

# Impact of Behaviour Nudges on Tax Compliance: Age as a Factor in Municipalities in the Republic of North Macedonia

VESNA GARVANLIEVA ANDONOVA & MARJAN NIKOLOV

**Abstract** We examine the effects of a tax behaviour nudging experiment on non-compliant property taxpayers in three Macedonian municipalities. The results indicate that on average the deterrence message was almost 6 percentage points more effective for non-compliant taxpayers when compared to the control group, while the social norm message and public good message were on average 4.4 and 3.2 percentage points more effective when compared with the control group, respectively. Furthermore, age as a variable is significant and negatively associated with tax compliance behaviour in one of the three municipalities. Finally, we recommend the experiment's approach to policymakers as effective, while being inexpensive and not requiring legislative changes.

**Keywords:** • North Macedonia • tax morale • tax behaviour • probit model

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## 1 Introduction

Tax non-compliance and tax evasion are universal problems, present both in developed and developing countries, but more pronounced in the latter. Tax evasion and non-compliance are primarily constrained by the threat of possible detection and punishment (explained in Allingham and Sandmo, 1972). While enforcement in many cases is empirically shown to lead to positive tax compliance (Birskyte, 2013), so are behavioural factors; these can thus be considered applicable in tax (non-)compliance research. The control of tax non-compliance affected by social and psychological factors has been explained by Andreoni, Erard, and Feinstein (1998). The psychological factors affecting compliance are said to stem from an individual's inner feeling of 'embarrassment' in their community (social norm), inner responsibility for not fulfilling their civic duty, or the possibility of sanctions (Luttmer and Singhal, 2014). In this context, individuals may have intrinsic motivations or norms to pay or not pay taxes (Dwenger et al., 2016). The existence of social and psychological factors is increasingly being recognized and studied. Empirical studies demonstrate the effects and importance of tax authority efforts (including of governments on either level) in modifying taxpayer behaviour and enhancing public resource mobilization.

Tax non-compliance (to tax legislation) results in losses in public revenues. It can be estimated that there is a roughly one hundred million EUR annual loss of public revenues in the Republic of North Macedonia due to non-compliance as a result of low tax morale (Smilevski et al., 2020). The Treasury within the Ministry of Finance and the Public Revenues Office of North Macedonia have not calculated this loss (public revenue forgone), thus the estimate is based on the assumptions valid for other European Union countries. The taxation capacity of the authorities in developing countries is more limited, and tax evasion is more present. Therefore, it is more likely that both group/community and individual attitudes concerning tax non-compliance would differ compared to those in developed countries. Hence, considering the lower degree of tax morale in the Republic of North Macedonia, i.e., lower than the average European Union levels, these losses are likely to be even higher. Furthermore, local tax losses, especially property tax losses, can be even higher due to shortcomings in the overall process of local property tax management (Garvanlieva et al., 2020).

Behavioural interventions in tax compliance attract attention because of the expected positive impact on the behaviour of taxpayers, as well as increased cash inflows for resource mobilization. The effectiveness of these behavioural interventions has been tested in many countries: USA (e.g., Coleman, 2007, Iyer et al., 2010, Meiselman, 2018, Chirico et al., 2019), UK (e.g., Hallsworth, 2014, John & Blume, 2018, Larkin et al., 2019), South and Central America (e.g., Castro & Scartascini, 2015, Bergolo et al., 2017, Brockmeyer et al., 2019), and different European countries (e.g., Hernandez et al., 2017, Doerrenberg & Schmitz, 2017, De Neve et al., 2019, Sloboda et al., 2022, Muthova et al., 2022, Dwengler et al., 2016). Different interventions have examined the effectiveness of

different intrinsic and extrinsic motivators such as social norms, deterrence, simplification, reminders, etc. Findings from various experiments provide inconclusive and complex conclusions on what works best and what does not.

The goal of this article is to test the effectiveness of behavioural interventions with different tax nudging messages on tax compliance and property tax revenue mobilization among non-compliant taxpayers. Furthermore, we test the significance of age and gender as variables in tax compliance to detect local variations. Therefore, the research questions covered herein are: Did the different nudge messages help to change the behaviour of non-compliant taxpayers of the local property tax? Which of the three messages had the most positive behavioural change? Are age and gender predictors of tax compliance behaviour?

