

Probability testing of Tax Behavior Nudges in Republic of North Macedonia

Social field experiment

During 2020, between the months of April and September, in three municipalities (LSGUs) in North Macedonia, with the support of the municipal tax departments, a tax behavior social experiment was conducted.

The experiment pilot tested the possibilities of behavioral nudges in increasing the property tax collection of overdue liabilities. The experiment used a controlled random trial approach and targeted the tax payers with overdue liabilities for property tax on a representative sample.

The targeted population sample together with the tax returns for 2020 received one of the three types of letters with a nudging messages with social norm, public good or deterrence message. The effects were measured in comparison with the control group, and the possible differences due to gender and age.

This summary reports the PROBIT estimation results of the database collected during the social field experiment in three municipalities in North Macedonia (we use the following notations for the municipalities: LSG₁, LSGU₂, LSGU₃).

With the social experiment, we tried to positively affect tax compliance by influencing property tax taxpayers' beliefs depending on different messages/letters they received: social norm, public good and deterrence.

Results indicate that different messages proved to be effective depending on the municipality. Tax compliance increased by 0.5% (public good message); 2.2% (social norm message); 4.3% (deterrence message).

Methodology

We employ baseline summary statistic with an OLS regression of the pre-treatment variable in question on treatment dummies and a constant term. We also employ PROBIT model to estimate the causal effects of the treatment messages on tax compliance.

Baseline summary statistic with an OLS regression

The observations are unstructured and present the number of taxpayers per municipality with overdue liability. In the OLS regression the dependent variable is a binary (1=paid; 0=not paid), and takes the value of 1 if the taxpayer paid an amount of the total tax liabilities during the observed period of the experiment. The constant captures the value for the control group (no message). The social norm, public good and deterrence variables show the difference in Macedonian denars (MKD) between the treatment groups and the control group. The results of the OLS regression are presented in the next table 1.

Table 1. Baseline summary statistics from the OLS regression

Municipality Dependent Variable	Constant (1)	Social norm (2)	Public good (3)	Deterrence (4)
LSG ₁ paid	0.0658*** (0.018)	0.0125 (0.024)	-0.001 (0.024)	0.051** (0.025)
LSG ₂ paid	0.164*** (0.035)	0.124** (0.054)	0.067 (0.056)	0.086 (0.053)
LSG ₃ paid	0.174*** (0.032)	0.078* (0.047)	0.026 (0.046)	0.064 (0.046)

The constant captures the value for the control group (no message). Columns (2)-(4) show the difference between the treatment groups and the control group. Monetary amounts are in Macedonian denars (MKD). Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The results from the table illustrate that:

- For LSG₁:
 - The *deterrence letter* influences the property tax taxpayers' beliefs significantly
 - Almost 7% paid as a control group
- For LSG₂:
 - The *social norm letter* influences the property tax taxpayers' beliefs significantly
 - Some 16% paid as a control group
- For LSG₃:
 - The *social norm letter* influences the property tax taxpayers' beliefs significantly
 - Some 17% paid as a control group

Probit model

To estimate the causal effects of the treatment messages on tax compliance we employ probit model. The model takes the following algebraic form as in equation (1):

$$Prob(Y_i = 1|X) = \Phi(\alpha + \beta_1 T1_i + \beta_2 T2_i + \beta_3 T3_i + \gamma Z_i + \delta_i) \quad (1)$$

where Y is the binary outcome variable equal to one if the individual taxpayer-i meets her tax obligations in the period; T-are binary variables representing the three treatment messages (T1=Social norm; T2=Public good; and T3=Deterrence), Z-is a vector of control variables comprising taxpayers' observable characteristics (age and gender) and δ -is a set of strata fixed effects.

In the next Table 2 we present *the average treatment effects of the probit estimation* described in equation (1). The dependent variable is a binary variable (1=paid; 0=not paid) and it takes the value of 1 if the taxpayer paid some amount of the total tax liability overdue. The estimations for the three municipalities include the three treatment messages (social norm, public good and deterrence), and the fixed effects. The control variables are for age and gender.

Table 2. Probit regression statistics

	LSG ₁	LSGU ₂	LSGU ₃
Constant	-1.528*** (0.316)	0.199 (0.353)	-1.363*** (0.337)
Social norm	0.093 (0.169)	0.366** (0.186)	0.265* (0.161)
Public good	-0.011 (0.174)	0.233 (0.195)	0.100 (0.164)
Deterrence	0.313* (0.167)	0.238 (0.186)	0.233 (0.161)
Age	-0.001 (0.004)	-0.018*** (0.004)	0.003 (0.004)
Gender	0.103 (0.189)	0.071 (0.192)	0.291* (0.160)

Dependent variable used in each regression identified in the header. The set of regressions includes the three treatment messages, control variables and block-level fixed effects. Note that the interpretation of the coefficient values is complicated by the fact that estimated coefficients from a binary model cannot be interpreted as the marginal effect on the dependent variable¹. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The results from the table illustrates that:

- For LSGU₁:

¹ See more: http://www.eviews.com/help/helpintro.html#page/content%2FImdep-Binary_Dependent_Variable_Models.html%23ww37432.

- The deterrence letter influences the property tax taxpayers' beliefs significantly.
 - Age and gender are not statistically significant.
 - The H-L and the Andrews test statistic show mixed results in testing goodness of fit of the probit regression².
- For LSGU₂:
- The social norm letter influences the property tax taxpayers' beliefs significantly.
 - Age is statistically significant. The older the taxpayer the less tax compliance in LSGU₂.
 - The H-L and the Andrews test statistic show satisfying goodness of fit of the probit regression.
- For LSGU₃:
- The social norm letter influences the property tax taxpayers' beliefs significantly.
 - Gender is statistically significant for tax compliance in LSGU₃. Male have higher tax compliance behavior than females in LSGU₃.
 - The H-L and the Andrews test statistic show mixed results in testing goodness of fit of the probit regression.

Conclusions

The tax behavior approach for nudging towards enhanced tax compliance is an innovative, alternative, inexpensive and effective method. This tax compliance enhancement tool can be used as a complement to other tax compliance methods. The models confirm that different messages can have various effects on the tax payers' behavior, depending on one's beliefs and values that vary locally as well. Furthermore, characteristics such as gender or age may be statistically significant in being more or less tax compliant depending on the specific location.

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² Ibid.