Smart Interventions for Smart Cities: Using Behavioral Economy in Increasing Revenue from Local Fees and Why It Might Sometimes Fail

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Abstract. The collection of taxes and fees is one of the main functions of a modern local government, through which many public goods and services are provided. However, in many local governments, there is a need to address the problem of non-payers of local taxes or other local fees. Although taxpayers are usually sent reminders to pay local taxes or charges, or if they fail to pay, they will be referred for distrainment, there are still people who do not fulfill their obligations to the local government. Several studies have confirmed that the use of behavioral intervention can be a useful tool to reduce the proportion of non-payers, i.e., the taxpayers can be 'nudged' to pay their taxes on time and correctly. In this paper, we present the results of a behavioral intervention in the city of Banská Bystrica, Slovakia. The aim of the intervention was to increase the city's revenues from garbage disposal fees, dog fees and property tax by proactive communication – reminder (a letter) and leaflets with targeted framing. In October 2021, the city sent a total of 520 reminder letters as part of the intervention. The letters were divided into 4 groups of 130 tax subjects. The data was analyzed using Cramer's V. The results in this particular city show that the intervention did not produce the expected results; we discuss other examples of Slovak local governments that show the positive effect of behavioral interventions in the area of tax and fee collection.

Keywords: Behavioral intervention · Modern government · Smart city · Tax and fee collection

1 Introduction

The introduction of behavioral interventions into public policy making is now widespread. Not only at the national level, but also at the regional and local level, behavioral nudges and other forms of interventions have proven to be an effective and efficient way to influence the effectiveness of public policy in a variety of areas. The area of making tax and fee collection more efficient, which is the focus of this paper, is no exception.

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When collecting taxes and fees, the responsible institutions are quite often faced with the problem of non-payers. The fact that there are people who refuse to pay compulsory taxes and fees has significant implications for the functioning of the public sector. First and foremost, it is associated with a shortfall in revenue in the respective budget, i.e., fewer resources are available to ensure that the tasks and functions of public administration at that level are carried out. This can negatively affect the level of service delivery. Revenue shortfalls therefore undermine the provision of public goods and the design and implementation of public policies, but they also have an impact on equity in terms of people's contribution to the generation of public resources.

Addressing this problem is also important because non-payment of taxes results in revenue shortfalls in local government budgets and has implications for the behavior of taxpayers themselves. Taxpayers who pay their taxes and fees may feel that they bear the tax burden, while non-payers benefit from public services in the same way as those who fulfil their obligations. This may be perceived as unfair and may negatively affect their behavior in terms of paying taxes and fees in the future.

Non-payment of local taxes and fees is therefore not only a legal problem in terms of compliance with legislation, an economic problem in terms of obtaining adequate resources to ensure the financing of the needs of the municipality or city, but also an ethical and moral problem in relation to the residents of the municipality who pay local taxes and fees.

Several studies have confirmed that the use of behavioral intervention can be a useful tool to reduce the proportion of non-payers, i.e., the taxpayers can be 'nudged' to pay their taxes on time and correctly [7, 9, 10, 12, 19]. The application of behavioral interventions to tackle problems with defaulters is usually done by sending out arrears notices that contain behavioral elements. Compared to standard reminders, the effectiveness of such reminders is generally higher. The behavioral approach is based on interventions that are called EAST: Easy, Attractive, Social and Timely [18]. It is essential to take this into account when designing an experiment in this area.

Therefore, in the first part of this paper we review behavioral interventions in the area of tax and fee collection. We then present a selected local government with a focus on its revenues from taxes and problems associated with tax and fee collection. We implemented the behavioral intervention in the form of a randomized controlled experiment, which is described in the Experiment design section, including the statistical methods used to evaluate the experiment. The next section presents the results of the experiment and a discussion with the results of similar experiments in other Slovak local governments. In the Conclusion we summarize the main points of the paper and point out the limits of our research.