In this paper, we present the results of a random control trial (quasi-experiment) for determining the effect of different behavioural messages, intended to nudge non-compliant taxpayers to pay their overdue property tax liabilities. The messages were sent via letters through the postal service, addressed from the municipalities to the non-compliant taxpayers. We present the impact of these different messages on the behaviour of non-compliant taxpayers, while focusing on the significance of age as a variable. The experiment was conducted in three municipalities (local self-government units - LSGUs) in the Republic of North Macedonia in 2020.

Our results from the experiment have noteworthy policy implications since they demonstrate the effects of a behaviour-nudging approach to local resource mobilization and tax compliance. The benefits of this approach are several, as this practice does not entail legislative changes or tax rate increases, while offering a relatively inexpensive method for local revenue mobilization. Thus, the approach results in a cost-effective complement to the standard measures governments and/or tax authorities undertake to discourage tax evasion. Furthermore, the approach does not affect possible privacy issues as constructed. Possible future experiments concerning public disclosure of non-compliant taxpayers entail other privacy issues (as shown in Lenter, Slemrod, and Shackelford, 2003; Blank, 2014). Our paper contributes to the increasing empirical literature in assessing the influence of factors on tax compliance in North Macedonia as a unique approach at a local government level.

The first part of this article introduces the theoretical basis of behavioural approaches to tax payment, with an overview of empirical research in the field. The second part presents the methodology and data used, followed by the experiment results. We implemented behavioural intervention in the form of a randomized controlled trial, presented in the section on the results of the experiment and models. The last two parts provide a discussion of the results from similar experiments in other countries and, in the end, we summarize the main points and provide conclusions.

## 2 Literature overview

There is a plethora of public finance literature in emerging and developed countries on the subject of non-compliance and tax morale, with consideration of various underlying socio-demographic characteristics (as shown by, for example, Scholz and Pinney, 1995; Luttmer and Singhal, 2014; Pomeranz, 2015; Stainmo, 2018). The motivation to avoid tax compliance has been researched across different scientific disciplines, and the models that predict the behaviour can be categorized either as rational economic or behavioural economic models (Hashimzade et al., 2012; Weber et al., 2014).

The initial tax compliance models (as explored, for example, by Becker, 1968; Allingham & Sandmo, 1972; Yitzhaki, 1974) are predominantly rooted in the economic theory of expected utility. Generally, economists have modelled tax evasion behaviour as a decision made under uncertainty (Allingham and Sandmo, 1972), meaning that the evasion (the evaded tax amount) will enable additional disposable income to the tax evader (non-compliant taxpayer). However, at the same time, the evader takes the risk that if detected, the evaded tax amount will be recovered in addition to a fine. Nevertheless, the model developed by Allingham and Sandmo (1972) is based on deterrence and does not offer an explanation of all tax evasion aspects, i.e., it does not take into account social, psychological-behavioural factors such as the feeling of guilt, embarrassment, intrinsic values, and attitudes or social and demographic characteristics of the taxpayer. In these early models, taxpayers are portrayed as rational and expected to maximize utility by measuring the monetary benefits of 'dishonest' behaviour, while assuming that the decision-making is influenced by the risk of being exposed and penalized. Thus, policy responses to such assumptions have been focused on increased frequency and coverage of financial controls and stricter penalties to deter non-compliance.

Later on, authors such as Walsh (2012), Alm and Torgler (2006), and others debate the above models as quite simplistic and neglectful of other aspects of tax compliance. Batrancea et al. (2012) in their review present models of tax compliance with an emphasis on economic and behavioural perspectives beyond the early models. These models argue that tax compliance is influenced by other factors as well, such as a sense of fairness (in Castro & Scartascini, 2015; Alm et al., 1995), trust in the tax system (positively influencing voluntary compliance), power of tax authorities (through enforced tax compliance) (as presented by Kirchler et al., 2008), the 'slippery slope' framework, the complexity of the tax system, etc. (by Dwenger et al., 2016). These authors suggest that the effectiveness of different tax compliance interventions in strengthening taxpayers' compliance predominantly depends on the intrinsic motivators of the taxpayer, such as moral values, as well as external motivators, such as deterrence/rewards systems.

