Individual styles of tax evasion: an experimental study[*]

Abstract

This paper studies the tax payers "styles" of tax evasion. It starts from a brief theoretical formulation of the tax payer's decisional problem which incorporates a psychological element into the usual expected utility maximisation approach. This psychological component is founded on the hypothesis that tax payers feel their awareness that they are stealing their contribution to the tax yield from the other citizens as a moral cost.

The theoretical model was tested by carrying out three experiments involving 90 experimental subjects. The most important finding to emerge from the experiments is that the traditional theoretical treatment of uncertainty and risk could not be used to provide a satisfactory explanation of the experimental subjects' behaviour when faced by the uncertain choice of evasion. When the experimental subjects had to cope with a repeated choice problem, they developed a sort of learning strategy, using a trial and error process to explore the space of alternatives. They thus produced a personal "style" in solving the uncertainty problem. The paper shows that is possible to produce a concise taxonomy of these game styles which could be used as the basis for further theoretical analysis.

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[*] The experiments described here are the result of team work involving many members of the Experimental and Computational Economics Laboratory of the University of Trento. I am grateful to all of these people, but I owe special thanks to my friend Paolo Patelli, who authored the software used in the dynamic experiments, and to Alessandra Gaburri, who gave me substantial help in the practical organisation of the experiments. As usual, responsibility for mistakes or omissions is mine alone.

1. Introduction

This work arose originally as the continuation of a previous research project (Bosco, Mittone 1995; Mittone, 1997) which analysed the influence of non-monetary factors on the decision to pay or to evade taxes. The specific intention of Bosco and Mittone was to study, by means of experiments, the role played by moral constraints in deterring tax evasion. The experimental devices introduced in their experiments were the publicising of the results from fiscal audits and the redistribution of tax. The assumption behind the former mechanism was that people dislike being exposed as "guilty" of evasion (social blame); the latter device was based on the hypothesis that experimental subjects feel the fact that they are stealing their contribution to the tax yield from the other participants to be a moral (Kantian) cost. I shall not present here the results obtained from the one-shot experiments, because they have been already discussed in the articles just mentioned.

While in Bosco and Mittone the focus of the analysis was mainly on aggregate behaviours, here it is on individual ones. The second difference between the two works is that the data in this paper derive from repeated choices experiments, while the results discussed in Bosco and Mittone and in Mittone were obtained from two separate groups of one-shot experiments. The objective here is to single out regularities in individual behaviours, within an experimental framework that reproduces the tax payment context.

The experimental literature on tax evasion has never attempted to come up with a classification of the different “styles” of tax payment. Normally, comparison among individual types of tax paying behaviour is restricted to analysis of the effects produced by economic or psychological factors. It is not my intention here to survey the literature, for which reason I shall limit myself to citing only two studies which represent good examples of the experimental approach applied to the study of both the economic and psychological determinants of tax evasion. Probably the best-known example of investigation into the role of economic factors is the seminal experiment designed by J. C. Baldry (1985) to test the effects of net income and of marginal tax rates on tax evasion. Among the earliest experiments intended to test psychological factors, Webley and Halstead (1986) investigated the effects of an experimental design which models a real world context, versus the effects produced by a pure game context. Finally for an extensive treatise on the experimental approach to tax evasion see Webley, P.Robben, H., Elffers, H.and Hessing, D. (1991) and the references.

Although the experimental economics literature on tax evasion covers a wide range of topics, no study has thoroughly investigated the dynamic response of the individual tax payer. As said, the aim of this work is to fill this gap by building a 'taxonomy' of behaviours by identifying groups of subjects that react in almost identical manner to certain critical economic and psychological factors.

In order to build this taxonomy, I shall utilize the results from three experiments that form part of a broader research project (a total of eight experiments were conducted) which constitutes the empirical grounding for this study.

The theoretical premises used to design the experiments are taken from the standard neo-classical theory of tax evasion; that is, they are drawn from the well known model developed by Alligham and Sandmo (1972). I shall not discuss the theoretical details here. Alligham and Sandmo's basic model is too well known to require illustration, and it suffices for the purposes of this work to stress that I start from a generic assumption of "economic rationality". To be economically rational in the context discussed here entails the expectation that the experimental subjects will try to maximize some generic expected utility function. The arguments of this utility function are income (positive relationship with utility), fines (negative relationship with utility for the obvious reason that a fine reduces income), and probability of being detected (negative relationship with the utility from evasion). Supposing, therefore, that the taxpayer's utility depends only on monetary income, we may write the usual tax evasion expected value EV^e formula:

$$EV^e = (1-\pi)\,[1-t\,(1-\lambda)]Y + \pi[1-t\ -\lambda\,P(\lambda)t]Y \qquad [1.1]$$

where:

Y is income before taxation;

λ is the percentage of tax evaded ($\lambda = 0$ if the taxpayer is perfectly honest, $\lambda = 1$ if the taxpayer is perfectly dishonest);

π is the probability that evasion will be discovered;

t is the tax rate;

$P(\lambda)$ is the punishment scheme which links the surcharge to the level of evasion[1]

The taxpayer's problem, given [1.1], is simply that of comparing the value of EV^e with the net income after taxation. When $EV^e = (1-t)Y$, the expected utility theory

[1] The experiments discussed here assumed that the penalty rate is imposed on evaded tax, an institutional feature commonly used in many developed countries.

conventionally assumes the taxpayer’s choice to be discriminatory between risk aversion and risk attraction.

The theoretical framework was complicated in the experiments discussed here by my introduction of two psychological devices in the second and third experiment. Specifically, I introduced a redistribution of the tax yield in the second experiment - prompted to do so by the results of the one-shot experiments – while in the third experiment I changed the context from simulation of a tax payment to a pure gamble situation. From a neo-classical perspective, changing of context from tax payment to pure gamble does not alter anything; conversely, redistribution of the tax yield may make some difference, because the amount of money finally given to the subjects changes.

How therefore does [1.1] change if we include the tax yield redistribution? We may hypothesise that *R* - that is, the amount of money redistributed after taxation - is a function of the tax payers' attitude towards risk, of total income, and of *t*. More precisely, if we hypothesise:

[H1] – that *t* is a fixed rate,

[H2] – that the government redistributes the tax yield simply by dividing the total amount of money collected from taxes (without including the fines paid by the evaders detected by the fiscal audits) into equal parts among taxpayers;

[H3] – the punishment system is the same for all taxpayers.

We may then say that *R* will depend only on the total income and on the average prevailing attitude towards risk. Equation [1.1] therefore becomes:

$$EV^{eR} = (1-\pi)\,[1-t\,(1-\lambda)]Y + \pi[1-t\ -\lambda P(\lambda)t]Y + R \qquad [1.2]$$

where:

$$R = K\,\frac{\sum_{i=1}^{n} tY_i - \lambda_i tY_i}{n}$$

and (i=1,..,n) is the total number of taxpayers.

Inspection of equations [2.1] and [2.2] shows that the nature of the tax payer's decisional problem is basically the same with or without redistribution. More precisely, and introducing the traditional assumption of a risk neutral taxpayer, one can expect to observe different decisions as one moves from the without-redistribution context to that with redistribution only when the ratio between the value of the sure choice (pay taxes) and the value of the uncertain one (to evade) becomes greater than one as a consequence of the amount of money redistributed. The amount of "sure" income, in fact, increases as a consequence of redistribution, so that the original ratio $(1-t)Y/EV^e$ of the without-redistribution lottery changes, becoming $[(1-t)Y+R]/EV^{eR}$. Note that the value of R can only be foreseen by the individual tax payer, as it is highly unrealistic to assume that s/he has "sure" information on the behaviours of the other tax payers. Hence it follows that the only way to compute the value of the sure choice is to assume that none of the other tax payers will pay. The value of the sure income for taxpayer j therefore becomes $[(1-t)Y_j$ + $tY_j / n]$, and in a similar manner EV^{eR} changes as well.

Consequently, the main effect expected to ensue from the inclusion of tax yield redistribution is a reduction in tax evasion due to some form of psychological cost not captured by any monetary element of the model. As said, this psychological cost is assumed to relate to some sort of Kantian category: the subjects do not evade because they regard tax evasion as morally unfair.

It is to be emphasised that both tax yield redistribution and the design of a pure gamble game, as in the third experiment, were intended mainly to test the robustness of the taxonomy of behaviours constructed from the data yielded by the first experiment.

The next section begins with a description of the parts of the experimental design common to all three of the experiments discussed.

2. The design of the experiments

The experiments were run using a computer-aided game designed for this specific purpose. Thirty subjects participated in each experiment, 15 men and 15 women, all of them students recruited by announcements on the bulletin board of the Faculty of Economics. The subjects' personal data were collected by the staff of the Computable and Experimental Economics Laboratory. All the experiments were of the same length (60 rounds, a duration that was communicated to the subjects) and they were run by taking the variables that enter the lottery structure as constant. The values for the lottery were the following:

a) *income* - 1000 Italian Liras from round 1 until round 48, then 700 Italian Liras;

b) *tax rate* - 20% from round 1 until round 10, then 30% from round 11 until round 30, and finally 40% from round 31 until the end;

c) *tax audit probability* - 6% from round 1 until round 21, then 10% from round 22 until round 40, and finally 15% from round 41 until the end;

d) *fees* - the amount of the tax evaded plus a fee equal to the tax evaded multiplied by 4.5; the tax audit had effect over the current round and the previous three rounds.

To approximate a real life situation more closely, I decided to extend the tax audit over a period of four rounds. The lottery structure for the dynamic experiments was kept constantly unfair, independently of variations in the probability of a the tax audit .

The players were not allowed to communicate during the experiment, and they received information only from the computer screen, which showed the following items of information:

a) the total net income earned by the player since the beginning of the game,

b) gross income in the active round,

c) the amount of taxes to pay in the active round,

d) the number of the active round.

The subjects underwent a fiscal audit in correspondence to the same rounds but following two different time-sequences (specifically, the subjects exposed to the first sequence were investigated in rounds 13, 31, 34, 48, 54, 58, while those exposed to the second sequence were investigated in rounds 3, 24, 27, 40, 46, 50).

A further information device in the experiment took the form of a snap interruption: the computer screen changed and a message appeared informing the subjects that the audit probability would change after three rounds (this item of information kept the subjects constantly informed about the relevant parameters of the lottery). When each subject had read the information on the screen and had taken her/his decision, s/he wrote, using the computer keyboard, the amount of money that s/he had decided to pay and then waited to see if s/he had been extracted for a fiscal investigation.

To test the individual response within different contexts, I used three different experimental designs:

DY1) was the standard experiment;

DY2) was the same as DY1 but with the introduction of the tax yield redistribution;

DY3) was exactly identical to the standard experiment, except that it was designed as a generic gamble and every reference to the fiscal environment was eliminated (I shall call it the “gamble experiment” for convenience).