2 Behavioral Interventions in the Services of Tax and Fee Collection

A number of local governments around the world are currently implementing behavioral interventions. Many times, it is the most efficient and least expensive way to nudge citizens to make the right decisions that will benefit the citizen, the local government and society as a whole.

In designing and implementing an experiment aimed at increasing tax and fee payment rates, one can take inspiration from the numerous studies that have emerged from successful previous experiments in this area.

Most of the experiments in tax and fee collection have taken the form of sending reminders to taxpayers. As a rule, a control group is defined to which a standard reminder is sent without any intervention. In addition to the control group, there are experimental (intervention) groups to which modified reminders are sent. The impact of alternative forms of behavioral interventions and which is most appropriate is examined. In doing so, the use of different methods of sending reminders or other related interventions may also be considered.

In 1995–1996, experiments were conducted in Minnesota, USA, to promote voluntary tax compliance [4]. The intervention took the form of reminder letters that included a morality-focused element and confronted taxpayers with perceived social norms. Taxpayers were divided into two groups, a control group that received a standard reminder letter and an intervention group that received a reminder letter containing an appeal to morality. In the area of income tax payments, the focus was on raising people's awareness that cheating on tax payments is not common, but rather an isolated phenomenon committed by only a minority of the population. The reason for focusing on this secondary objective was the results of a survey carried out two years prior to the intervention, which found that up to 20–50% of people in the state thought that they cheated on their taxes. In a letter using the social norm, taxpayers were informed that 93% of people pay their taxes on time. The results confirmed that tax collection was statistically significantly higher for recipients of the letter that included a reference to the social norm compared to the control group.

A behavioral intervention using reminder mailings was also carried out in Poland, where a field experiment was conducted to maximize the proportion of tax payers. They specifically targeted non-payers of income tax. The intervention groups received differently worded reminders. The experiment was carried out in cooperation with experts from the World Bank [9]. The reminders sent were formulated in different ways (Table 1). The research confirmed that the behavioral nudge letters were successful and resulted in a statistically significant increase in the proportion of tax payers.

Table 1. Wording of the letters sent to tax-payers. Source: own based on Hernandez et al. 2017.

Type of letter	Description of letter	Tone of the letter
Control group, status quo	Official letter used by the polish tax office	Neutral tone
Standard behavioral	Letter written in accordance with best practice in behavioral research using plain language and clear instructions	Neutral tone
Social norms	Variation of the standard behavioral letter, emphasizing that most citizens have already paid their tax	Soft tone
Public goods (benefits)	Variation of the standard behavioral letter, including a reminder that taxes pay for public goods	Soft tone
Public goods (loss)	Variation of the standard behavioral letter, including a reminder that not paying taxes harms the community	Soft tone
Deterrence	Variation of the standard behavioral letter, including a reminder of the steps the tax authority can take to punish noncompliance	Harsh tone
Deterrence + Distrainment order	Deterrence letter with a sample distrainment order sent to taxpayers ordering them to pay their taxes	Harsh tone
Omission	Variation of the standard behavioral letter and behavioral framework - non-payment as a deliberate choice	Harsh tone
Omission + Deterrence	Variation of the standard behavioral letter including deterring message and omission	Harsh tone
Omission + Taxpayer perspective	Variation of the omission and deterrence letter telling defaulters that they should have a feeling of dishonesty	Harsh tone

An evaluation of the experiment found that behavioral letters improved individuals' behavior compared to a control letter; letters written with a harsh tone were more effective than letters with a soft tone, which were even less effective than standard behavioral letters, although the effectiveness also depended on the characteristics of the individual payers. They also found that the method of letter delivery had no effect on taxpayers, and if the most effective version (omission + deterrence) was sent to the entire sample, it would generate 28 times the return over the cost of the intervention [9].