Empirical studies published on socio-demographic effects on the level of tax compliance or evasion globally are inconclusive. Some studies suggest that tax compliance varies across socio-demographic categories (for example, Ahmed and Braithwaite, 2004; Bobek, Roberts, and Sweeney, 2007; Kastlunger et al., 2010). These studies note significant differences among different professional categories (jobs) and their opportunities to evade taxes, while research on the relationship between tax compliance and age, gender or education, disposable income, etc. does not offer clear and uniform results across countries.

On one hand, some studies (Ahmed and Braithwaite, 2004; Bobek, Roberts, and Sweeney, 2007; Kastlunger et al., 2010) show a significant link between these variables and tax compliance, while other authors (such as Grasmick and Bursik, 1990; Ashby, Webley, and Haslam, 2009; Muehlbacher and Kirchler, 2009; Muehlbacher, Kirchler, and Schwarzenberger, 2011) show no significant effect. Still, these factors could be confounders or variables that interact with primary variables. Empirical studies on this subject have been predominantly focused on the developed and Western world and much less on emerging markets.

Antinyan and Asatryan (2020) in their meta-data analysis provide an extensive, global overview of recent studies based on forty-five randomized controlled trials with behavioural tax nudges and compare the results. They conclude that interventions concerning individual tax morale are on average ineffective in combating tax evasion and inducing better tax compliance compared to the positive effect of deterrence nudges. Overall, the effects of deterrence nudges show a modest increase in the probability of compliance of 1.5 to 2.5 percentage points compared to non-deterrence nudges. Furthermore, they suggest that nudges are more effective for late payers and when delivered in-person, while they are less effective for long-term behaviour change and among lower income countries. Some randomized controlled trial results in other countries, such as in Guatemala, indicate that deterrence messages are most effective, as are social norm messages having a lesser, but still significant impact (Kettle et al., 2016). Study results in a municipality in Argentina (Castro and Scartascini, 2015) find deterrence letters to be most effective, while messages of reciprocity and peer-effect were found to be insignificant. In Slovenia, compliance of small businesses was positively affected through personal communication rather than letters (Doerrenberg and Schmitz, 2017). In London and the surrounding areas, social norm messages have not only been unsuccessful, but have had an adverse effect (as explained by John & Blume, 2018).

In a separate study, Torgler and Schaltegger (2005) provide empirical evidence that age (as one of the factors of tax behaviour) is an important and significant determinant for tax morale and tax behaviour. They demonstrate that age is statistically significant in determining tax behaviour for all age groups and positively correlated with tax compliance in Europe overall (in 1989/90). Specifically, the authors demonstrate a positive and significant relationship between age and tax morale in Switzerland (in 1989,

but not significant in 1999), Germany (in the same period), Spain (in 1990, but not in 1995), Belgium, and Great Britain. In the same paper, they also find positive results on the American continent, as well as in transitional European countries (in the 1990s), such as Russia, Estonia, Poland, Bulgaria, and Slovenia.

Hofmann, Voracek, and Kirchler (2017) find that the correlation between age and tax compliance varies depending on the (global) geographical region, i.e., the region where the data were collected. Their research reveals a stronger positive relationship in Eastern Europe, Central Asia, and North America, then a less significant positive link in East Asia and Pacific Sub-Saharan Africa, Latin America, and the Caribbean, and no relation between age and tax compliance in South Asia. Their results support the hypothesis that older taxpayers are more compliant than younger ones.