I shall give more details of the structure of the experiments in the following section, when I discuss the results.

3. The results: a first taxonomy

The data discussed here only concern individual behaviours. Analysing individual records is a rather complex undertaking, mainly because a relatively large number of observations are involved (30 subjects for each of the 3 experiments multiplied by 60 rounds each gives a total of 5400 values for each variable considered by the experiment) and because the individual behaviours displayed marked variability. A first step in organising the data set is to build some sort of behaviour taxonomy. One may begin analysis of individual behaviours by plotting the percentage of tax paid in each round and by looking at the frequency of evasion. The aim is to find one or more general rules of behaviour.

Figs. 1, 2, 3 and 4 show the individual trends in tax payment exhibited by four subjects taken from the standard experiment (DY1) who were assumed to be representative of four different "styles" of play. Each graph reports the amount of money due (the continuous line), the amount of money actually paid by the subject (the dotted line), and the rounds in which a tax audit took place (the bars).

The first kind of behaviour can be called "absolute stability". It is displayed by subject no. 28 (fig. 1), who invariably paid all the tax due (in fact the two lines, the tax due one and the tax paid one, coincide). In the standard experiment only one subject decided to adopt this "pure" strategy, while in the experiment with tax yield redistribution (experiment DY2) 7 subjects always paid the whole amount of tax due, which confirms the hypothesis that tax yield redistribution is a deterrent against tax evasion. The second kind of behaviour is exemplified by the graph of subject no. 18 (fig. 2). This can be called "relative stability" because the subject always evaded but followed a variable path, i.e. s/he changed the amount of money evaded in each round.

Fig. 1 Tax payments subject 28

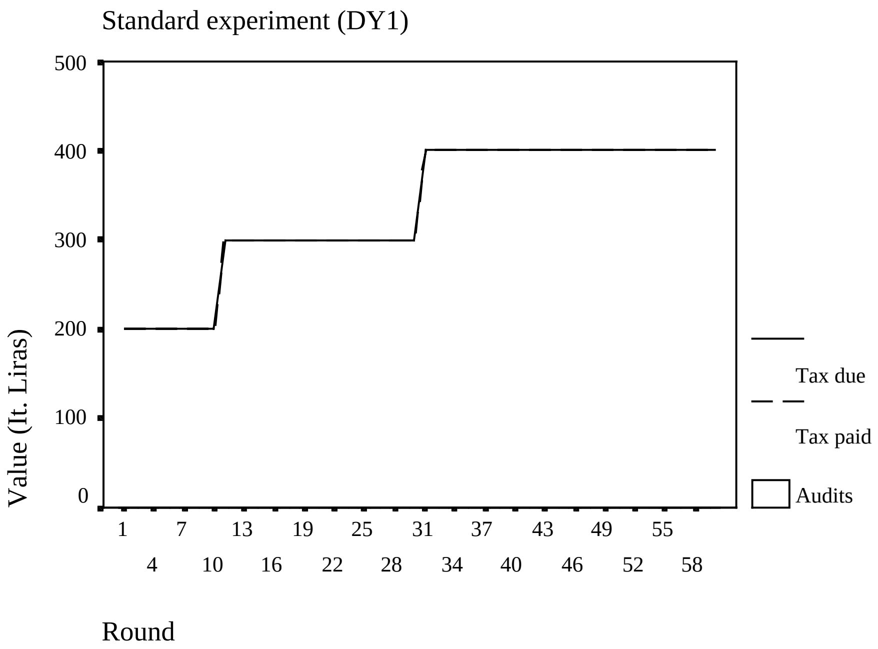
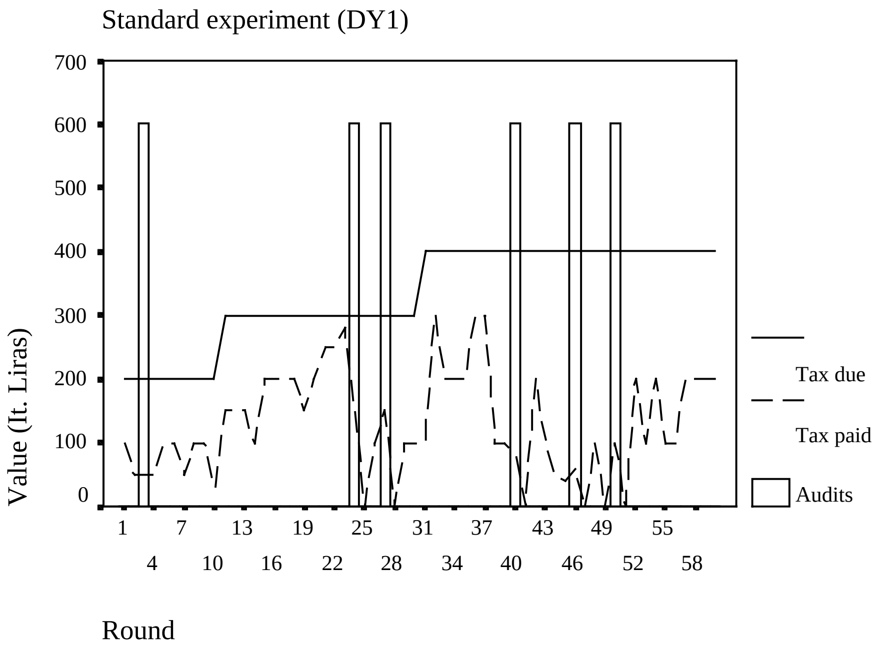


Fig. 2 tax payments subject 18



Subjects 28 and 18 can be assigned to the same behavioural group even though they adopted opposite strategies, because they show the same constancy in their attitude towards risk throughout the duration of the experiment. In fact, subject 28 was always risk averse (or risk neutral) while subject 18 was always a risk taker. The characteristic that prevents their placement in a single homogeneous behavioural group is the "oscillatory" dynamic shown by subject 18, who changed the percentage of tax paid in each round, which is exactly the opposite of the absolute constancy shown by subject 28, who never changed the percentage of tax paid (always 100%).

Fig. 3 Tax payments subject 0

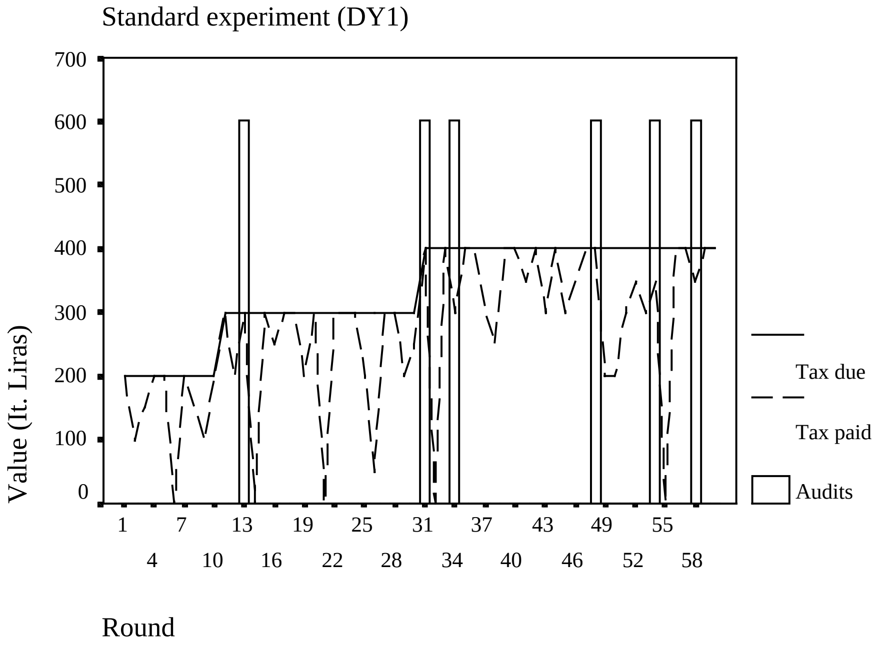
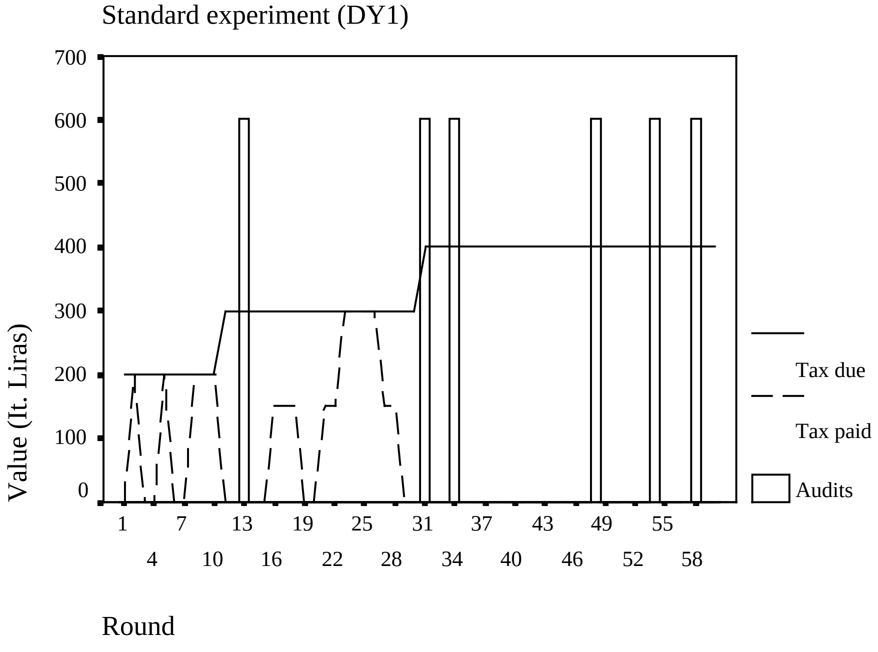


Fig. 4 Tax payments subject 8



The oscillatory trend of the choices made by subject 18 is similar to that followed by all the other subjects who took part in the standard experiment. It is exemplified by the graph for subject 0 (fig. 3). Subject 0 followed some sort of random walk dynamic, combined with a constantly changing attitude towards risk whereby s/he oscillated between total payment and partial (or sometimes total) evasion, with a ratio that comes very close to a perfect 1 to 1. This behaviour, which can be called "pendulum-like" (or, in other words, "once I pay, once I evade") is unusual in its regularity (the almost perfect 1 to 1 ratio between evasion and payment) but it is very common with respect to the variability of the risk attitude.