The authors of the experiment used reminders predominantly using the influence of social norms to remind taxpayers of the benefits of paying their taxes and to point out that most taxpayers were complying with their tax obligations. A total of 101 471 individuals, geographically distributed across different areas of England, Wales and Northern Ireland, took part in the experiment. Participants included people who owed between £400 and £100,000 in tax. It was found that all the letters sent to the intervention groups were successful and led to an increase in the proportion of taxpayers. In terms of increasing the number of tax payers, letters using social norms were the most successful. Messages pointing to the lack of public services due to budget shortfalls did not lead to significantly better results than messages pointing to the benefits of paying taxes in relation to the provision of public goods. This field experiment was replicated a year later to see if the effectiveness of these changes had diminished over time.

In the UK, it is also standard practice to send letters to taxpayers who fail to pay their taxes on time. Their experiment was also based on changing the wording of the letters sent. The new letters were successful and helped to increase tax collection, the most successful of which was a letter reminding taxpayers that they were part of a minority who had not yet paid their taxes [5].

Another experiment was conducted at the local authority level in London (London Borough of Lambeth) to increase the success rate of tax collection. This local authority is very heterogeneous, with only 57.1% of the population being of white ethnicity. The borough is also characterized by large disparities in income and wealth between residents. Taxpayers were divided into four groups. The first group received a classic tax calculation letter. The second group received a modified tax calculation letter, which was slightly modified as follows: at the top of the letter was key information - how much to pay, by when to pay, and a contact point where the taxpayer could go in case of confusion or miscalculation of the tax. The third group received a tax calculation letter, which additionally included the information that more than 95% of people in the local authority pay their taxes on time and correctly. The last group received letters that contained a combination of a simplified letter and a social norm. That is, immediately at the beginning of the letter there was key information and also the message that 95% of taxpayers in the local authority are paying their tax obligations properly. In this experiment, it was found that taking into account the social norm did not have a statistically significant effect; on the contrary, simplifying the letter to include the tax calculation proved to be a successful behavioral intervention. In this case, it succeeded in increasing the number of tax payers by 3.8%. The most successful result was achieved with a reminder letter that combined the social norm with simplified data, where it managed to increase the proportion of tax payers by 4.3% [10].

In 2019, Luts and Roy, in collaboration with IOTA (Intra-European Organisation of Tax Administration), carried out an experiment in Belgium targeting non-payers of income taxes at the national level. The experiment was carried out by sending various reminder letters to groups of taxpayers who had not paid their tax. Their aim was to see which of the reminder alternatives was the most effective in nudging the non-payers to pay the tax. They drafted seven versions of the letters that included different behavioral insights. The first of the letters used social norms formulated in such a way that 95% of taxes in Belgium are paid on time. Another letter informed taxpayers about the areas

that are financed thanks to taxes (education, health, etc.) and a negative version of this letter. Other versions of the letters used, for example, status quo heuristics, loss aversion - they informed about the penalties that follow for not paying taxes, or were a combination of some of the letters, and there was also a basic version of the letter for the control group. By evaluating the experiment, they found that the most effective version contained information about the penalty, which increased payments by 20% compared to the control group, and the cost-benefit analysis also showed the cost-effectiveness of the project [14].

In 2016, Dwenger et al., using a natural experiment, investigated the impact of incentives on church tax payments in Germany. The authors used three schemes to motivate taxpayers, - simplification of tax payment; different ways to discourage non-payment of taxes; rewards for compliance such as social recognition, inclusion in a prize draw for cash prizes, or a combination of these. The authors conclude that intrinsic motivation affects compliance positively, while extrinsic motivation affects compliance negatively. This suggests that rewarding taxpayers for contributing to the financing of public goods (rather than punishing them for not paying taxes) creates a signal that a given tax system contains voluntary aspects and puts the legally binding obligation to pay taxes on the back burner [6].