The justification behind the age-tax compliance link comes through socialization aspects. Social values and attitudes of younger people differ from those of older people; however, the authors explain that these values and attitudes are transformative with age and can move in either direction (becoming more or less compliant). As an individual ages, the need for public services/public goods increases, and so does the need for social security benefits and health care. Consequently, the appreciation for and value of the benefits of the paid taxes increase as well. Additionally, older generations might be financially better off (Kirchler, 2007). In this same vein, tax knowledge increases with age (Eriksen and Fallan, 1996), and risk aversion intensifies. On the other hand, older age could be linked to reduced tax compliance as well, as in Warneryd and Walerud (1982) and Wahlund (1992) who find a negative connection, where older taxpayers are less compliant compared to younger generations of taxpayers.

In our case study, we present the impact of various nudging messages on tax compliance, as well as demonstrate the significance of age and gender as socio-demographic characteristics in achieving compliance. We present experimental results taking into consideration the relationship between local property tax compliance and the age and gender of the non-compliant taxpayer in three municipalities in North Macedonia.

### **3 Research**

The three LSGUs covered in the experiment are heterogeneous in size and area, geographical position, and share of the property tax in local revenues, which makes them representative of the heterogeneity of Macedonian LSGUs. In terms of population size, there is one LSGU in each of the following categories: large, medium, and small (the average population of municipalities in North Macedonia is 23,000). All municipalities have a seat in urban centres. The selection and inclusion of the three LSGUs in the research are based on their interest to implement the tax behaviour intervention experiment, conducted from July to September 2020.

Property tax collected from natural persons is a significant portion of the municipal own source revenues. For the LSGUs covered in this experiment, the property tax collected from natural persons represents 7%, 12%, and 20% of their own source tax revenues, respectively. The cumulative overdue liabilities of the taxpayers over the past several years present a significant amount for all LSGUs and often surpass the property tax revenues collected annually (Table 1).

**Table 1:** Selected data from the sample LSGUs

		LSGU1	LSGU2	LSGU3
Population	(in '000)	81.0	5.5	17.5
Avg. annual revenue from PT	(in mill MKD)	12.1	0.9	6.3
Avg. annual OSR from Taxes	(in mill MKD)	175.7	7.6	31.5
Share of PT in OSR from Taxes	(in %)	7%	12%	20%
5 year cumulative PT liabilities	(in mill MKD)	42.93	1.41	5.97
Sample size	#	1,021	451	607
Treatment response rate	(in %)	8%	23%	21%
Sample Cumulative PT: Prior treatment	(in mill MKD)	15.60	1.12	5.24
Sample Cumulative PT: After treatment	(in mill MKD)	15.13	1.01	4.49
Change (pre/post)	(in %)	-3%	-9%	-14%

Note: PT – property tax revenues, natural persons only

OSR – Own Source Revenues

1 EUR = 61.69 MKD

### 3.1 Data and Methodology

To raise local property tax compliance and the mobilization of revenues, we evaluate the effectiveness of behavioural nudges through random controlled trials in three municipalities in the Republic of North Macedonia. The nudges were sent through printed letter messages to non-compliant taxpayers. The three municipalities (authorities) agreed to alter their conventional communication for the collection of the property tax and to include different letters when mailing annual property tax bills. Thus, they agreed to participate in a randomized experimental setting. This study used quantitative methodology to determine the effects of different nudging messages addressed solely to non-compliant taxpayers, and the goal of the messages was to prompt non-compliant taxpayers to pay their overdue liabilities for the local property tax. The research was conducted in three municipalities in North Macedonia (overall sample size  $n=2,079$ ).

The overdue taxpayer liability for the property tax was recorded before treatment, and the effects were measured after treatment. The data are based on the financial records of the municipalities, which cover the personal property outstanding balance of taxpayers who are owners of real estate and who are registered as property taxpayers. The difference between the outstanding balance prior to the treatment and after the treatment is the

indicator of whether the taxpayer fully or partially paid the outstanding debt for the property tax. The sample was stratified by age groups and by gender, based on the distribution of these categories in the overall population of non-compliant taxpayers.

