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Tax Compliance & Public Goods:
Do They Really *Get Along*?

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Abstract

The following work provides the first experimental evidence of the economic and demographic determinants of tax compliance in Mexico. The results are compared to a similar experiment administered in the United States [Alm, Jackson and McKee (1992)]. The substantial differences observed in compliance when the government provides a public good are a call for researchers to verify the robustness of these results in a cross-cultural setting. The experimental evidence also shows that there are important and significant demographic factors affecting compliance in Mexico. Specifically, in both experiments i) increasing the probability of audit, always increases compliance, ii) higher penalty rates are ineffective to increase compliance, iii) there is a negative relationship between tax rates and compliance, iv) there is free riding in the public goods sessions in Mexico, even when the government is efficient in the provision of the public goods, v) the Mexican evidence shows that woman are more compliant and that age can negatively change compliance.

Key words- tax compliance, experiments, public goods, gender, Mexico.
JEL- classification: H26, H41, C92.

Resumen

Este trabajo presenta la primera evidencia experimental sobre los determinantes económicos y demográficos de la recaudación de impuestos en México. Los resultados obtenidos son comparados con experimentos similares administrados en los Estados Unidos [Alm, Jackson and McKee (1992)]. Las diferencias sustanciales encontradas en la recaudación cuando el gobierno provee un bien público, son una llamada de atención para que los investigadores verifiquen la robustez de estos resultados en contextos multiculturales más ricos. La evidencia experimental también muestra que hay factores demográficos muy significativos que afectan a la recaudación en México. Específicamente, en ambos experimentos i) incrementos en la probabilidad de auditoría aumenta a la recaudación, ii) altas tasas de penalización son ineficientes para mejorar la recaudación, iii) existe una relación negativa entre la tasa de interés y la recaudación, iv) en el caso de México, se presenta el problema del free rider, aun cuando el gobierno es eficiente en la provisión de bienes públicos, v) la evidencia mexicana muestra que las mujeres son quienes mejor cumplen con sus obligaciones y que la edad puede afectar negativamente a la recaudación.

Palabras clave- cumplimiento del pago de impuestos, experimentos, bienes públicos, género, México.

Clasificación JEL: H26, H41, C92.

I. Introduction

The scarcity of evidence about tax compliance for countries other than the United States is a call for researchers to design empirical studies that contribute to better understand the problem of compliance. The present work provides experimental evidence for the Mexican case, and compares it with the results from a similar experiment administered in the United States.¹

By comparing experimental studies, it is possible to empirically determine which kinds of behavior exhibit parallelism, and which do not: "Series of experiments (rather than single experiments) [are] the unit around which discussion is organized, because series of experiments allow the full power of the experimental method to be played best".² The objective is to look at the change in the rate of compliance, to changes in various fiscal parameters among individuals from countries with different levels of income, different institutional development, and different income distribution, under similar laboratory conditions.

The present work evaluates the impact on the compliance rate of two different policies that the tax authority can pursue. One policy is to increase enforcement forces, such as penalties and the probability of being audited. The other is to improve the government's performance in the provision of public goods.

In spite of the problems that can arise in cross-cultural experiments, the experimental results present parallels in the deterrence sessions: *i*) increasing the probability of audit always increases compliance, which confirms the prediction of the Allingham-Sandmo model, *ii*) higher penalty rates are ineffective as a means to increase compliance, *iii*) there is a negative relationship between tax rates and compliance in Mexico and in the United States. However, the public goods sessions show different results between experiments.³ As opposed to the American evidence, there is free riding in the public goods sessions of Mexico, even when the government is efficient in the provision of the public goods. Also, Mexican evidence shows that age negatively changes compliance and its effect is larger than the positive effect of an audit. Finally, consistent with almost all work relating gender to offending, women are more compliant.

Considering the lack of "real" data, these experiments provide insight on the determinants of compliance behavior. For instance, if a certain hypothesis is consistently rejected at the experimental level, it might be reasonable to conclude that it would also be rejected by more reliable data. Because of the differences observed in the public good sessions among experiments, these

¹ Alm, Jackson and McKee (1992).

² Kagel and Roth (1995), Smith (1982).

³ Kagel and Roth (1995) pp. 282-284.

results are a call to attention to verify the robustness of the public good sessions in different cultural settings. These results show that policy makers have to take into account how taxpayers assess government services and the demographic information, in order to increase compliance.