Finally, the fourth behaviour is represented by subject 8 (fig. 4). This can be called "mixed" because in the first part of his/her experimental life this subject adopted a strategy in some way similar to that chosen by subject 0 (a sort of "pendulum" strategy but with a longer interval of oscillation and a different ratio between total payment and evasion, something like: I pay, I evade, I evade, I evade, I pay), while in the second part of his/her experimental life s/he constantly evaded the whole amount of tax due. This definitive change in the attitude towards risk, which developed in the course of the experiment, was evident in no other example in any other experiment, so that subject 8 was unique in displaying this behaviour.

The simple taxonomy described by using the four graphs in figs. 1, 2, 3 and 4 is not satisfactory, because it does not provide an unambiguous criterion with which to group the subjects into statistically robust categories. The only unambiguous group is the one represented by subject 28. Unfortunately, this kind of behaviour (always pay the entire amount of tax due) is uncommon (only 1 subject in experiment DY1, 7 subjects in experiment DY2, and no subject in the gamble experiment DY4). It can therefore be assumed to be some sort of highly specific behavioural category. Similarly, the strategy adopted by subject 18 (always evade) can also be assumed to be an extreme behavioural category, given that almost no other subject chose this style of play (only subject 18 in experiment DY1, none in experiment DY2 and in experiment DY3, and only 1 in experiment DY4).

I used a two-step methodology to classify the experimental subjects into homogeneous categories. In the first step I constructed new data-bases, one per experiment, which included 30 cases (each case was an individual subject) each characterised by seven variables chosen as proxies for the following attributes:

1) NU_{EVA} = number of tax evasions during the experiment → proxy for the degree of stability of the risk attitude;
2) AV_{EVA} = average amount of money evaded during the experiment → proxy for the absolute risk propensity;
3) SD_{EVA} = standard deviation of tax evasion → proxy for the degree of variability of the risk propensity;
4) FINE = total amount of fines paid during the whole experiment → proxy for the total deterrent effect of the punishment system;
5) N_{FINE} = number of fines paid during the experiment → proxy for the frequency of direct experience of the punishment system;
6) R_{SQ} = Regression coefficient computed by interpolating the amount of money evaded in each round with a quadratic curve computed by using time as the only independent variable → proxy for the degree of similarity of the individual tax payment trend with the best interpolating function for the whole population;
7) Y_{CUM} = Total income cumulated at the end of the experiment → proxy for the degree of success of the game strategy chosen by the subject.

In the second step of the procedure I ran a cluster analysis using the variables just listed. The broad idea followed in this analysis was that the dynamic behaviours of the subjects could be captured by a set of variables summarising the most important characteristics of the behaviours themselves. The values assumed by these variables should then have helped to group the subjects into homogenous categories of behaviour.

Among the possible methods available to build clusters of homogeneous categories, I decided to use the average linkage between groups method (also called IPGMA, unweighted pair-group method using arithmetic averages) and to run the cluster using standardised variables. The use of standardised variables is common in cluster analysis, given that all cluster techniques are based on some form of comparison between distances, so that variables measured with large numbers influence the computation of distances more than do variables measured with small numbers. The standardisation method chosen was a technique built into the statistical package that I used to run the cluster analysis. It is based on a system of scores with a mean of 0 and standard deviation of 1. The algorithm adopted by the software (SPSS) subtracts the mean from each value of the variable being standardised, and then divides by the standard deviation of the values. If a standard deviation is 0, all values are set to 0.

A common way to represent the results obtained from a cluster analysis is to plot a dendogram. The dendogram plotted running a cluster analysis using the standard experiment data is shown in fig. 5.

The dendogram gives a graphical representation of the links among the groups of subjects constructed using the variables just described. Since the clusters move from the highest level of scattering to the lowest (in the end, there is only one large cluster which includes all the subjects), the problem is finding a good compromise between the number of clusters obtained (reasonably small) and the degree of similarity of the subjects included. One way to solve this problem is to inspect the distance that separate the clusters. This distance (re-scaled to fall within the range of 1 to 25) is measured on the horizontal axis, and one is helped in the choice of the best number of clusters by seeing when it becomes fairly large. A possible level of "cutting" the clusters is represented by the dashed line in fig. 5 and corresponds to four groups of subjects and to four isolated cases (the subjects labelled 3, 8, 15 and 28) representing clusters consisting of only one subject. Some summarising statistics on the clusters are given in table 1, where the variables used to run the cluster analysis have been augmented by two new variables: $NTOT_{EV}$ which reckons the number of total evasions, and $NTOT_{PAY}$ which sums the number of times that the subjects paid the total amount of tax due.

Fig. 5 Dendrogram Standard Experiment (DY1)

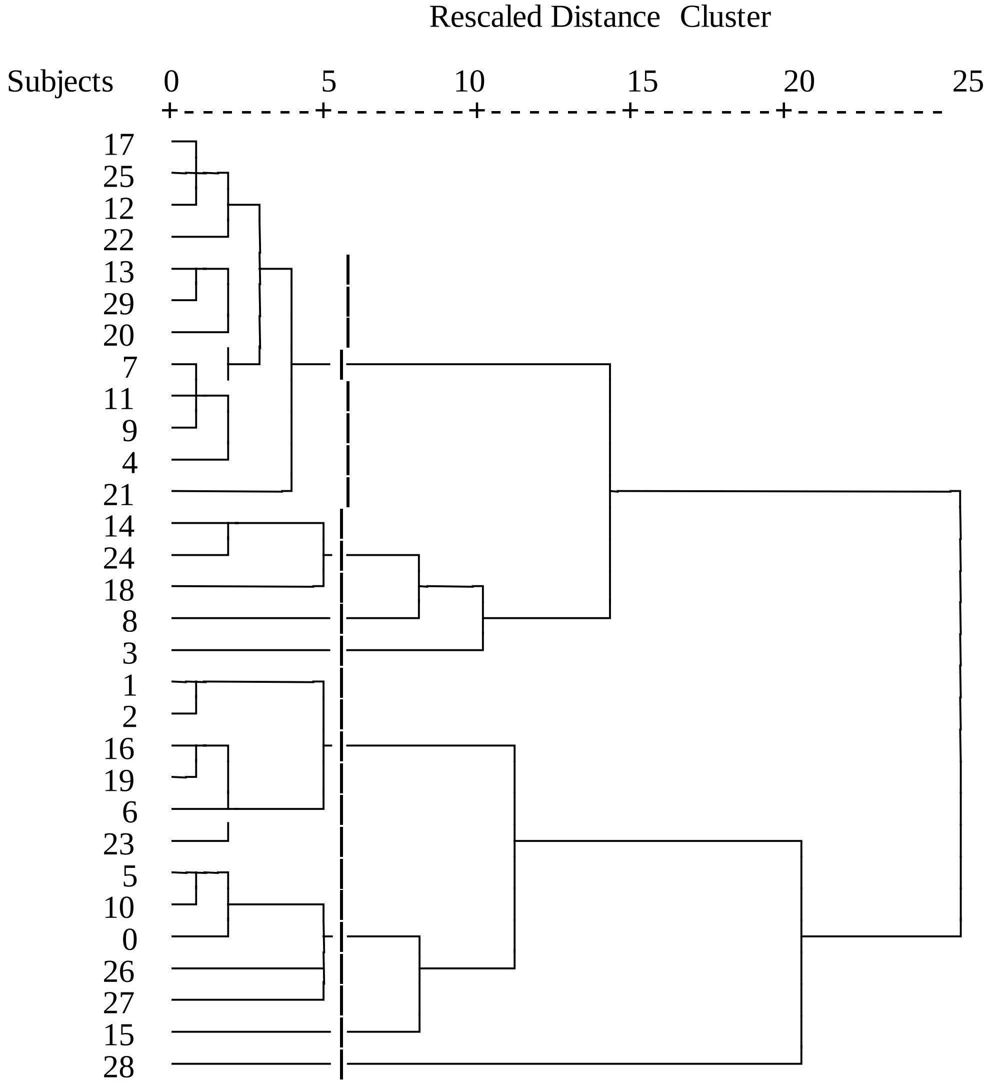


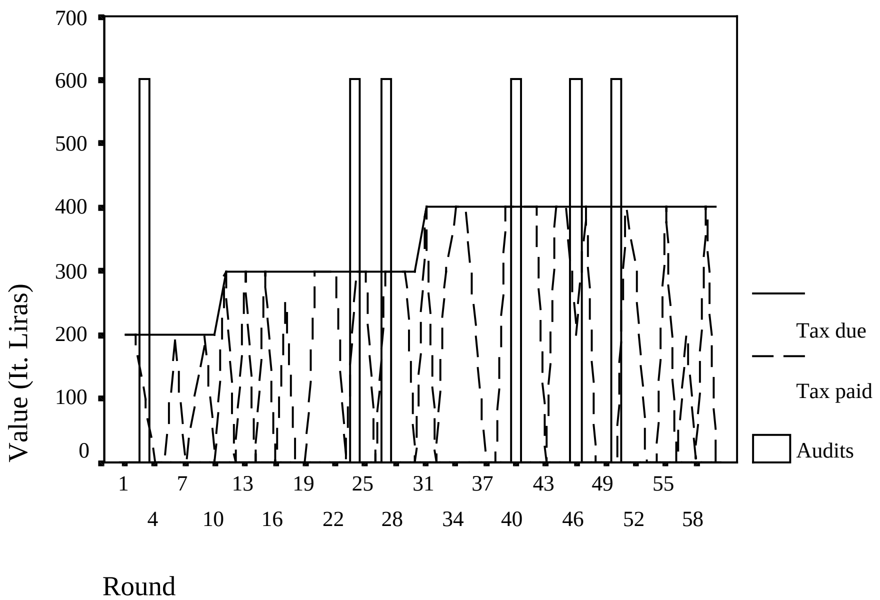
Table 1 can be used to define the four clusters with more than one subject. The largest is cluster 4 which comprises 12 subjects displaying behaviour that could be called “totally evade once, then pay the entire tax one or more times”. The variables reported in the two last columns of table 1 show that the average number of total tax evasions for cluster 4 is 19.5 while the average number of total payments (i.e. when the subject pays the entire tax due) is 22.16. This means that the subjects belonging to this cluster tend to oscillate between two opposite kinds of choice with an almost perfect ratio of 1:1. The best example of this kind of behaviour is provided by the graph of tax payments by subject 17 (fig. 6), who, with only three exceptions (rounds 17, 46 and 57), always either paid the entire tax or totally evaded.