In Guatemala, attempts have been made to address the high proportion of tax defaulters through behavioral interventions, as the local tax office estimated that up to 30% of taxpayers do not file their tax returns on time, which translates into a practical loss of tax revenue of approximately US $1.9 million USD [12]. This has obviously limited the ability to implement social programs for residents and has led to a deepening of poverty. The intervention targeted payers of value-added tax (VAT) on services, which is paid monthly in Guatemala. The authors examined two effects: a timing effect and a message text effect. Taxpayers were sent a text message designed to increase their VAT payments. Text messages were sent to recipients at two times - four days before the tax was due and twenty days after the tax was due. They tested three types of behavioral incentives: personalization of the messages, they made the messages more personal; simplification, they added a web link directly into the messages where the tax return could be filed; and deterrence, where the messages included information that if the return was not filed on time, the taxpayer would receive a fine. It was found that messages that were consistent with behavioral science findings and were sent before the due date had a significant positive impact on the number of tax returns filed. This effect persisted throughout the six-month duration of the study, confirming its lasting impact on individual taxpayer behavior. The number of tax returns in each group that received one of the reports increased by 1%. In contrast, messages sent after the VAT due date in any text form did not have such a significant positive effect. This finding documents that the timing of the intervention is very important. In the above experiment, the timeliness of the message was a more significant factor than the wording of the message itself. Another important finding is that the increase in tax returns filed did not translate into an increase in tax payments. It turned out that many taxpayers filed tax returns with zero tax payments.

Castro and Scartascini conducted a large-scale field experiment in a municipality in Argentina in which they sought to influence compliance rates in property tax payment by focusing on the different levels of compliance assurance, the reciprocity associated

with the use of the tax revenue, and the impact of the attitudes of other taxpayers in the municipality. Participants were divided into control and intervention groups. Individuals in the intervention group were sent attachments along with the tax regulations containing information on tax enforcement and fines; on the behavior of other taxpayers; and on how tax revenues are used by the government. The results of the PROBIT statistical model conducted suggest that the information sent to deter taxpayers from not paying the tax (e.g., informing about tax recovery and fines) had a statistically positive and economically significant effect on compliance with the regulations. Sending such information increased tax compliance by almost 5 percentage points. On the other hand, information on how others in the municipality pay taxes or how the municipality uses the tax revenue did not have a statistically significant impact. However, the results suggest that information about what the collected resources will be used for, as well as how other taxpayers behave, is also relevant to some people's decisions about whether to pay taxes - e.g., after taking into account the individual characteristics of individuals, the results suggest that those who have complied with tax regulations in the past tended to react in the same direction to information about how others comply [3].

In Canada, they conducted an experiment on employers who were late in paying taxes in previous years. Letters guided them on how, where and when to complete their tax returns, resulting in a 4.2% increase in the first year and a 6.1% increase in the second year compared to the control group [15].

In Slovakia, behavioral experiments in the area of paying taxes and local fees are relatively new. The first experiment in Prievidza focused on sending reminders to debtors of the municipal garbage fee. The main aim of the experiment was to find out what effect a reminder in the form of a letter would have on the behavior of the debtors and also to find out what effect other moral norms and thank-you letters in the form of leaflets would have on them [17]. The authors point out that for objective reasons a random distribution could not be made, and therefore the economic department of the city of Prievidza ensured that they were divided into two groups according to gender and amount of debt, so that the groups were similar to each other. One group received a reminder and the other, the control group, did not. The frameworks chosen were the social norm and the thank you, which they named Intervention A (letter + social norm), Intervention B (letter only) and Intervention C (letter + thank you). The intervention that has proven to be the most effective was a reminder together with an injunctive social norm leaflet. It resulted in a 1.7 times higher probability for the debt to be paid. The results also indicate that a reminder is significantly more effective if targeted at debtors who only owe one payment - this group was three times more likely to pay their debt after being exposed to the intervention [17].

From the above review (which is not exhaustive, but covers several countries around the world and different outcomes), it is clear that the studies that have emerged from behavioral interventions conducted around the world can provide a starting point for the formulation of the intervention in our experiment, both in terms of the content and modality of the intervention implemented, and in terms of the methods that can be used to evaluate it.

2.1 Tax Collection in the Municipality of Banská Bystrica

The town of Banská Bystrica is both a district and regional seat of local government, with a population of 78,484 inhabitants it is the sixth largest town in Slovakia. Real estate taxes constitute a significant part of the city's income, almost one-fifth (Table 2).