Although, other factors such as honesty, morality, peer pressure, perception of fairness, and social norms, affect compliance; almost every government recognizes deterrence and the provision of public goods as the main policies to encourage tax compliance. Consequently, the work of Alm, Jackson and McKee (1992) represent a good starting point to evaluate the effectiveness of these forces at the international level as a strategy to increase compliance. To the extent that these results are compared with other national experiences, this information will help researchers and policy makers to better understand the problems of tax compliance.

The structure of the present work is the following. The theoretical framework is in Section II. Section III describes the experimental design. The experimental results are in Section IV. Section V contains the conclusions.

II. Theoretical Framework

According to the traditional model of tax compliance by Allingham and Sandmo (1972), taxpayers choose how much income to report on their tax returns by solving a standard expected utility-maximization problem that trades off the tax savings from underreporting true income against the risks of audit and penalties for detected noncompliance.

The taxpayer must choose how much income x to declare to tax authorities so that he maximizes his expected utility. He faces a fixed penalty rate if he is caught evading taxes.

$$(1) \quad E[U] = (1 - p)U[v + t(y - x)] + pU[v - s(y - x)]$$

Where v is the true after tax-income, $y(1-t)$, y being the exogenous true fixed income, only known by the individual. The constant tax rate is t and p is the probability of being audited. If the taxpayer evades taxes and is audited, he must pay a constant penalty s on all unreported income.

In this framework, both the threat of penalty and of audit make people pay their taxes. The solution of the model indicates that an individual will report zero income whenever the audit probability he faces is less than $t/(t+s)$.

Theoretical analysis of this model indicates than an increase in the probability of audit leads to a higher level of compliance. This model also predicts a positive relationship between the penalty rate and the level of compliance.

Yitzhaki (1974) modified the Allingham-Sandmo model by imposing the penalty on tax understatement, and concluded that compliance actually increases with greater tax rates, since a higher tax rate lowers income and, leads to significantly higher compliance.

The fiscal exchange approach recognizes the relation between the taxpayer and the government, where elements such as government performance in the provision of public goods and the impact of the public expenditure affect tax compliance decisions. Individuals may voluntarily pay taxes to provide for public goods –even if there is no penalty or exclusion in the consumption of the public good for the failure to pay– because they recognize that they will receive something for their tax payments.⁴

Government's performance through the provision of public goods also affects compliance. An increase in the payoff that the individual receives from a given tax payment can increase the tendency to comply. For the same reason, taxpayers will refuse to pay their taxes if they feel that the government is wasting their money: Spicer and Lundstedt (1976) and Webley *et al.* (1991) detect a positive relationship between government performance and compliance.

Looking to associate government performance to taxpayer satisfaction, Cowell and Gordon (1988) link the two sides of the government budget, income and expenditure, by introducing public goods. They find that if tax rates increase, evasion decreases; however, the main result of their model is that tax evasion appears to depend not only on public revenue and audit systems, but also on public expenditures.

In other words, individuals pay taxes because, on the one hand, they value the goods provided by the government, and on the other, they recognize that their payments are necessary to finance these goods. Empirical evidence to date supports the notion that compliance depends, in part, on how tax revenues are used. However, the impact of culture on the value of the public goods provided by the government across nations has not been analyzed in deep.

III. Experimental Design

Individuals in a controlled laboratory environment receive income, randomly selected by the computer, and they must decide how much income to report. Taxes are paid at some rate in voluntary reported income. Individuals know that there is a fixed probability of audit, and if they are detected cheating, they will pay a penalty on unpaid taxes.⁵

⁴ Becker, Buchner and Sleeking (1987).

⁵ For instance, a penalty rate of 2 implies that subjects will pay back taxes plus a penalty equal to back taxes if caught cheating.

This process will be repeated for a fixed number of rounds. Individuals will not know that the total number of rounds is predetermined at 30 in order to avoid end-of-treatment effects. At the end of each round, subjects are shown their balances, and a new round then begins.

Each subject is assigned an identification number. At the end of the experiment, each will be paid according to his performance. The currency used in the experiment is called "tokens." The participants are told that all tokens accumulated during the experiment will be redeemed for cash at the end of the session at a fixed exchange rate of 50 tokens per Mexican peso at the end of the session.

