Online Appendix: An Experimental Analysis of Tax Avoidance Policies*

October 12, 2016

1. Online Appendix

1.1. Appendix: Between Analysis

Our analysis so far does not control for any individual characteristics such as risk aversion, gender etc., that may also explain the behavior of an individual towards evasion and avoidance and therefore may also have important implications for the tax gap measures. We therefore conduct a formal regression analysis to study whether the conditional averages of evasion, avoidance and the tax gap measure are affected significantly by the AAR treatment. To do so, we run the following ordinary least squares regression:

$$\frac{E_i}{W_i} = \alpha_E + \beta_E Treatment_i + \gamma_E X_i + \epsilon_i \tag{1}$$

$$\frac{A_i}{W_i} = \alpha_A + \beta_A Treatment_i + \gamma_A X_i + \epsilon_i \tag{2}$$

$$\frac{TG_i}{W_i} = \alpha_{TG} + \beta_{TG} Treatment_i + \gamma_{TG} X_i + \epsilon_i \tag{3}$$

$$\tag{4}$$

where our dependent variables are evasion, avoidance and the tax gap measure denoted by E_i/W_i, A_i/W_i and TG_i/W_i, respectively. The variable *Treatment* is a binary variable

*This paper involves the collection of data on human subjects and the author(s) disclose that they have obtained Institutional Review Board (IRB) approval.

that takes a value 1 if the observation belongs to the AAR treatment and 0 otherwise. X_i is a matrix of controls which include a set of exogenous variables such as our risk aversion measure, a dummy for gender where female is coded 1 and male is coded 0, another dummy for whether the subject studies economics which is coded 1 and otherwise coded 0, and age. We are interested in the sign as well as significance of β's which captures the treatment effect of AAR on our variables of interest.

Table 1: Evasion/Earning (E/W) and Avoidance/Earning (A/W)

	(1) $\frac{Evasion}{Earning}$	(2) $\frac{Evasion}{Earning}$	(3) $\frac{Avoidance}{Earning}$	(4) $\frac{Avoidance}{Earning}$
Treatment	0.123**	0.118**	-0.208***	-0.212***
	(2.069)	(2.089)	(-6.087)	(-6.228)
Risk Aversion		-0.156***		0.034
		(-2.677)		(1.037)
Age		-0.014		0.005
		(-1.576)		(0.940)
Female		-0.095*		0.034
		(-1.737)		(0.973)
Economics		0.027		-0.066*
		(0.409)		(-1.725)
Constant	0.180***	0.628***	0.406***	0.278**
	(5.148)	(2.820)	(14.640)	(2.101)
N	133	133	133	133
R^2	0.031	0.128	0.221	0.259

Robust t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Our main results are based on our between design and we present these results in Table 1 for evasion and avoidance measures and Table 2 for tax gap measures. All results are based on robust standard errors.

Columns 1 and 2 in Table 1 present our estimates based on the specification with evasion measure as the dependent variable (based on Equation 1) without and with controls, respectively. Column 3 and 4 present our estimates based on the specification with avoidance measure as the dependent variable (based on Equation 2) without and with controls, respectively. Based on these estimates of β_E and β_A, which capture the treatment effect of AAR on evasion and avoidance respectively, we conclude that a null hypotheses of $\beta_E = 0$ and $\beta_A = 0$

are rejected in our data. In other words, with the implementation of the AAR, proportion of avoided income reduces significantly (by 0.208 in the specification without controls and 0.212 in the specification with controls) but the proportion of evaded income increases significantly (by 0.123 in the specification without controls and 0.118 in the specification with controls) in our data. In addition, higher risk aversion and being a female play an important role in reducing evasion while these variables do not play a significant role in determining avoidance.

Overall, our formal regression results are consistent with our descriptive statistics that highlight that the intended effect of the AAR, to reduce avoidance, is coupled with an unintended consequence in the form of higher evasion. Moreover, we also observe that avoidance is reduced more than evasion which plays an important role in our discussion of the policy implications for the tax gap which we discuss next.

