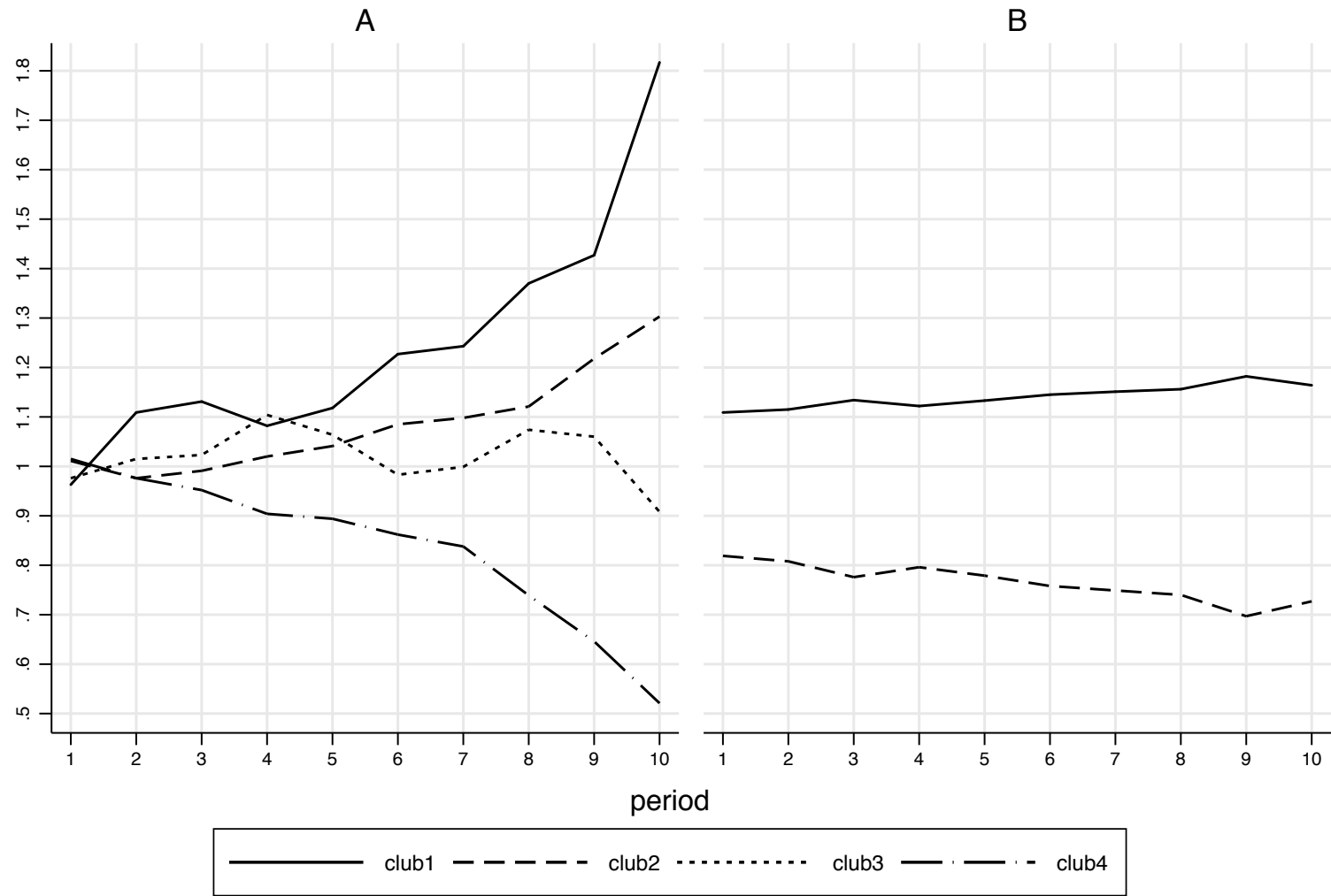
**Figure 1:** (A) mean contribution before and (B) after punishment



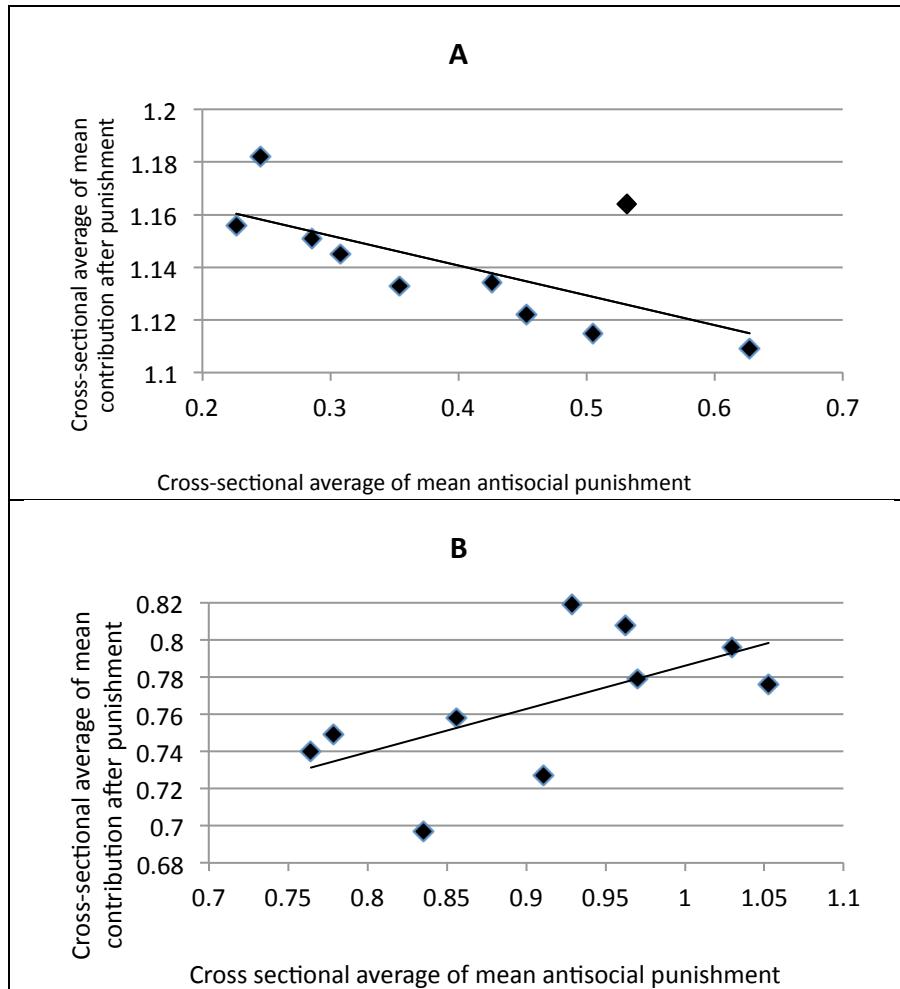
**Figure 1:** (C) relative mean contribution before and (D) after punishment



**Figure 2:** mean contribution against mean antisocial punishment (Spearman= -0.90 [0.00])



**Figure 3:** (A) clustering before and (B) after punishment.



**Figure 4:** (A) the association between contribution and punishment of cluster 1 (spearman=-0.62 [0.05]) and (B) Cluster 2 (spearman=0.66 [0.05])