At the beginning of a round, each subject is given one income varying between 25 and 200 tokens in 25 token increments, as randomly chosen by the computer. Only the individual knows his or her true income.

The experiment is made up of sessions, each consisting of three parts. After the first ten rounds, individuals face a new level of the parameter for another ten rounds. Compliance is then compared in the presence and in the absence of that specific change. Table 1 shows the details of each session.

T A B L E 1
EXPERIMENTAL DESIGN

SESSION	AUDIT RATE	FINE RATE	TAX RATE	PUBLIC GOOD
1	5%, 30%, 50%	2	30%	No
2	30%, 50%, 5%	2	30%	No
3	50%, 5%, 30%	2	30%	No
4	30%	2, 4, 6	30%	No
5	30%	4, 6, 2	30%	No
6	30%	6, 2, 4	30%	No
7	30%	2	10%, 30%, 40%	No
8	30%	2	30%, 40%, 10%	No
9	30%	2	40%, 10%, 30%	No
10	30%	2	30%	M=0,1,2
11	30%	2	30%	M=1,2,0
12	30%	2	30%	M=2,0,1

In session 1 to 9 individuals are organized in groups of eight. In the first three sessions, individuals face three different levels of probability of audit: 5, 30, and 50 percent. Sessions 4 to 6 leave the probability of audit constant, but change the fine rate on underreported taxes from 2 to 4 and finally to level 6. The response of the compliance rate to changes in the tax rate (10, 30 and 40 per cent) is captured in sessions 7 to 9.

Sessions 10, 11 and 12 examine the impact of the role of the government providing public goods in tax compliance. The group is organized in groups of 4

subjects. After taxes are paid, and penalties if any are assessed, the total amount of taxes is summed into the “group fund”.

The group fund is multiplied by a factor (m) that reflects the government performance in the provision of public good. When m equals zero indicates an inefficient government. If m equals to one, this means that the government is efficient. The case of public good is when m equals 2.

In each round the resulting group fund is divided equally among the 4 individuals. The net balance for each subject is calculated (the original income minus taxes, minus penalties, plus the share of the group fund). Note that any amounts collected from the audits are not added to the group fund. A new round then begins, with the subject’s balance carried over from the previous round.

This experimental design is similar to that used in the voluntary public good provision literature, which argues that the individual pays taxes in order to receive some public output. In much of the research in voluntary provision, subjects receive an income that may be kept or contributed to a public good under various provision rules.⁶ The task of subjects in these experiments is to choose a level of contribution, while in the tax compliance setting; subjects must choose how much to declare to the tax authority. The main difference between these two literatures is that, most of the voluntary provision literature does not have an enforcement program, while most of the compliance literature does not have an expenditure program.

All sessions begin with the subjects reading their own copy of the instructions and they are instructed not to communicate with one another.⁷ The learning time in this sort of experiment is fast. For that reason, only two practice rounds are given, and any questions are answered. Subjects are permitted to keep the instructions during the experiment for reference.

The instructions use “neutral” terminology. That is, all references to taxes, audits, declared income, and the like are replaced with such neutral words as payments, checks, reported income and so on. The purpose of the neutral language is to avoid context effects or framing effects that may bias subjects’ choices predictably.⁸

The subjects used in the experiments are undergraduate students at the Centro de Investigacion y Docencia Economicas (CIDE) in Mexico City, Mexico. They were recruited in class on voluntary basis, and they were allowed to participate only once.⁹

⁶ See Isaac, R. *et al.* (1985) for examples of different rules for the provision of public goods.

⁷ A sample set of instructions is in the Appendix.

⁸ See Plott (1987) and Smith (1982) for further discussion on experimental design. Alm, McClelland and Schulte (1992) conclude that there is no difference in experiments with students that use neutral terminology versus those that use tax specific language. However, previous research has given instructions to the subjects to place the experiment in the context of tax evasion. For further reference, see Cummings, Martínez-Vazquez and McKee (2001), Bosco and Mittone (1997) & Friedland, Maital and Rutenberg (1978).

⁹ Specifically, this experimental design is very similar to experiments that have been run in the United States at the University of Colorado and at the Universidad Carlos III de Madrid in Spain. See Alm, Jackson and McKee (1992) and,

Subject earnings range from seven to eleven dollars depending on the subject's performance in the experiment. A session typically lasts less than one hour.