The treatment was conducted through three different messages in specially designed letters, printed and marked with the municipal official letterhead alongside the 'new' annual property tax bills. The messages were delivered by postal service to the residency of the taxpayer. The content of the messages was intended to nudge the non-payers' behaviour by invoking their inner values and attitudes toward social norms, public good, and deterrence. The sample excluded taxpayers who had a mailing address outside the municipality. In the course of the selection, an average of around 5 per cent of taxpayers could not be matched across both the register of taxpayers and the list of taxpayers' property tax bills; these individuals were also excluded from the sample. One of the municipalities was smaller in terms of the total number of taxpayers and, thus, non-compliant taxpayers and the sample included all identified, non-compliant taxpayers. Each non-compliant taxpayer was then randomly assigned to a treatment group and to a control group. Overall, 75 per cent of the sample was assigned to one of the three treatment groups, and 25 per cent was randomly assigned to the control group. The treatment groups included letters with messages as shown in Table 2.

**Table 2:** Treatment messages

Type of message sent within a letter attached to the tax property annual bill	Excerpt of the letter with the message to be conveyed
The Social Norm Letter/Message	<i>...According to our records, most of the citizens in the municipality have paid their property tax. You are part of the minority that has not yet fulfilled that duty...</i>
The Public Good Letter/Message	<i>...Do you know that 100% of the property tax revenues collected are spent for your needs and the needs of our citizens? With these revenues the municipality finances preschool and primary education, building local infrastructure and social programs. Do not be an irresponsible citizen and pay your tax...</i>
The Deterrence Letter/Message	<i>...Not paying taxes places an unfair burden on all the taxpayers who are honestly fulfilling their obligations. The municipality can undertake execution procedures, thus exposing you to additional costs...</i>

### 3.2 Experiment and model results

The overall results achieved through the randomized controlled trial in the three municipalities in North Macedonia can be summarized as follows: on average 10 per cent of the treated non-compliant taxpayers with overdue liability for the property tax reacted positively by paying their full liability. An additional 6 per cent partially paid their



overdue liabilities. Taxpayers within the treatment groups of the experiment reduced their overdue liabilities for the property tax by 6 per cent.

Overall, the most effective result was achieved by the deterrence letter, followed by the social norm message and the public good message. There are geographical differences per the municipality as well, and in the sub-samples, the social norm took precedence. Furthermore, females reacted better to the social norm message, unlike males who reacted better to the deterrence message. The average overdue liability owed by a single citizen before treatment in the treated sample was reduced by 6 per cent on average. The results indicate the following impact on tax payments (of the overdue property tax):

- (1) **Deterrence message:** The impact on tax payments for those who received the deterrence message was on average almost 6 percentage points higher than for the control group (taxpayers who did not receive any message).
- (2) **Social norm message:** The impact on tax payments for those who received the social norm message was on average 4.4 percentage points higher than for the control group.
- (3) **Public good message:** The impact on tax payments for those who received the public good message was on average 3.2 percentage points higher than for the control group.

On a single municipal level, in two of the three municipalities, the social norm letter influenced property taxpayers' beliefs significantly, while in the third, the deterrence letter influenced their beliefs significantly.

To estimate the causal effects of the treatment messages on tax compliance, we employed a probit model. Based on the nature of the dependent variable (payment of overdue liability), which is captured using a dummy 1 and 0, the specified model is analysed using binary regression techniques, as classical regression techniques will not be suited for dichotomous dependent variables. We assume that the cumulative distribution follows a standard normal distribution, thus the use of the probit form of the binary regression technique. We employ the probit technique as adequate as it was also used by other authors of comparable research (Doerenberg & Peichl, 2018; Castro & Scartascini, 2015; Anderson, 2015; Trogler et al., 2008, etc.). We employ baseline summary statistics with an OLS regression of the pre-treatment variable in question on treatment dummies and a constant term. We then employ the probit model to estimate the causal effects of the treatment messages on tax compliance.

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 Table 3.