Tab. 1 Standard experiment (DY1): summary statistics for 8 clusters

Cluster		NUEV	AVGEV	SDEV	YCU	FIN	NFIN	RS	NTOTE	NTOTP
1	**Mean**	24.000	285.982	112.832	33774.200	5466.800	5.800	.3666	3.200	36.000
	N	5	5	5	5	5	5	5	5	5
	Std.	9.460	15.995	11.278	1872.061	2780.877	1.095	.1809	2.280	9.460
2	**Mean**	7,000	305.583	112.400	34050.000	4015.000	2.166	.4288	4.000	53.000
	N	6	6	6	6	6	6	6	6	6
	Std.	2.529	14.068	16.356	1386.362	1785.595	1.169	.1421	2.828	2.529
3	**Mean**	58.000	168.500	53.010	21760.000	33330.000	6.000	.3740	.0000	2.000
	N	1	1	1	1	1	1	1	1	1
	Std.	.	.	.	.	.	.	.	.	.
4	**Mean**	37.833	178.623	150.724	26155.916	19526.750	5.833	.1003	19.500	22.166
	N	12	12	12	12	12	12	12	12	12
	Std.	7.529	20.796	16.417	2991.373	3761.628	.3892	7.930E-	6.388	7.529
5	**Mean**	51.000	54.170	95.800	8875.000	44275.000	6.000	.1960	44.000	9.000
	N	1	1	1	1	1	1	1	1	1
	Std.	.	.	.	.	.	.	.	.	.
6	**Mean**	55.666	120.423	113.646	19178.333	29996.333	6.000	.1277	19.666	4.333
	N	3	3	3	3	3	3	3	3	3
	Std.	3.785	31.793	28.762	2493.262	1768.787	.0000	8.950E-	12.096	3.785
7	**Mean**	59.000	234.500	94.590	29185.000	13145.000	6.000	.2830	2.000	1.000
	N	1	1	1	1	1	1	1	1	1
	Std.	.	.	.	.	.	.	.	.	.
8	**Mean**	.0000	333.330	75.160	36400.000	.0000	.0000	.8940	.0000	60.000
	N	1	1	1	1	1	1	1	1	1
	Std.	.	.	.	.	.	.	.	.	.
Total	**Mean**	31.700	218.622	123.558	28026.566	15549.466	4.933	.2580	12.633	28.300
	N	30	30	30	30	30	30	30	30	30
	Std.	18.558	76.100	29.866	6622.151	11326.162	1.892	.2136	11.484	18.558

Fig. 6 Tax payments subject 17 (cluster 4)

Standard experiment (DY1)

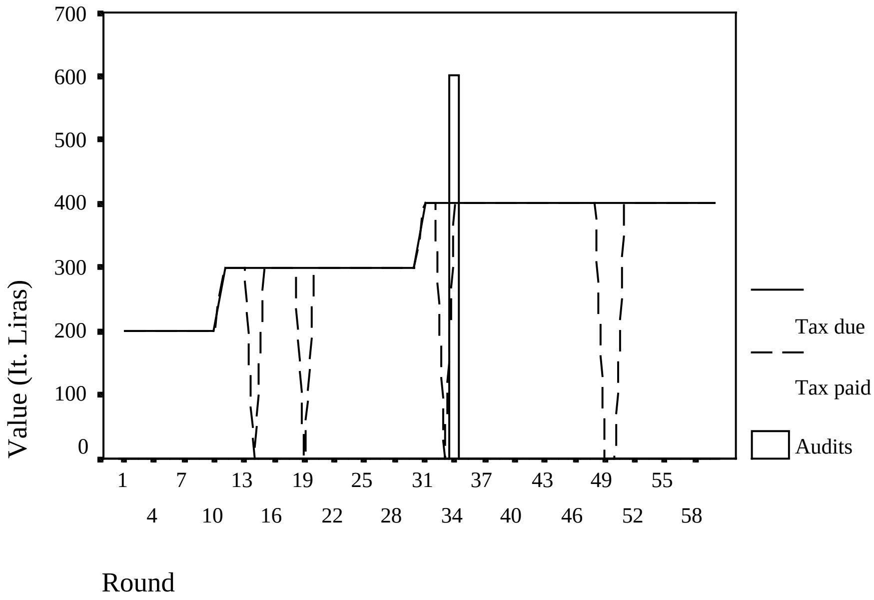


The second largest cluster by number of members is cluster 2, which includes 6 subjects whose behaviour can be called “mainly pay the whole tax due and sometimes evade the entire tax”. Again looking at table 1, one notes that the average number of total payments for subjects belonging to this cluster is 36, while the average number of total evasions is 3.6. This behaviour is therefore the reverse of that adopted by the subjects belonging to the previous cluster (cluster 4), because these subjects show a tendency to adopt fundamentally stable behaviours, while those belonging to cluster 4 continuously oscillate between totally opposite choices. Confirmation of this profound difference is provided by the values of the regression coefficient, which is very low for cluster 4 (R_{SQ} = 0.1) and much higher (the highest of all clusters with more than one subject) for cluster 2 (R_{SQ} = 0.42). This difference in the values of R_{SQ} is closely related to the different styles of play, since the quadratic curve used to interpolate the individual game strategies cannot fit constantly oscillating behaviour such as that followed by the subjects belonging to cluster 4.

Although I have distinguished between oscillatory behaviour and stable behaviour, it would be more correct to say, for the sake of precision, that both the clusters identify "stable" behaviours, in the sense that the subjects belonging to both these clusters never changed their strategy of play throughout the entire duration of the experiment. The fundamental difference between the two clusters is therefore that members of cluster 4 chose a pendulum-like behaviour, as opposed to the quasi-perfect constant behaviour selected by the subjects of cluster 2. As previously noted, the large majority of subjects choose to follow the same strategy for the whole duration of the experiment (an exception to this rule, already commented on, was subject 8, fig. 4), and it seems that the only learning process undergone by the subjects is represented by an increase in the frequency of evasions during the course of the experiment for those who experienced the first audit at round 13 instead of round 3. A good example of the game style chosen by the subjects of cluster 2 is shown by fig. 7.

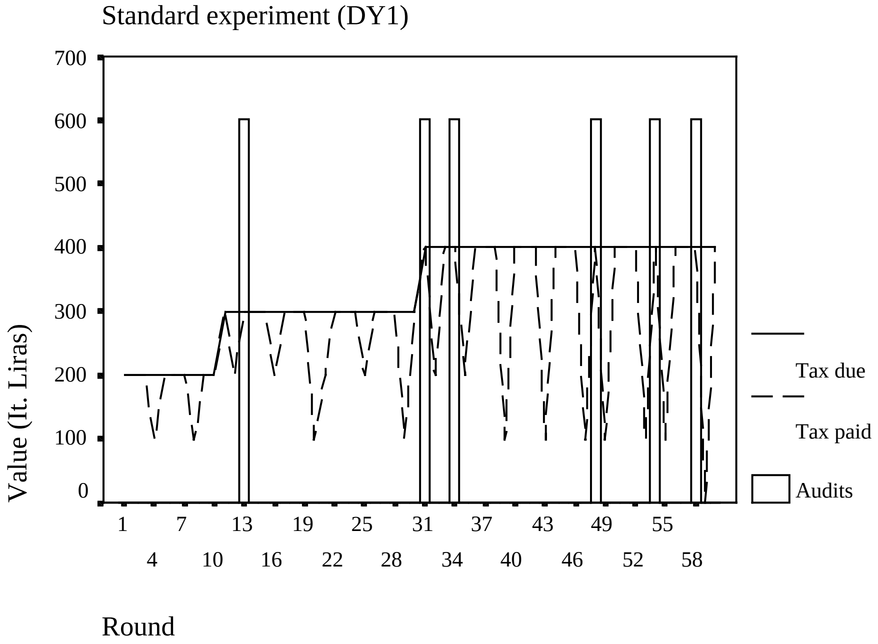
Fig. 7 Tax payments subject 1 (cluster 2)

Standard experiment (DY1)



The other two clusters with more than one subject are cluster 1, with 5 subjects, and cluster 6 with 3 subjects. Cluster 1 comprises experimental subjects whose behaviour has some affinity with the behaviour of the subjects in cluster 4, and which could be "once evade *a part* of the tax due, then pay the entire tax one or more times". The main difference with respect to cluster 4 is that the members of cluster 1 almost never evade the whole amount of tax due, while the subjects in cluster 4 almost never evade less than the entire tax. Another difference between the two clusters is that the members of cluster 1 alternate payments and evasions in a ratio where tax payment slightly predominates over tax evasion (the average number of tax evasions, measured by variable NU_{EVA} of table 1, is 24, which corresponds to 40% of the total number of rounds), while the subjects belonging to cluster 4 to a slight extent prefer to evade rather than pay (NU_{EVA} computed for cluster 4 is 37.8). An example taken from the subjects belonging to cluster 4 is given in fig. 8.

Fig. 8 Tax payments subject 10 (cluster 1)



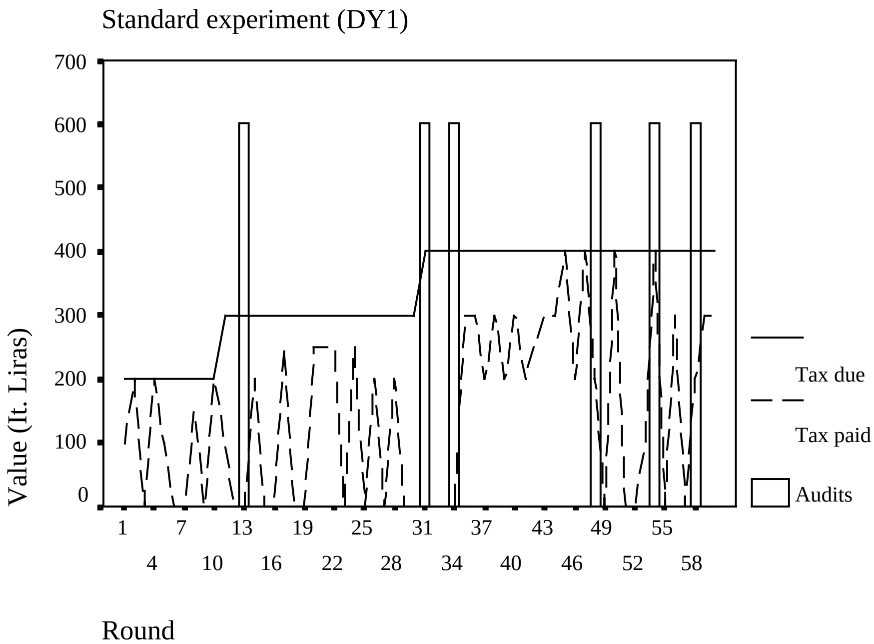
While cluster 1 can be considered some sort of subgroup of cluster 4, this is not the case of cluster 6, which, although very small, must be kept separate because it represents a quite different category of behaviour. This cluster could be labelled "mainly evade the whole amount of tax due or a part of it and sometimes pay". The value of NU_{EVA} for cluster 6 is 55.6, which means that the subjects belonging to this cluster paid, on average, the entire tax fewer than five times during their experimental lives. An example of the behaviour adopted by the subjects belonging to cluster 6 is shown in fig. 9.