IV. Experimental Results

The comparison of the experimental results is based on the elasticity of the declared income with respect to the audit rate, the fine rate, the tax rate and the group fund between experiments.¹⁰ See Table 2.

T A B L E 2
TOBIT ESTIMATES
DEPENDENT VARIABLE DECLARED INCOME

INDEPENDENT VARIABLE	UNITED STATES MODEL 1		MEXICO MODEL 2	
	COEFFICIENT	ELASTICITY	COEFFICIENT	ELASTICITY
CONSTANT	-0.055 (0.19)	—	-1.006 (1.69)	—
INCOME	0.357 (4.16)	0.651	0.527 (25.84)	1.123
AUDIT RATE	5.769 (1.89)	0.168	6.302 (5.84)	0.387
FINE RATE	0.025 (1.42)	0.037	0.043 (0.50)	0.023
TAX RATE	-2.371 (7.73)	-0.517	-4.43 (2.86)	-0.267
PUBLIC GOOD	-0.406 (1.59)	—	-1.507 -3.55	—
GROUP FUND	0.9153 (2.06)	0.045	-0.018 (0.08)	-0.0006
LOG-LIKELIHOOD	-4252.1		-6829.07	
N	3000		2520	

*Each elasticity is calculated at the mean values of the variables. The absolute values of the estimated *t*-statistics are in the parentheses.

Alm, Sánchez and de Juan (1995). Unfortunately, Alm, Sánchez and de Juan omitted the value of the elasticity for the public goods sessions, making the comparison with the Spanish case not possible.

¹⁰ The estimation follows the one suggested by Alm, Jackson and McKee (1992).

Probability of Audit. According to the experimental results, tax revenues increase with greater enforcement efforts in both experiments. These results confirm the predictions of the Allingham-Sandmo model and are also consistent with the empirical work of Witte and Woodbury (1983), Dublin and Wilde (1988) and Dublin, Graetz and Wilde (1990).

Penalty Rates. The sign of the elasticity of declared income with respect to the fine rate is positive in both experiments. Nevertheless, the coefficients are very close to zero and their significance is low. The literature and the empirical evidence have not reached any definitive conclusion about the effect of penalties.¹¹ Tax authorities might be tempted to increase compliance via penalties because of its low administrative cost. However, they should be careful because of the low return of such policy in terms of increasing tax compliance.¹²

Tax Rates. The experimental results show that higher taxes lead to significantly lower compliance, which is consistent with the notion that the payoff to successful evasion is greater when the tax rate is high. The results presented here refute the theoretical results of Allingham-Sandmo model as modified by Yitzhaki (1974), although they are consistent with Clotfelter (1983), Slemrod (1985), Crane and Nourzad (1986), Baldry (1987), Poterba (1987) and Friedland, Maital, and Rutenberg (1978). Indeed, tax savings from noncompliance is a function of the tax rate, which suggests that the incentives for noncompliance are related to the tax rate.

Public Goods. Both experiments show a negative coefficient for the dummy variable. However, it is non-significant for the United States, as opposed to the case of Mexico where it is very significant. The estimation results for the group fund are more dramatic. The coefficient is negative but non-significant for the case of Mexico, in contrast to the United States where is positive and significant.

The failure of the government performance in the provision of public goods to increase compliance for the case of Mexico is consistent with the work of Isaac, McCue and Plott (1985), Isaac et al. (1984), and Kim and Walker (1984), in which they find funding levels for public good are close to zero, a result which is very much in accord with the economic theory.

In addition, each individual was able to see how much they were receiving from the common fund on their computer screen. Therefore, each individual had an idea of how much the rest of the members in the group contributed. The results presented here corroborate what Spicer and Hero (1985) found in their experiments: an individual's compliance did not depend upon his or her perception of the compliance behavior of the others.

¹¹Doob and Webster (2003), Roth *et al.*, Vol. 1, 1989, p. 6. Grasmick and Bursik (1990).

¹² For instance, in the Mexican experiment, when the probability of audit was 50 percent, the average number of audits was 4.3 per round. However, not all of them were "productive" because many people declared honestly.