**Table 3:** Baseline summary statistics from the OLS regression

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

Note: 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. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . LSGU – local self-government unit, municipality

The results from Table 3 illustrate that:

- For LSGU1: The deterrence letter influences the property tax taxpayers' beliefs significantly; almost 7 per cent paid as a control group
- For LSGU2: The social norm letter influences the property tax taxpayers' beliefs significantly; some 16 per cent paid as a control group
- For LSGU3: The social norm letter influences the property tax taxpayers' beliefs significantly; some 17 per cent paid as a control group

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

$$Pr(Y_i = 1|X) = \Phi(\alpha + \beta_1 T1i + \beta_2 T2i + \beta_3 T3i + \gamma Zi + \delta is) \quad (1)$$

where Y is the binary outcome variable equal to one if the individual taxpayer-i meets their 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  $\delta$ -is a set of strata fixed effects.

In the following Table 4, we present the average treatment effects of the probit estimation described in the above 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 three municipalities' estimations include three treatment messages (social norm, public good, and deterrence) and the fixed effects. The control variables are age and gender.

The probit model estimate explains the payment of the overdue property tax liability to the taxpayer receiving a specific letter message, conditional to the age and gender of the taxpayer. A positive coefficient means that an increase in the predictor leads to an increase in the predicted probability, while a negative coefficient means that an increase in the predictor leads to a decrease in the predicted probability. Thus, we are testing the null hypothesis that the payment reaction of the taxpayer is unrelated to the gender/age of the taxpayer. The testing with a statistically significant and positive coefficient estimate is indicating that we would reject the null hypothesis and conclude that the regression coefficient has been found to be statistically different from zero given the other variables in the model.

**Table 4:** Probit regression statistics

	LSGU <sub>1</sub>	LSGU <sub>2</sub>	LSGU <sub>3</sub>
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)

Note: The dependent variable used in each regression is 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 variable. (See more: [http://www.eviews.com/help/helpintro.html#page/content%2Fflimdep-Binary\\_Dependent\\_Variable\\_Models.html%23ww37432](http://www.eviews.com/help/helpintro.html#page/content%2Fflimdep-Binary_Dependent_Variable_Models.html%23ww37432)).

Robust standard errors are in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

LSGU – local self-government unit, municipality

The results from Table 4 illustrate that:

- For LSGU1: 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 the goodness of fit of the probit regression, suggesting that caution should be used in the interpretation of the results of the model estimation.
- For LSGU2: The social norm letter influences the property tax taxpayers’ beliefs significantly. Age is statistically significant. We would reject the null hypothesis

and conclude that the regression coefficient for age has been found to be statistically different from zero. The older the taxpayer, the less tax compliance in LSGU2, i.e. the older the taxpayer there is less probability for payment of the overdue tax liability. The H-L and the Andrews test statistic show satisfying goodness of fit of the probit regression, suggesting that the model shows a good reliance that can be placed on the results.

- For LSGU3: The social norm letter influences the property tax taxpayers' beliefs significantly. Gender is statistically significant for tax compliance in LSGU3. We would reject the null hypothesis and conclude that the regression coefficient for gender has been found to be statistically different from zero. Males have higher tax compliance behaviour than females in LSGU3. The H-L and the Andrews test statistic show mixed results in testing the goodness of fit of the probit regression, suggesting that caution should be used in the interpretation of the results of the model estimation.

#### **4 Discussion**

We conducted a randomized field controlled trial to test whether including messages in the property tax bill about the social norm, public good, or enforcement of the tax would modify taxpayers' behaviour and cause them to pay their overdue liabilities. Through the experiment, we made efforts to provide evidence of the significance of the approach as a complementary policy instrument of the classical enforcement instruments in North Macedonia. With the findings, we test the hypotheses of which message is more effective and whether age is a significant variable in the direction of tax compliance. Using a local property tax on a municipal level allows for more localized information on the impact, providing data on possible local differences.

When put into perspective, extending the use of the nudging behaviour messages to the overall population of non-compliant taxpayers on a national level throughout the municipalities in North Macedonia may result in a substantial increase in compliance and local revenue mobilization. We further investigated age as a variable for improved tax compliance, and the results indicated that age is negatively associated with tax compliance; however, age was significant for only one of the three municipalities in our study. This result indicates that in one of the municipalities, the older the taxpayers are, the more likely the non-compliance with property tax obligations. This may stem from different underlying reasons that could be explored further. These results are in line with the findings of Warneryd and Walerud (1982) and Wahlund (1992), but differ from the findings of Kirchler (2007) and Eriksen and Fallan (1996).