Table 2: Tax Gap/Earning (TG/W)

	(1) $\frac{TaxGap}{Earning}$	(2) $\frac{TaxGap}{Earning}$
Treatment	-0.048**	-0.052**
	(-2.042)	(-2.250)
Risk Aversion		-0.063***
		(-2.760)
Age		-0.004
		(-1.107)
Female		-0.025
		(-1.129)
Economics		-0.020
		(-0.724)
Constant	0.293***	0.448***
	(24.427)	(4.476)
N	133	133
R^2	0.031	0.108

Robust t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Table 2 columns 1–2, we present results for $\frac{TG_i}{W_i}$ measure (with and without additional controls, respectively) for our between sample. The results show that the conditional average tax gap measure decreases significantly with the AAR treatment for our $\frac{TG_i}{W_i}$ measure (by

0.052). We also conduct the same analysis for avoidance, evasion and tax gap measures using our within dataset which we present in detail in Appendix 1.2. In particular, the within dataset is collected for each subject performing both control and the AAR treatment in a randomized order. The first sample is composed of subjects performing the control condition first and the AAR treatment second and the second sample is composed of subjects doing the AAR treatment first and the control condition second.

The main finding from the within analysis is that our results are qualitatively similar to the between analysis and therefore consistent with the resulted presented in this section. In particular avoidance reduces significantly from the control to the AAR treatment in both within samples whereas evasion reduces significantly for the first within sample and although reducing but only insignificantly for the second within sample. We must therefore conclude that there are some order effects present in our within samples potentially driven by biases such as artificial (in)consistencies and fatigue mentioned earlier.[1] We also show that the average tax gap measure reduces significantly in our within samples consistent with our results based on the between sample.