Having discussed the four clusters with more than one subject, explanation is required of the fact that four subjects apparently do not fit any of these four clusters. First of all, one should bear in mind that cluster analysis is a kind of "qualitative" statistical method that requires careful interpretation of the results.

Referring once again to the dendogram in fig. 5, one notes that two of the isolated subjects, specifically subject 8 and subject 15, would respectively join cluster 6 and cluster 1 if the rescaled distance increased from 5.5 to 8.5. Unfortunately, both these aggregations can be criticised, albeit for different reasons. In the case of subject 8, I have already pointed out that s/he displays a very special behavioural pattern, having adopted some sort of dichotomous strategy which splits his/her experimental life into two separate periods. On the other hand, none of the subjects in cluster 6 ever chose to change his/her game style at any stage of the experiment (for the sake of precision, the only subject that can be coupled with subject 8 is subject 24, who at the end of the experiment decided always to evade the whole tax, but s/he took this decision only after the 50th round, while subject 8 started this strategy at round 29, i.e. in the middle of the experiment).

The difficulty of joining subject 15 to cluster 1 derives from the fact that, in spite of the values assumed by some of the variables used by the cluster analysis, this subject actually behaved in a way much more similar to that followed by the subjects belonging to cluster 6. Inspection of table 1 shows that, with the exception of NU_{EVA}, no other variable of cluster 6 has values nearer to the values of subject 15 (who corresponds to cluster 7 in table 1) than to those assumed on average by the subjects belonging to cluster 1. Nevertheless, it is clear from the graph of tax payments by subject 15 (reported in fig. 10) that his/her game style is very similar to that of the subjects in cluster 6 ("almost never pay; almost always evade the whole amount of tax due or a part of it") and quite different from that adopted by the subjects belonging to cluster 1 ("evade a part of the tax due once, then pay all the burden one or more times").

Fig. 9 Tax payments subject 14 (cluster 6)



Finally to be considered are the two remaining isolated subjects: subject 3 (fig. 11) and subject 28. Subject 3 could be included in cluster 6, but this time in accordance with the dendogram, which in fact puts subject 3 very near to cluster 6, while subject 28 should be left alone because of her/his uniqueness for this experiment. In spite of the statistically good proximity of subject 3 with the behaviours of the subjects belonging to cluster 6, it is worth stressing that his/her game style also differs markedly from that of the other subjects in cluster 6. This difference regards his/her tendency to adopt a highly constant behaviour, while his/her cluster mates follow an oscillatory strategy very similar to that adopted by the majority of the experimental subjects in all the clusters. From an economic point of view, the behaviour of subject 3 can be coupled with that of subject 28, i.e. the only subject who decided always to pay the entire tax. The difference between these two subjects, in fact, is one of different risk propensities, but they resemble each other in that they interpret the game by looking at the lotteries structure, which in fact does not change with each round but remains constant for quite long periods.

The conclusion to be drawn is that the final number of clusters can be reduced to four clusters with more than one subject (clusters 1, 2, 4, 6 with the inclusion of subject 3, subject 15 and subject 8) plus a cluster with only one subject, i.e. subject 28. Finally, it is worth stressing that the taxonomy of behaviours suggested at the beginning of this section captured only part of the entire repertoire of strategies used by the subjects.

Fig. 10 Tax payments subject 15 (cluster 7)

Standard experiment (DY1)

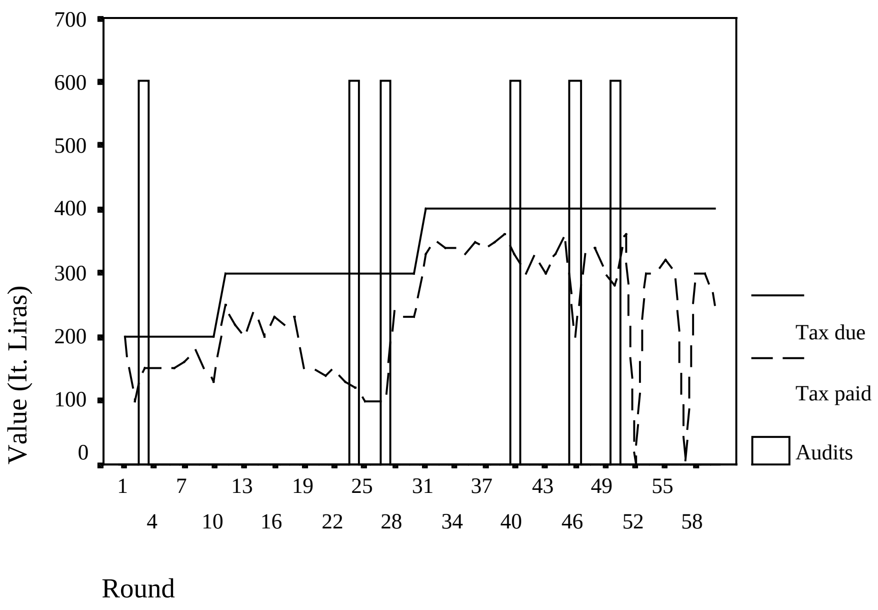
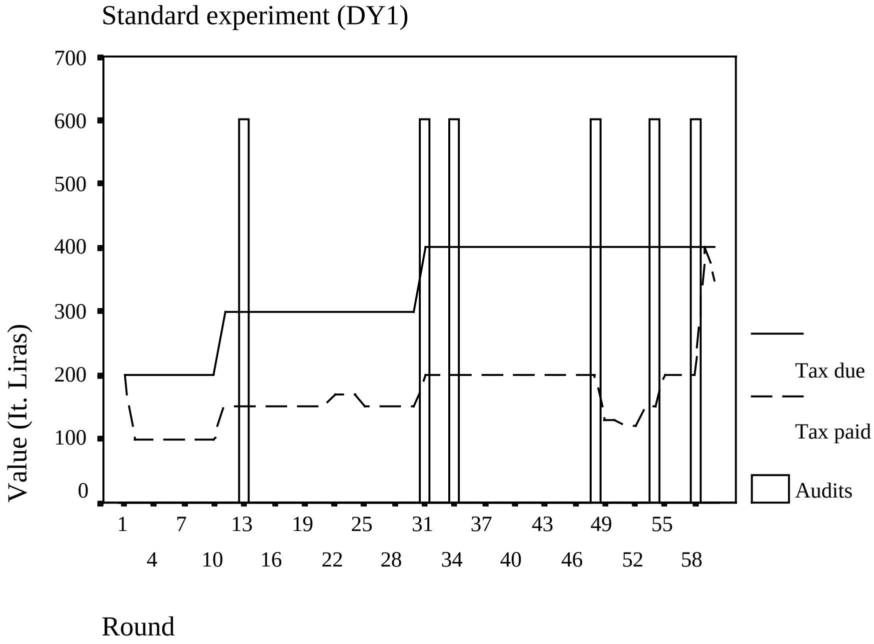


Fig. 11 Tax payments subject 3 (cluster 3)



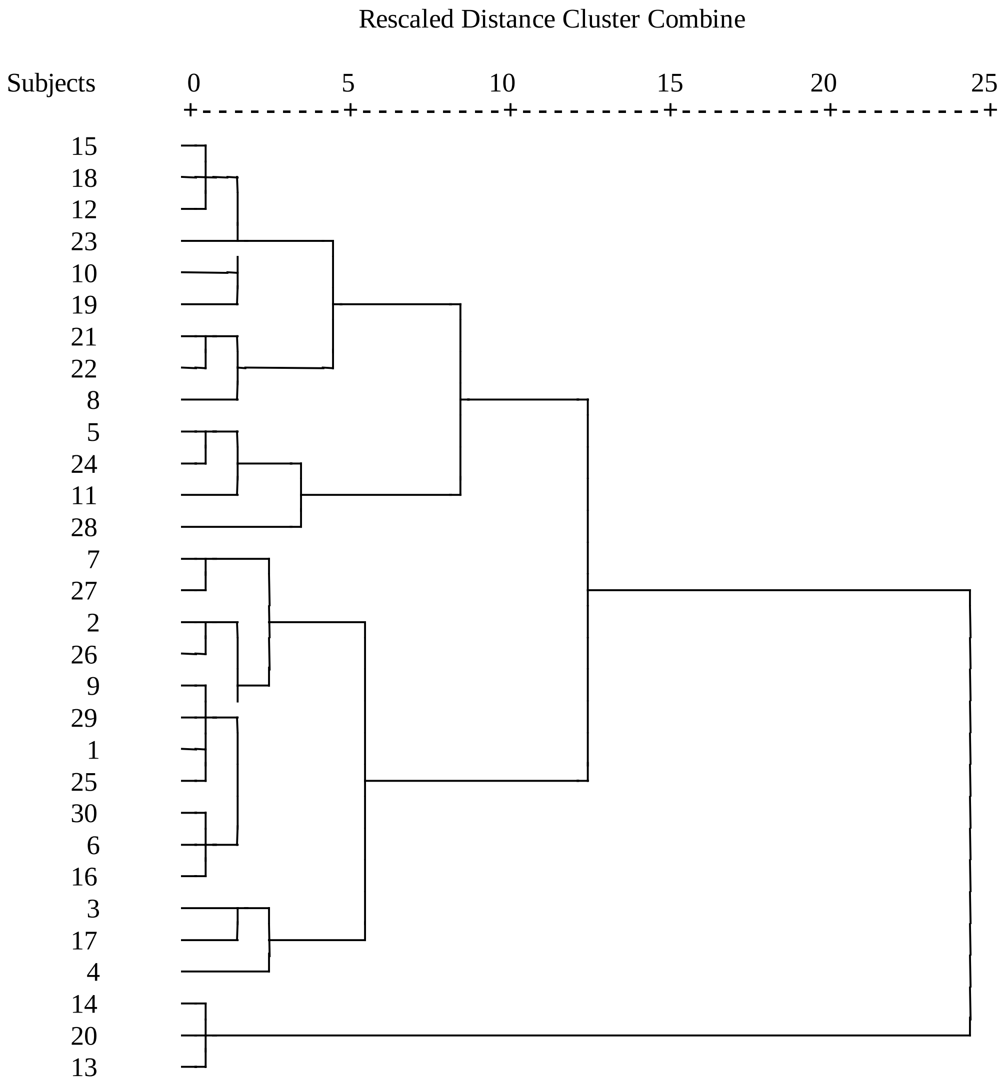
4. Testing the taxonomy

One way to test the robustness of the taxonomy just constructed is to carry out a cluster analysis using the data from other experiments and ascertain whether the clusters contain groups of behaviours similar to those obtained with the data from the standard experiment. Obviously, one cannot expect the result to be a perfect fit with the original categories, given that cluster analysis always requires some form of interpretation, which inevitably requires some degree of adaptation of the original taxonomy. This also means that comparisons among different experiments, for example in order to compare the numerousness of similar clusters, requires great caution.