The results indicate that the effect on tax payments (for the overdue property tax) for the group of taxpayers who received the deterrence message was on average almost 6 percentage points higher when compared to the control group (taxpayers who did not receive any message). The impact on tax payments for those who received the social norm

message was on average 4.4 percentage points higher than for the control group, while the impact on tax payments for those who received the public good message was on average 3.2 percentage points higher than for the control group.

On a municipal level, in two of the three municipalities, the social norm letter significantly influenced the property taxpayers' beliefs, while in the third municipality, the deterrence letter significantly influenced their beliefs. Our findings are partially in line with the findings of other authors. Our findings for two municipalities coincide with the findings of Muthova et al. (2022) on the positive effects of social norm messages in one municipality in Slovakia. Unlike Torgler et al. (2008), who conclude that females are more tax compliant, we did not find significance between tax compliance and gender except in one of the municipalities, where we found a weak correlation, but among male taxpayers. The findings are in line with the extensive meta-analysis of Antioyan and Asatryan (2020), as well as with the findings of Hernandez et al. (2017) and others, that the approach can be an effective policy instrument, complementing enforcement, and that behaviour nudges are more effective among non-payers, with deterrence messages having the overall strongest effect.

The most important result of our study is that deterrence has a positive nudging effect on non-compliant taxpayers, as does social information on individual tax compliance. Individuals are inclined to change their tax-compliance behaviour when exposed to the possibility of being penalized, as well as exposed to information on the 'good' behaviour of others in the community.

While our results provide novel empirical evidence for North Macedonia about whether influencing taxpayers' behaviour affects tax compliance, more in-depth research is needed to further understand the causal channels, and it may be useful to replicate the experiments on a larger scale covering more municipalities that are more regionally dispersed, as well as covering other taxes.

## **5 Conclusions**

The approach of nudging behaviour 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 taxpayers' behaviour, depending on one's beliefs and values that vary locally as well. Furthermore, characteristics such as gender or age may be statistically significant in individuals being more or less tax compliant depending on the specific location. Our paper explores empirically whether providing different information/messages to taxpayers influences the individual taxpayer's compliance decision, as well as the significance of age.

While our results provide innovative empirical evidence for North Macedonia about whether influencing taxpayers' behaviour affects tax compliance, more in-depth research is needed to understand the causal channels further, and it may be useful to replicate the experiments on a larger scale covering more municipalities that are more regionally dispersed, as well as covering other taxes.

Furthermore, this paper presents evidence on the importance of policymakers managing and making use of opportunities to influence citizens' beliefs with policies of behavioural nudges, customized to the taxpayers' profile. Our work also demonstrates how this alternative/complement could yield benefits. The effectiveness of this approach and the fact that it can be used complementary to traditional approaches should serve as valid motivation for local governments to introduce it when dealing with non-compliant taxpayers. The benefits of the approach are that it is inexpensive and does not encompass legislative changes. It is also significant and valid for North Macedonia as a method to contribute to the shift in attitudes and norms toward better tax compliance.

One should be careful with the possible extrapolation of the findings to the overall population of taxpayers and other municipalities, as we have explored a limited range of parameters. It is nevertheless observable that both deterrence and social norm messages have a stronger impact on individuals. Our findings highlight the importance of acknowledging peer effects and deterrence when studying tax compliance behaviour. Therefore, this study provides information and guidance for local policies designed to deter local tax evasion. In particular, the results imply that providing information on the extent to which one's close community complies with local tax may encourage higher compliance.

Finally, there are limitations in this study as it was conducted on a limited number of municipalities and provides localized results. Therefore, additional testing and replication of the experiment design are important. This study has limitations caused by local data availability connected with the profile of the taxpayers. It may be possible to analyse extended longer-term effects and to consider other variables besides age and gender, such as marital status, household size, employment status, education level, etc. Furthermore, due to the usage of postal services for the delivery of the messages, the effects may have been underestimated as we are assuming that all the letters reached all targeted taxpayers.

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