The public goods results support the theoretical results: there is a free rider problem. A possible explanation of why people reject the public good—even with the use of neutral language—is because of the weak institutional framework in Mexico that prevents cooperation. Perhaps if the income side of the experiment were linked to the expenditure side, there would be no free-riders. In other words, a more detail explanation of the use of the funds (education, health, public service) could have increased the compliance rate in Mexico.

Age and Gender. We include demographic factors for the case of Mexico. The experimental evidence also shows that there are important and significant demographic factors influencing compliance for the case of Mexico.

T A B L E 3
TOBIT ESTIMATES
DEPENDENT VARIABLE DECLARED INCOME

INDEPENDENT VARIABLE	COEFFICIENT	ELASTICITY
CONSTANT	-1.006 (1.69)	—
INCOME	0.529 (26.05)	1.128
AUDIT RATE	6.347 (5.91)	0.39
FINE RATE	0.003 (0.04)	0.001
TAX RATE	-4.822 (3.12)	-0.291
PUBLIC GOOD	-0.977 (2.21)	—
GROUP FUND	-0.016 (0.07)	-0.0005
AGE	-.109 (1.24)	-0.45
GENDER	.8935 (3.90)	—
LOG-LIKELIHOOD	-6819.37	
N	2520	

The Mexican evidence shows that age can negatively change compliance and its effect is larger than the positive effect of an audit.¹³ This result reinforces the findings of Dornstein (1976) in Israel. This is important, particularly in countries like Mexico where the percentage of young people is high. Among the demographic factors, gender is more significant. The evidence shows that compliance is higher among women, which is consistent with almost all work relating gender to tax offenses (Hindelang (1971)).

V. Conclusions

Economists traditionally have viewed the problem as one of rational decision making under uncertainty –cheating on your taxes is a gamble that either pays off in lower taxes or subjects one to sanctions. From this perspective, one would expect that noncompliance would respond only to changes in both the likelihood that an act of evasion would be detected and punished, as well as to the severity of the punishment. Nevertheless, social scientists from other disciplines claim that government interaction with taxpayers and the provision of public goods are also important factors.

However, in general, every time academics have turned their attention to tax compliance, they have quickly realized that there is little empirical evidence on which to base policy prescriptions. Consequently, on the one hand, there is little evidence on tax compliance *per se*. And on the other hand, despite all the effort that has gone into analyzing the main relationships between citizens, government and its mediation through the tax system; one still does not know how to best include the government's behavior in a theory about compliance. The results from this study definitively will contribute to the growing body of tax compliance research.

The experimental results indicate that the change in compliance in response to the change in deterrence factors work in the same direction under similar laboratory conditions, using individuals from countries with different levels of income, different institutional development and different income distribution. In both experiments, increasing the probability of an audit is more effective than imposing more severe penalties, although the impact was higher in Mexico than in the United States.

However, the presence of public goods does not increase the rate of compliance in any of the sessions for the Mexican experiment. Individuals denied the benefits from the public goods, even when each member could be better off.

A possible explanation of why people reject the public good could be that the income side of the experiment is not linked to the expenditure side "in detail". In other words, future research should try to design an experiment that

¹³ The coefficient is significant at the 10-percent level.

explains in more detail the type of public good (use, characteristics, frequency in the consumption, etc.).

Another possibility to increase compliance in the Mexican case could be to allow participants to punish free-riders—via monetary or non-monetary punishment.¹⁴ However, the puzzle remains as to why in the American experiment individuals accept the public good as opposed to the Mexican experiment, even in the absence of a punishment for free riders.

According to Alm (1991) experiments should be administered in a uniform and consistent manner to allow replicability. This allows to test the robustness of the design, in order to avoid erroneous conclusions. The unexpected differences observed among countries in the public good sessions show that this independent variable has different impact depending of the particular tax culture. These results are a call to attention for researchers to verify the robustness of the public good sessions in different cultural settings.

¹⁴A recent study that deals with voluntary provision and punishment is Fehr, Ernst and Simon Gächter (2000).

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Appendix

INSTRUCTIONS

The following instructions were originally written in Spanish. The instructions were adapted accordingly to the different sessions. They are available upon request.

This is an experiment in the economics of decision making. The instructions are simple and, if you follow them carefully, you will have an opportunity to earn A CONSIDERABLE AMOUNT OF MONEY that will be paid to you in cash at the end of the session.