The aggregate results from the experiment with tax yield redistribution are those that differ most from those obtained by the standard experiment. Conversely, the gamble experiment produced aggregate results that were most similar to those from the standard experiment. For this reason, it is more convenient to change the order in which the results are analysed by testing the taxonomy first on the basis of the data from the gamble experiment (DY3), and then on the basis of those collected by the tax yield redistribution experiment (DY2).

Starting from the dendogram plotted by performing a cluster analysis (fig. 12) on the gamble experiment (obviously using the same variables just used for the standard experiment), one immediately notices that “cutting” the dendogram at the same distance chosen for the dendogram plotted for the standard experiment yields only five clusters, instead of the eight obtained by experiment DY1. To obtain the same number of clusters, it is therefore necessary to reduce the distances among the clusters. The results for eight clusters are given in table 2.

Fig. 12 Dendogram Gamble Experiment (DY4)



, We can attempt to derive some correspondences among the clusters from the two experiments by comparing table 2 with table 1. Recalling the results obtained from the standard experiment, we have the following main categories (clusters) of behaviour:

a) category 1TE1P “totally evade once, then pay the entire tax one or more times”;
b) category MPSE “mainly pay the whole tax due and sometimes evade the entire tax”;
c) category 1E1P “evade a part of the tax due once, then pay the entire tax one or more times”;
d) category MESP “mainly evade the whole amount of tax due or a part of it and sometimes pay”;
e) category AP “always pay”.

With the exception of category AP, which is a “pure” category, all the other categories include a moderate mix of behaviours which more or less closely approximate the label just suggested. This means that if a category becomes sufficiently differentiated, it can give rise to two or more other sub-categories, and this possibility increases as we expand the total number of subjects considered. For example, subject 18, who as we saw at the beginning of this section never paid and was included in cluster 6, could become a member of a sub-category of category 4 (or give origin to a new category) if we find some other subjects who adopted his/her game style.

Tab. 2 Gamble experiment (DY3): summary statistics for 8 clusters

Cluster		NUEV	AVGEV	SDEV	YCU	FIN	NFIN	RS	NTOTE	NTOTPA
1	Mean	42,181	157,783	143,802	24691,818	21175,181	6,000	,1225	17,272	17,818
	N	11	11	11	11	11	11	11	11	11
	Std.	9,282	22,958	16,992	2423,264	2532,496	,0000	5,826E-	6,768	9,282
2	Mean	53,500	220,250	129,911	20132,500	29482,500	6,000	2,300E-	19,000	6,500
	N	2	2	2	2	2	2	2	2	2
	Std.	4,949	28,402	23,860	1933,937	229,809	,0000	5,657E-	21,213	4,949
3	Mean	59,000	262,433	97,832	14153,000	37993,000	6,000	1,200E-	13,000	1,000
	N	1	1	1	1	1	1	1	1	1
	Std.	,	,	,	,	,	,	,	,	,
4	Mean	31,666	38,388	52,490	35128,666	3574,666	5,666	,6807	2,000	28,333
	N	3	3	3	3	3	3	3	3	3
	Std.	8,504	7,322	5,531	1078,107	1448,415	,5774	,1143	,0000	8,504
5	Mean	11,333	55,000	124,294	32916,666	6783,333	3,333	,2523	9,666	48,666
	N	3	3	3	3	3	3	3	3	3
	Std.	3,055	14,131	6,797	1543,286	2222,798	1,154	7,023E-	3,214	3,055
6	Mean	31,333	93,416	117,774	30425,833	11579,166	6,000	,2703	9,000	28,666
	N	6	6	6	6	6	6	6	6	6
	Std.	8,115	25,559	14,484	1168,440	2484,623	,0000	,1318	3,847	8,115
7	Mean	1,666	8,877	55,174	35466,000	1466,666	,6667	,5917	1,333	58,333
	N	3	3	3	3	3	3	3	3	3
	Std.	1,154	3,829	6,122	1172,291	1270,170	,5774	4,382E-	,5774	1,154
8	Mean	60,000	68,750	73,355	31230,000	9295,000	6,000	,6250	5,000	,0000
	N	1	1	1	1	1	1	1	1	1
	Std.	,	,	,	,	,	,	,	,	,
Total	Mean	33,733	112,486	113,845	28344,900	14804,300	5,166	,2742	11,300	26,266
	N	30	30	30	30	30	30	30	30	30
	Std.	17,532	69,690	36,699	5721,750	9693,943	1,763	,2298	8,618	17,532

By considering the results from other experiments we do exactly as just described: we increase the number of subjects analysed, and consequently we also increase the possibility of distinguishing among sub-categories of behaviour. Once more, by comparing table 1 with table 2, which reports the results from the cluster analysis run using the data from the gamble experiment, we can build a broad structure of correspondences between the clusters of these two experiments (table 3).

Tab. 3 Correspondences among clusters: standard and gamble experiments

Categories	Standard experiment	Gamble experiment	Mann-Whitney test
cat. 1TE1P "totally evade once, then pay the entire tax one or more times"	cluster 4; 12 subjects	cluster 1; 11 subjects; cluster 6; 6 subjects (as a mixed sub-category)	good
cat. MPSE "mainly pay the whole tax due and sometimes evade the entire tax"	cluster 2; 6 subjects	cluster 5; 3 subjects; cluster 7; 3 subjects (this could become a sub-category)	very good
cat. 1E1P "evade a part of the tax due once, then one or more times pay the entire tax"	cluster 1; 5 subjects	cluster 4; 3 subjects	good
cat. MESP "mainly evade the whole amount of tax due or a part of it and sometimes pay"	cluster 6; 3 subjects + cluster 3; 1 subject + cluster 5; 1 subject + cluster 7; 1 subject	cluster 2; 2 subjects + cluster 3; 1 subject	good
cat. AP "always pay"	cluster 8; 1 subject		

On analysing table 3 one finds that the original categories should be supplemented with at least two new categories or sub-categories of existing ones. These two new sub-categories are represented by cluster 6 and cluster 7 of the gamble experiment. Cluster 6 of the gamble experiment represents some sort of mix between category 1TE1P and category

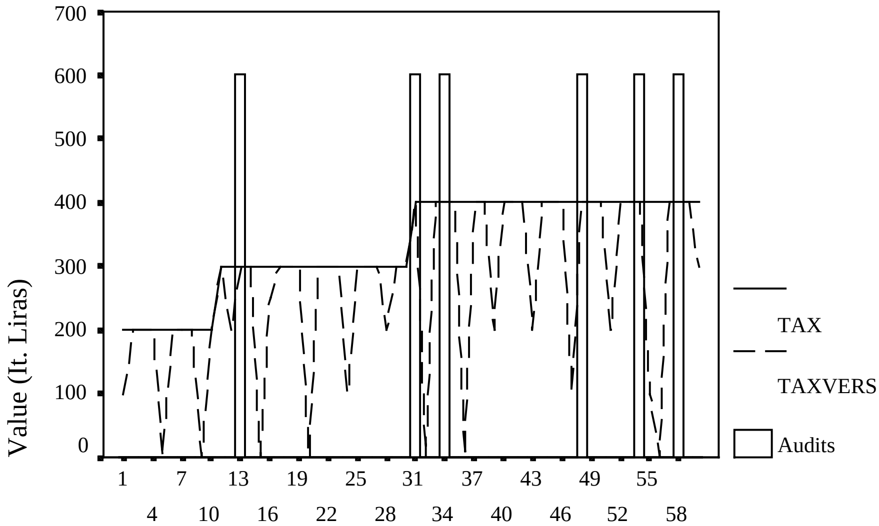
1E1P, because the data (and individual graphs, like that of subject 10 reported in fig. 13) show that the strategy followed by the subjects is something like " totally evade once, then pay the whole tax due, then evade a part of the tax, then pay the entire tax", and so on, following the usual quasi-cyclical path.

On the other hand, cluster 7 of the gamble experiment, unlike cluster 6, can be viewed as an "extreme" sub-category of category MPSE, because the subjects belonging to this cluster have evaded in only one or two rounds.

One way to verify whether the correspondences shown in table 3 are statistically significant is to compute the Mann-Whitney test, which allows one to check if the samples corresponding to the clusters linked in the categories of table 3 can be considered as extracted from the same statistical population.

Fig. 13 Tax payments subject 10

Gamble experiment (DY4)



Round

The results from the Mann-Whitney test are reported in the appendix (tabs. A1-A8) and are summarised here with a qualitative judgement in the last column of table 3. The meanings of the qualitative judgements are the following:

very good = acceptance of the hypothesis that the samples are extracted from equally distributed populations for 6 or more of the cluster variables;

good = acceptance of the hypothesis that the samples are extracted from equally distributed populations for at least 4 of the cluster variables;

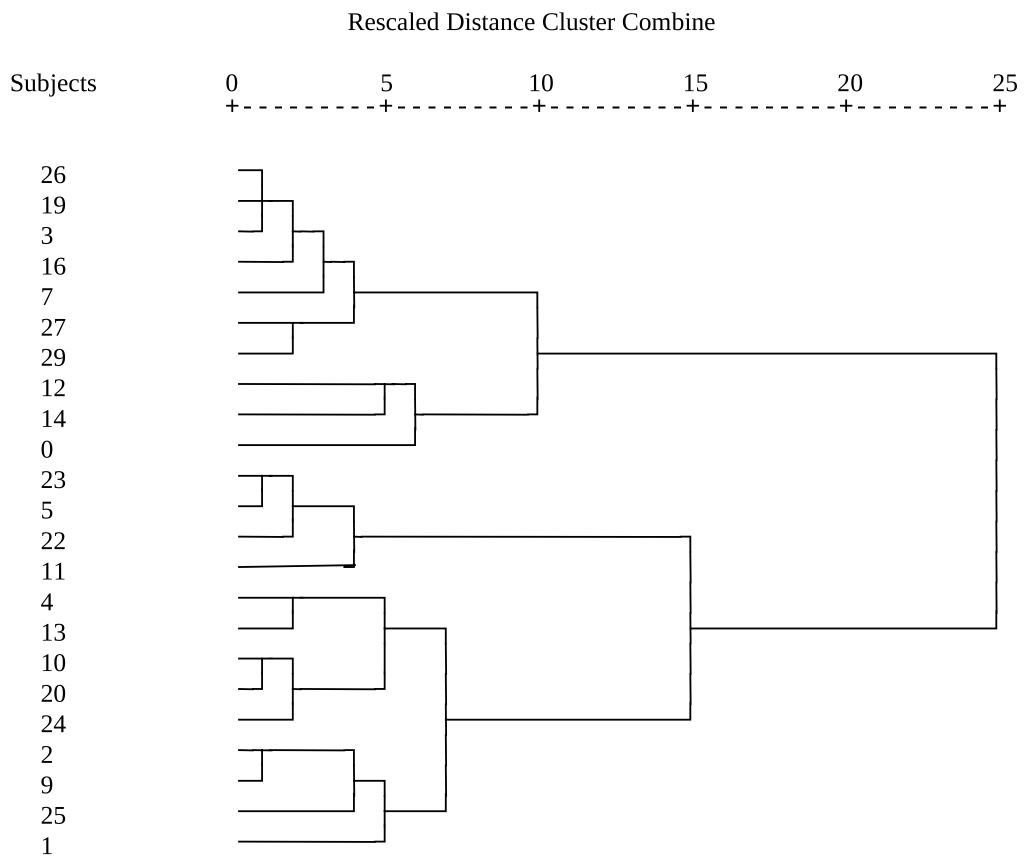
fairly bad = acceptance of the hypothesis that the samples are extracted from equally distributed populations for 3 cluster variables

bad = acceptance of the hypothesis that the samples are extracted from equally distributed populations for 2 or less cluster variables.