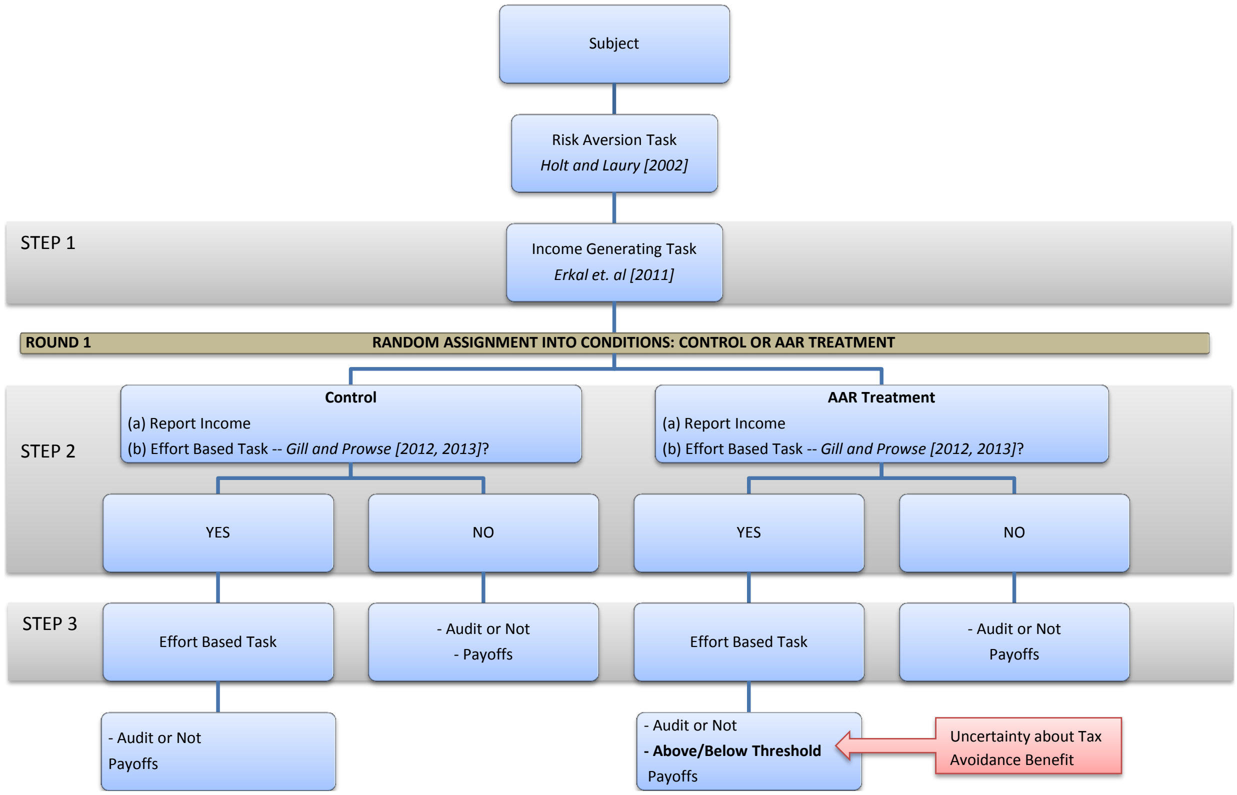
1.2. Appendix: With-in Analysis

In this section, we provide the descriptive and distributional analysis for our with-in samples. As mentioned in the text, the collection of with-in sample is innocuous to our main dataset and the analysis therein. However, it provides us with more observations to ensure and explore whether our main results are also consistent with the with-in sample. We randomize the subjects in either the control or the AAR treatment in the first round of the experiment and then allow the subjects to take part in the second round of the experiment where the remaining treatment is performed as illustrated in 2. This provide us with two within samples. One where subjects perform control and then treatment (we call this Sample 1) and another sample where the subjects perform treatment and then control (we call this Sample 2). Prior to the actual analysis of our data, it must be noted that the usual issues of artificial consistency and inconsistency may be present though we minimize these issues by randomizing the final payment contingent only on one round's performance. Construction of variables is same as provided in the text.

Descriptive statistics for evasion measure, avoidance measure and the tax gap measure in

[1] For completeness we also include the regression for the pooled sample of our two within samples in Appendix 1.2. However, given the order effects we have to be cautious in making any inferences from this analysis. Nevertheless, we note that the results for the pooled sample are qualitatively consistent with our previous findings.

Figure 1: Illustration of Experimental Design – Round 1



the control and the AAR treatment for our within samples are provided in Table 3 for sample 1 and Table 4 for sample 2. Using sample 1 and sample 2, we can make two observations. First, in sample 1 our average evasion measure significantly increases (from 0.18 to 0.30) while our average avoidance reduces significantly (from 0.40 to 0.20) from control to treatment. Based on the statistical tests (Sign-rank test and paired t-test) it is clear that our variables have significantly changed in the AAR treatment. Second, in sample 2 our average evasion measure though increases (from 0.28 to 0.30) but loses significance and avoidance measure decreases (from 0.26 to 0.19), with weaker significance but still significant. The loss of significance is partly reflects some order effect. However, overall, the results show that the direction of change in each of the variables is consistent with the direction of change in our between sample.

We now present the descriptive statistics for our tax gap measure. Recall, the tax gap measure (TG/W) is the tax gap normalized by earning which is measured using the effect of the AAR treatment on both avoidance and evasion. Table 5 presents the descriptive analysis for the tax gap measures for sample 1 while Table 6 presents the corresponding analysis for sample 2.

Table 3: Within Summary Table: Sample 1

Measure	Treatment	Mean	SD	Signed Rank	T Test	N
$\frac{Evasion}{Earning}$	Control	0.1801	0.2843	0.0023	0.0027	66
	AAR	0.3000	0.3553			66
$\frac{Avoidance}{Earning}$	Control	0.4057	0.2251	0.0000	0.0000	66
	AAR	0.2011	0.1449			66

Table 4: Within Summary Table: Sample 2

Measure	Treatment	Mean	SD	Signed Rank	T Test	N
$\frac{Evasion}{Earning}$	Control	0.2832	0.3708	0.6956	0.6461	67
	AAR	0.3030	0.3931			67
$\frac{Avoidance}{Earning}$	Control	0.2672	0.2308	0.0142	0.0113	67
	AAR	0.1973	0.1645			67