You have been organized in groups of eight people. Each group will consist of the same eight people for the duration of the session. The specific identities of the other people in your group will not be revealed to you. YOU MAY NOT COMMUNICATE WITH ANYONE ELSE IN THE ROOM DURING THE SESSION. If you do not follow the rules, we will have to exclude you from the experiment and you will not receive any payment.

The session will last for several rounds, each one is independent from the others. In each round, you will be required to make a decision and your total earnings will depend on these decisions. You will not know the total number of rounds. At the beginning of the session each individual will be given 2000 tokens. You will have the opportunity to add to these tokens in each round. At the end of the session, the tokens you have accumulated will be converted to cash at the rate of 50 tokens per pesos. For example, if at the conclusion of the experiment your balance on the computer is 5000 then you will receive 100 pesos. YOU SHOULD FEEL FREE TO TRY TO MAKE AS MUCH MONEY AS YOU CAN. The experiment is divided in two parts.

At the beginning of each round, on the top left corner, the session number, participant and round will appear on your computer. In each round, you will be given a new amount of tokens (actual tokens). The exact quantity you and the others in your group receive will be randomly drawn by the computer from the range of 25 to 200 tokens in increments of 25 tokens. All values are equally likely and only you will know the quantity you have received. You have the choice of keeping your tokens or disclosing them to contribute to a common fund together with other 3 participants. Move the mouse to enter in the input-field "reported tokens". You may disclose any amount of tokens between zero and the amount of tokens that you actually receive.

You will pay 30 percent of the tokens you disclose. For example, if you receive 100 tokens and disclose 70 tokens, you will pay 21 tokens (0.3 times 70). You do not pay on money you do not disclose, and only you know the true amount of money that you receive at the start of each round. After you have decided the number of tokens that you want to disclose, please copy this number in the report sheet (yellow sheet), as well as the round number. In the above example, you will fill the report sheet with the following numbers:

Round	Reported Tokens
1	70

Now, WAIT FOR THE INSTRUCTION TO PRESS THE BUTTON "ACCEPT". Please check the number of tokens that you disclose, because once you click the "Accept" button, you will not be able to change your mind. After everyone has disclosed his or her tokens, some individuals may be selected for a check. In this check, the computer will compare the person's true quantities of tokens for the current round with the actual levels disclosed. If you are checked, any tokens received but not disclosed will be discovered. You will pay the shortfall (30 percent of over the tokens received but not disclosed) plus a penalty. In this session, you pay the shortfall plus an amount equal to one time the shortfall—. In the above example, you would pay 18 additional tokens, that is, the shortfall (30 tokens times 0.3), plus fine of 9. The computer will calculate the shortfall payments and subtract it from your balance. Only you will know the result of your own check.

Once all the participants have reported their tokens, the computer will add the tokens from 4 members of the group into a common fund. The common fund will be divided between the 4 members and it will be added to each balance. To know how much are you receiving from the common fund, WAIT FOR THE INSTRUCTOR'S SIGNAL TO PRESS THE BUTTON "COMMON FUND". Along the experiment, the common fund will be multiplied by different values. In fact, at the beginning of the session, it will be multiplied by zero. In this way, even though you reported tokens you will not receive any additional tokens from the common fund. However, at a certain point, the common fund will be multiplied by another value. Whenever this happens, you will receive more tokens than your original payments made by the 4 participants.

The procedure for selecting the person for a check is as follows: each person has an ID number that appears on your computer screen, between 1 and 8. In the bingo cage that appears on the top right corner of your screen there are balls numbered 1 through 20. After everyone has disclosed his or her tokens, a ball will be drawn from the cage. If the number of the ball is from 1 to 8, the person with that ID will be checked. If the number is from 9 through 20, no one will be checked in that round. Once the ball has been drawn from the bingo cage, WAIT FOR INSTRUCTIONS TO CLICK ON THE BUTTON "ARE YOU READY TO CONTINUE?". Once you have clicked the button, you can continue to the next round.

We will begin with two practice rounds to familiarize you with the payment, disclosure, and check process. These practice rounds will not be counted to calculate your payment. At the end of the two practice rounds, your balance will be reset to 2000 tokens as the bidding or real rounds begin.

Are there any questions? Please, raise your hand, DO NOT ASK THE QUESTION OUT LOUD. When you finish reading these instructions, please place them face down on your own desk.