The overall results obtained from the Mann-Whitney test are good. We may therefore conclude that the categories built using the findings of the cluster analysis applied to the standard experiment can reasonably include also the subjects belonging to the clusters of the gamble experiment. As we have just seen, two new sub-categories could be added to the original ones. But the Mann-Whitney test has been computed by aggregating the sub-categories, and therefore the good results refer to the original categories as if they included the subjects belonging to the new ones.

The final step in this discussion is to compare the results from the cluster analysis computed using the data from the experiment with tax yield redistribution (DY2) with those of the standard experiment.

Fig. 14 Dendrogram Experiment with Redistribution (DY2)



The cluster analysis applied to the data of the experiment with redistribution was conducted using only 23 subjects, because 7 subjects of this experiment belonged to the "pure" category AP (always pay) and could be therefore be excluded from the sample. Consequently, the dendogram (shown in fig. 5.32) must be split into 7 clusters. This yields 4 clusters with more than one subject, and 3 individual clusters (subjects 0, 12 and 14 which coincide respectively with clusters 1, 6 and 7), while in the standard experiment there were 4 individual clusters. Comparing table 5.6 with table 5.9, this time it is rather more difficult to find clusters from the standard experiment which look sufficiently similar to some cluster of the redistribution experiment for them to be allocated to the same category.

Tab. 4 Redistribution experiment (DY2): summary statistics

Cluster		NUE	AVGE	SDE	YCU	FIN	NFI	RS	NTOT	NTOTP
1	Mean	25.00	121.6	157.0	20600.0	23100.0	4.00	.23	20.00	35.00
	N	1	1	1	1	1	1	1	1	1
	Std.	.	.	.	.	.	.	.	.	.
2	Mean	19.25	61.51	119.2	32281.0	7809.7	5.25	.29	9.25	40.75
	N	4	4	4	4	4	4	4	4	4
	Std.	6.23	25.34	29.10	1392.8	2361.4	.50	.14	4.34	6.23
3	Mean	32.71	112.7	141.0	29386.4	13781.4	5.71	.16	12.42	27.28
	N	7	7	7	7	7	7	7	7	7
	Std.	5.43	17.56	22.34	1294.6	1593.6	.75	.11	5.65	5.43
4	Mean	12.80	49.08	108.2	34714.0	4631.0	2.40	.32	7.20	47.20
	N	5	5	5	5	5	5	5	5	5
	Std.	5.58	28.64	31.57	1288.8	1903.8	.54	6.063E	6.49	5.58
5	Mean	6.25	7.98	36.00	35820.5	1058.7	1.75	.73	.50	53.75
	N	4	4	4	4	4	4	4	4	4
	Std.	3.40	3.87	17.02	941.0	1032.2	1.25	.12	.57	3.40
6	Mean	34.00	183.3	179.0	19350.0	28050.0	6.00	2.100E	28.00	26.00
	N	1	1	1	1	1	1	1	1	1
	Std.	.	.	.	.	.	.	.	.	.
7	Mean	45.00	126.2	125.0	20050.0	23925.0	6.00	.18	6.00	15.00
	N	1	1	1	1	1	1	1	1	1
	Std.	.	.	.	.	.	.	.	.	.
Tot	Mean	21.69	75.83	113.4	30942.6	10007.5	4.17	.31	9.39	38.30
	N	2	2	2	2	2	2	2	2	2
	Std.	12.40	50.30	45.87	5115.0	7758.2	1.87	.23	7.66	12.40

Table 5.10 reports the clusters from the redistribution experiment which fit the original categories constructed using the standard experiment data. The categories shared by both experiments are category 1TE1P, category MPSE and category 1E1P. Note that categories 1TE1P and MPSE are those with the highest number of members for all the three experiments, and they can therefore be considered to be the two dominant types of behaviour. Note also that cluster 5 from the redistribution experiment should be considered a sub-category of MPSE because the subjects belonging to this cluster mainly pay the

whole amount due (as do the members of MPSE), but they never totally evade the entire tax, while the majority of subjects belonging to MPSE alternate total payments with total evasions.

Table 5 Correspondences among clusters: standard and redistribution experiments

Categories	Standard experiment	Redistr. experiment	Mann-Whitney test
cat. 1TE1P "totally evade once, then pay the entire tax one or more times"	cluster 4; 12 subjects	cluster 3; 7 subjects;	good
cat. MPSE "mainly pay the whole tax due and sometimes evade the entire tax"	cluster 2; 6 subjects	cluster 4; 5 subjects; cluster 5; 4 subjects	very good fairly bad
cat. 1E1P "evade a part of the tax due once, then one or more times pay the entire tax"	cluster 1; 5 subjects	cluster 2; 4 subjects	very good
cat. MESP "mainly evade the whole amount of tax due or a part of it and sometimes pay"	cluster 6; 3 subjects + cluster 3; 1 subject + cluster 5; 1 subject + cluster 7; 1 subject		
cat. AP "always pay"	cluster 8; 1 subject	"artificial" cluster; 7 subjects	

In this way, 27 subjects from the redistribution experiment find systemisation, while 3 should be organised into a new category. On the other hand, when looking at fig. 5.32 we discover that these 3 subjects should form a single cluster, and that they have been split "artificially" because the software was forced to build 7 clusters. Unfortunately, this eighth cluster is difficult to interpret because its 3 members display behaviours that only vaguely resemble each other, and are probably close in the dendogram only because they are not sufficiently similar to the other subjects to be included in some other cluster. In fact, if we return to table 5.9 and look at the values of some variables (e.g. NU_{EVA} or AV_{EVA}) computed for subject 12, we find that this subject could be added to category 1TE1P as its “extreme” member, while in terms of the values of other variables s/he is differs too greatly from the other members. On the other hand, subject 0 may represent a mixed category midway between the mirror-like categories MESP and MPSE, because s/he chose to adopt a dichotomous strategy which alternated periods (lasting about10 rounds each) of strategy MESP and of strategy MPSE. Finally, subject 14 used a double strategy: in the first two thirds of her/his experimental life (until round 47) s/he played as if s/he belonged to category MESP but then decided always to evade the entire tax or a part of it.

5. Some conclusions from the data

Analysis of the individual data has shown even more clearly that the dynamic of the subjects' behaviours is almost impossible to explain using a traditional expected utility maximisation approach. At the same time, two interesting remarks can be made: the role played by the tax yield redistribution as a deterrent against tax evasion is confirmed, and common game styles exist.

The existence of a limited number (about 4-5 main categories) of common game styles suggests that it should be possible to find some general rule of behaviour on which to base a theoretical model of individual responses to this kind of decision frame. It is to be stressed that the choices made by the large majority of subjects are stable (or in other words, can be considered as a dynamic equilibrium), and that only very few subjects (for example, subject 8 in the standard experiment) changed game style during the experiment. Furthermore, the largest category for all the three experiments analysed is the one with the most cyclical dynamic, i.e. 1TE1P, and this suggests that when subjects must cope with a situation of repeated choices under risk, they find it very difficult to understand the probabilistic nature of the problem correctly. They therefore choose to alternate opposite choices (once evade the whole tax, once pay the whole tax). There is a strong suspicion that the dynamic experiments produced an environment which induced the subjects to re-model the probabilistic structure of the problem, and this could provide the starting point for a theory on the subjective modelling of probability under conditions of risk. It should be borne in mind, in fact, that the subjects were always perfectly informed about the nature of the lotteries confronting them, and therefore had to decide under conditions of risk, not of uncertainty (here accepting Knight's (1921) classic distinction between uncertainty and risk).

It seems that the cognitive complexity of the task assigned to the subjects of the dynamic experiments (the difficulty of computing the expected value of evasion for each round) artificially transformed a problem of decision-taking under given probability into a situation of uncertainty. This latter consideration goes in the same direction as the more recent criticism on the distinction between "subjective" and "objective" probabilities (Hirshleifer and Riley, 1992).

6. Normative lessons from cluster analysis

An interesting question concerns the possibility of using the five taxpayer categories identified by the cluster analysis as a basis for the design of tax policies. One could, in fact, envisage two main areas of action for the fiscal authorities: the first regards fiscal audit strategies, the second the design of the punishment scheme.

As is well known, a crucial problem for the tax authorities is how to reduce the administrative costs of carrying out fiscal audits. The best way to increase the efficiency of the fiscal police is to give them good "targets", that is, to reduce the number of unnecessary audits as much as possible, concentrating investigative effort only on high risk tax payers. For obvious reasons this selection cannot be performed by concentrating on individuals, but it is feasible if specific socio-economic categories are selected. Unfortunately, in modern societies socio-economic groups are generally very large, and they consequently preclude construction of a good screening system. In this regard, the results from the cluster analysis just discussed may help to improve the effectiveness of the screening system. For example, one could investigate whether the opportunities to evade available to a specific socio-economic group and due to some imperfection in the tax system fit with the most "dangerous" cluster category, i.e. cat. MESP (mainly evade the whole amount of tax due or a part of it and sometimes pay).

An example of this kind of correlation is provided by a sub-group of self-employed workers (e.g. some types of artisan: plumbers, painters, electricians, etc.) who derive their yearly earned incomes mainly by adding the payments of numerous small professional services. The parcelling out of the sources of earned income allows reproduction of a tax payment style which fits the MESP category because the tax payer is able to hide each single revenue by not invoicing her/his customers or by under-invoicing the real price[2] Remembering that in all the repeated choices experiments discussed here the MESP category is one of the largest, and that the style of tax payment adopted by its members is stable behaviour, it seemed reasonable to conclude that a high percentage of tax payers belonging to the artisan class (and all the other socio-economic groups with the same characteristics) will adopt the MESP strategy.