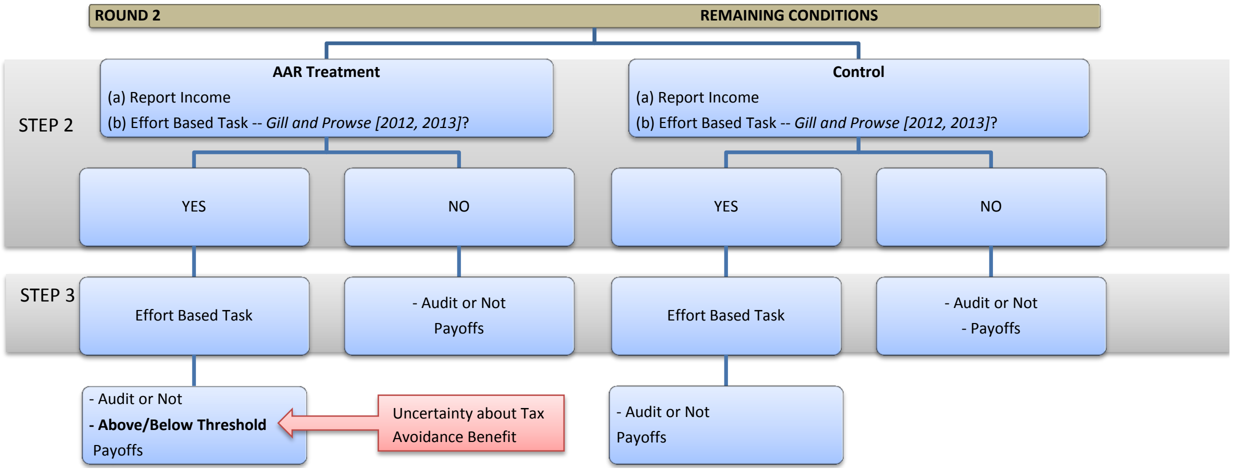
Table 5: Within Summary Table: Sample 1

Measure	Treatment	Mean	SD	Signed Rank	T Test	N
$\frac{TG}{W}$	Control	0.2929	0.0974	0.0068	0.0050	66
	AAR	0.2526	0.1368			66

Table 6: Within Summary Table: Sample 2

Measure	Treatment	Mean	SD	Signed Rank	T Test	N
$\frac{TG}{W}$	Control	0.2751	0.1355	0.0486	0.0730	67
	AAR	0.2445	0.1673			67

Figure 2: Illustration of Experimental Design – Round 2



Based on these results, two main observations can be made. First, TG/W reduces with the implementation of AAR (from 0.293 to 0.253 in sample 1 and 0.275 to 0.245 in sample 2). However, the nonparametric test is not significant for both samples. The opposing effects of the AAR on avoidance and evasion may partly offset the overall effect on tax gap and therefore we observe qualitatively and quantitatively smaller impact on the tax gap measure. However, like avoidance and evasion measures, with the implementation of AAR the direction of change is consistent across our within and between samples.

The results show that the average evasion, avoidance and tax gap measures in sample 1, all change significantly in the directions consistent with our between sample. However, in sample 2, evasion and the tax gap, do not have significance. We also present the distributional analysis for each of our variables of interest in our two sample. Panel 1 of the Figure 3 corresponds to sample 1's distributional plots while panel 2 of the Figure presents sample 2's distributional plots. It is clear from the distributional plots that sample 1 plots are consistent with our between distributional plots. Another important outcome of this analysis is the distributions for TG/W which shows second order stochasticity. This further highlights that the effectiveness of AAR policy in achieving higher tax compliance is hindered due to the substitution away from avoidance but towards evasion. However, sample 2 plots are not clean to make stochasticity analysis as we did in the text. However, overall this was expected given the difference in the evasion and tax gap measure in response to the AAR treatment in sample 2 is much smaller and insignificant.