This conclusion may seem rather obvious and it is certainly not brand new: in fact, we do not need to run a cluster analysis to discover that craftsmen often belong to the persistent tax evader category. Nevertheless the results from the cluster analysis just discussed suggest a specific two-step fiscal audit strategy:

a) in the first step, the fiscal authority carefully analyses whether the conditions of tax payment allowed to a given socio-economic group may give rise to MESP behaviours, thus making a first selection of the potential candidates for fiscal audits;
b) in the second step, remembering that the tax payers belonging to the MESP category seemed very reluctant to change their style of tax evasion even when they have been detected and punished, the fiscal authority should put each tax payer discovered as MESP in a special "high risk" audit group, monitoring her/him on a regular basis.

It seems reasonable to expect that this two-step procedure, and in particular the knowledge of running the risk of becoming a member not only of the "potential evaders category" but also of the very undesirable closely monitored group, should work as a strong deterrent to tax evasion.

The largest cluster category, i.e. cat. 1TE1P (totally evade once, then pay the entire tax one or more times), offers further suggestions for modelling audit strategy. The members of this category seemed unable to correctly evaluate the risk of being detected and punished, oscillating between two opposite behaviours, totally pay or totally evade, as if they were confronted by a probability of being audited that changed dichotomously (once high probability then low probability), whereas, as we know, this kind of change never occurred in the experiments. Therefore a good audit strategyto counter their attitude towards tax evasion, would be that of extending the tax audit over the longest period possible. This device should force the 1TE1P tax payers to build a mental representation of the probability of being audited along some sort of time continuum. The objective of this

[2] This form of tax evasion in very common in many developed countries, especially in Italy.

kind of fiscal audit policy should be to convince those tax payers that might fall into the 1TE1P category to switch their behaviours to the AP (always pay) category, as a response to a probability of being punished which is perceived as constant over time.

The second area of intervention by the fiscal authorities that might benefit from the results of cluster analysis is that of the punishment system. The most effective punishment system against the most dangerous evader category, i.e. cat. MESP, is probably a progressive one. The tax evaders belonging to the MESP category are indifferent to how many times they have been detected and punished; but this behaviour is probably due to the fact that the value of the fines in the experiments was independent of the number of tax evasions. This means that the fee applied to each tax evasion was always the same (4.5 times the amount of tax evaded), independently of how many times the tax payer had evaded. Changing this punishment system to a progressive one, that is, a system which increases the fines as the number of evasions detected increases (e.g. 4.5 for the first tax evasion, then 5.5 the second, 6.5 the third and so on), would probably break the behavioural pattern of MESP tax evaders.

Similarly, also the tax evaders belonging to category 1TE1P could be forced to change their behaviour by using a specific punishment system which applies higher fines when the tax evasion is total or very near to total. Admitting that these tax evaders find it difficult to model the audit probability, and remembering that this cognitive (computational) constraint induces them to adopt a dichotomous behaviour - evade or pay the entire amount of tax due - a system that punishes total evasion very severely should break the basis of their strategy. This system in fact should force them, when they have decided to evade, to reject the easy choice of total evasion, because it becomes much less dangerous to modulate the amount of money evaded. Given their computational limitations, this could increase the number of honest income declarations, because they involve no additional cognitive cost.

Unfortunately these last considerations are not explicitly supported by the experimental results and may therefore form the subject of further experiments.

A final question prompted by the results from cluster analysis is the following: is there some correlation between the styles of tax payment and particular socio-economic indicators like income, level of education and so on? Finding a relationship of this kind might help to concentrate fiscal audits on those tax payers with the highest probability of falling into the high risk categories. Unfortunately, I did not collect this kind of information on the experimental subjects and therefore cannot verify this hypothesis unless

I call the experimental subjects back for further inquiry. On the other hand, it is worth remembering that all the subjects used in the experiments were university students, and therefore share numerous common socio-economic characteristics. It follows that they are not the best possible sample with which to verify the existence of a correlation between styles of evasion and many of the indicators just suggested.

7. Appendix

Tab A.1 Mann–Whitney test Cat. 1TE1P
Standard exp. ---- Gamble exp.
Cluster 4 ← → Cluster 1 + 6

Test Statistics[b]

	AVGEVA	DEVSTEVA	MULTA	NUEVA	NUMULT	REDCUM	RSQ
Mann-Whitney U	34,000	56,000	90,000	96,500	85,000	93,500	57,000
Wilcoxon W	187,000	209,000	243,000	174,500	163,000	171,500	135,000
Z	-3,011	-2,037	-,532	-,244	-1,714	-,376	-1,994
Asymp. Sig. (2-tailed)	,003	,042	,595	,807	,087	,707	,046
Exact Sig. [2*(1-tailed Sig.)]	,002[a]	,043[a]	,616[a]	,811[a]	,471[a]	,711[a]	,048[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

Tab A.2 Mann - Whitney test Cat. MPSE
Standard exp. ---- Gamble exp.
Cluster 2 ← → Cluster 5 + 7

Test Statistics[b]

	AVGEVA	DEVSTEVA	MULTA	NUEVA	NUMULT	REDCUM	RSQ
Mann-Whitney U	,000	13,000	18,000	16,000	16,000	16,000	17,000
Wilcoxon W	21,000	34,000	39,000	37,000	37,000	37,000	38,000
Z	-2,887	-,802	,000	-,321	-,331	-,320	-,160
Asymp. Sig. (2-tailed)	,004	,423	1,000	,748	,741	,749	,873
Exact Sig. [2*(1-tailed Sig.)]	,002[a]	,485[a]	1,000[a]	,818[a]	,818[a]	,818[a]	,937[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

Tab A.3 Mann - Whitney test Cat. 1E1P
Standard exp. ---- Gamble exp.
Cluster 1 ← → Cluster 4

Test Statistics[b]

	AVGEVA	DEVSTEVA	MULTA	NUEVA	NUMULT	REDCUM	RSQ
Mann-Whitney U	,000	,000	5,000	3,500	6,000	4,000	,000
Wilcoxon W	6,000	6,000	11,000	18,500	12,000	19,000	15,000
Z	-2,236	-2,236	-,745	-1,200	-,512	-1,043	-2,236
Asymp. Sig. (2-tailed)	,025	,025	,456	,230	,608	,297	,025
Exact Sig. [2*(1-tailed Sig.)]	,036[a]	,036[a]	,571[a]	,250[a]	,786[a]	,393[a]	,036[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

Tab A.4 Mann - Whitney test Cat. MESP
Standard exp. ---- Gamble exp.
Cluster 6 + 3 + 5 + 7← → Cluster 2 + 3

Test Statistics[b]

	AVGEVA	DEVSTEVA	MULTA	NUEVA	NUMULT	REDCUM	RSQ
Mann-Whitney U	1,000	4,000	9,000	7,500	9,000	7,000	,000
Wilcoxon W	22,000	25,000	15,000	13,500	15,000	13,000	6,000
Z	-2,066	-1,291	,000	-,389	,000	-,516	-2,324
Asymp. Sig. (2-tailed)	,039	,197	1,000	,697	1,000	,606	,020
Exact Sig. [2*(1-tailed Sig.)]	,048[a]	,262[a]	1,000[a]	,714[a]	1,000[a]	,714[a]	,024[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

Tab A.5 Mann - Whitney test Cat. 1TE1P
Standard exp. ---- Redistribution exp.
Cluster 4← → Cluster 3

Test Statistics[b]

	NUEVA	AVGEVA	DEVSTEVA	REDCUM	MULTA	NUMULT	RSQ
Mann-Whitney U	21,500	,000	35,000	11,000	3,000	42,000	22,000
Wilcoxon W	49,500	28,000	63,000	89,000	31,000	70,000	100,000
Z	-1,737	-3,550	-,592	-2,620	-3,298	,000	-1,690
Asymp. Sig. (2-tailed)	,082	,000	,554	,009	,001	1,000	,091
Exact Sig. [2*(1-tailed Sig.)]	,083[a]	,000[a]	,592[a]	,007[a]	,000[a]	1,000[a]	,100[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

Tab A.6 Mann - Whitney test Cat. MPSE
Standard exp. ---- Redistribution exp.
Cluster 2← → Cluster 4

Test Statistics[b]

	NUEVA	AVGEVA	DEVSTEVA	REDCUM	MULTA	NUMULT	RSQ
Mann-Whitney U	5,500	,000	12,000	9,000	13,000	12,000	9,000
Wilcoxon W	26,500	15,000	27,000	30,000	34,000	33,000	24,000
Z	-1,755	-2,739	-,549	-1,095	-,366	-,582	-1,095
Asymp. Sig. (2-tailed)	,079	,006	,583	,273	,714	,561	,273
Exact Sig. [2*(1-tailed Sig.)]	,082[a]	,004[a]	,662[a]	,329[a]	,792[a]	,662[a]	,329[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

Tab A.7 Mann - Whitney test Cat. MPSE
Standard exp. ---- Redistribution exp.
Cluster 2← → Cluster 5

Test Statistics[b]

	NUEVA	AVGEVA	DEVSTEVA	REDCUM	MULTA	NUMULT	RSQ
Mann-Whitney U	9,500	,000	,000	3,000	2,000	10,500	,000
Wilcoxon W	19,500	10,000	10,000	24,000	12,000	20,500	21,000
Z	-,538	-2,558	-2,558	-1,919	-2,138	-,332	-2,558
Asymp. Sig. (2-tailed)	,591	,011	,011	,055	,032	,740	,011
Exact Sig. [2*(1-tailed Sig.)]	,610[a]	,010[a]	,010[a]	,067[a]	,038[a]	,762[a]	,010[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

Tab A.8 Mann - Whitney test Cat.
Standard exp. ---- Redistribution exp.
Cluster 1← → Cluster 2

Test Statistics[b]

	NUEVA	AVGEVA	DEVSTEVA	REDCUM	MULTA	NUMULT	RSQ
Mann-Whitney U	8.000	.000	8.000	5.000	5.000	5.500	7.500
Wilcoxon W	18.000	10.000	23.000	15.000	20.000	15.500	17.500
Z	-.490	-2.449	-.490	-1.225	-1.230	-1.173	-.615
Asymp. Sig. (2-tailed)	.624	.014	.624	.221	.219	.241	.539
Exact Sig. [2*(1-tailed Sig.)]	.730[a]	.016[a]	.730[a]	.286[a]	.286[a]	.286[a]	.556[a]

a. Not corrected for ties.

b. Grouping Variable: EXP

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