Lastly, we pool the two within samples to construct a pooled data where each observation from the subject is assumed to be an independent observation. We show that our qualitative results remain unchanged.

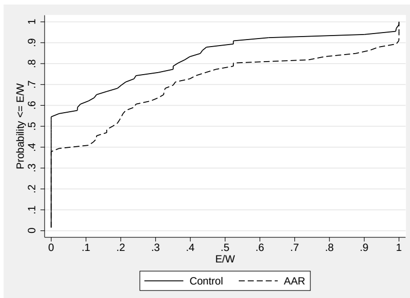
Table 7: E/W, A/W & TG/W

	(1) E/W	(2) A/W	(3) TG/W
Treatment	0.070*	-0.137***	-0.034**
	(1.663)	(-5.710)	(-2.155)
Risk Aversion	-0.111***	0.020	-0.046***
	(-2.819)	(0.873)	(-2.883)
Age	-0.014**	0.010***	-0.002
	(-2.016)	(2.607)	(-0.760)
Female	-0.133***	0.047*	-0.043***
	(-3.276)	(1.922)	(-2.804)
Economics	0.041	-0.061**	-0.010
	(0.844)	(-2.294)	(-0.505)
Constant	0.668***	0.080	0.374***
	(3.823)	(0.813)	(5.734)
N	266	266	266
R^2	0.096	0.163	0.082

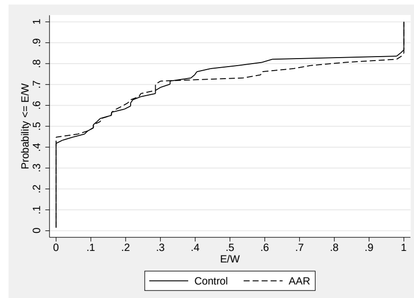
Robust t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

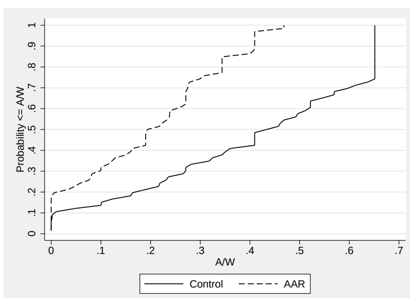
Figure 3: CDF: $\frac{Evasion}{Earning}(\frac{E}{W})$, $\frac{Avoidance}{Earning}(\frac{A}{W})$ & $\frac{TaxGap}{Earning}(\frac{TG}{W})$



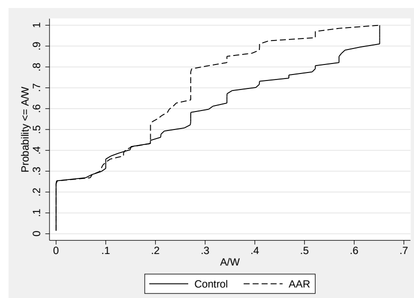
(a) $\frac{E}{W}$ Sample 1



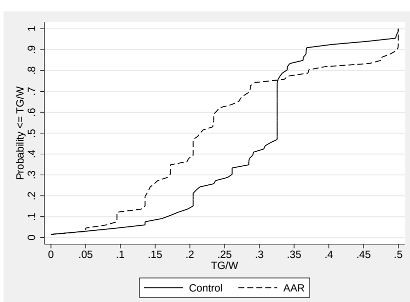
(b) $\frac{E}{W}$ Sample 2



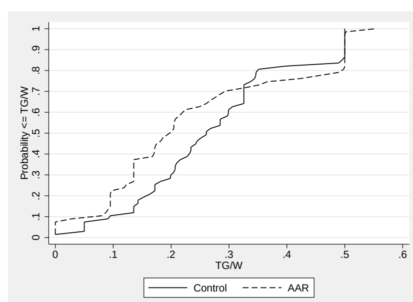
(c) $\frac{A}{W}$ Sample 1



(d) $\frac{A}{W}$ Sample 2



(e) $\frac{TG}{W}$ Sample 1



(f) $\frac{TG}{W}$ Sample 2