Table 2. Percentage share of real estate tax on current tax revenues of the city of Banská Bystrica for the years 2015–2020. Source: own based on Banská Bystrica´s budgets.

Year	% share of real estate tax in current tax revenue
2015	19.43
2016	18.00
2017	17.10
2018	16.10
2019	15.56
2020	19.52

A list of defaulters is published by the city as of 31 December each year on its website, namely those whose arrears exceed € 160 in the case of a natural person and € 1,600 in the case of a legal entity.

The city sends a reminder to non-payers of taxes - a notice to pay every 2 years. If the debtors fail to pay the arrears even after the expiry of the deadline for payment set in the notice sent, the recovery of the arrears in the tax distrainment procedure is referred to an external bailiff.

In addition to the service of summonses and the referral of cases for distrainment, the names of debtors are published on an electronic notice board. The list of debtors is published in accordance with Article 52 of Act No 563/2009 Coll [1]. This is a list of tax debtors as of 31 December of the previous year whose aggregate amount of tax arrears exceeded € 160 for a natural person and € 1,600 for a legal person.

The City of Banská Bystrica registers approximately 4,440 real estate tax defaulters as of 18 October 2021 (Banská Bystrica, 2021). The total debt of natural persons amounts to approximately € 516,000. Arrears for municipal garbage for individuals amounted to approximately € 1,650,000. In this case, there are 10,455 defaulters.

Interviews with representatives of the City of Banská Bystrica revealed that defaulters are often from socially disadvantaged groups, which makes the recovery of arrears particularly challenging. The administration associated with sending notices and distrainment proceedings is also time-consuming, so the city is interested in trying to increase the efficiency of tax and fee collection and reduce the number of defaulters by using behavioral intervention.

3 Experiment Design

The main objective of the proposed experiment is to solve the problem of non-payers of local real estate tax and local fees in the city of Banská Bystrica. Using a behavioral

intervention, we want to find out how the defaulters will react to different forms of behavioral nudges embedded in a leaflet that will be part of the tax payment reminder. We will evaluate the data collected from the experiment to see which form of intervention proves to be effective.

In order to meet the objective, we set 3 research questions (RQs):

RQ1: Did the implemented nudge help to change the behaviour of non-payers and contribute to the timely and correct payment of local taxes and fees in the city of Banská Bystrica, compared to the control group?

RQ2: Which of the three versions of the leaflet sent out most influenced the behaviour of non-payers in the desired direction?

RQ3: Which of the three versions of the leaflet sent out was not effective or did not influence the behaviour of non-payers in the desired direction?

When designing the leaflets, we drew on experiments carried out in the field of taxes and fees from around the world and in Slovakia.

The results of many experiments point to the effectiveness of behavioral interventions that use social and moral norms [7, 9, 13, 17]. An example of a moral norm is the statement, "9 out of 10 people already pay their taxes on time." In this way, taxpayers become more identified with their city, and a more significant change from the general social norm occurs. We also used this framing in the design of our behavioral intervention and the leaflet sent to the first group informs how other citizens behave: "Did you know that 9 out of 10 taxpayers in Banská Bystrica have already paid their real estate tax?" The leaflet encourages non-payers to join the paying majority.

The leaflet sent to the second group highlights social norms. The change from the first group is its focus on belonging to a group of people with the same surname. A similar social norm is used by the Brno City Transport Company, which informs its passengers about the most common names of passengers who do not buy tickets. In addition to self-interest, how others behave also influences the behavior of other individuals. A third version of the leaflet encourages defaulters to keep a good reputation and informs, "Did you know that people with the same surname as you pay their real estate tax on time? Be one of them".

The leaflet designed for the third group is intended to be a deterrent. It encourages defaulters to pay the tax they have been assessed to avoid distrainment proceedings. The leaflet works with the concept of loss aversion and informs defaulters that "There is a high likelihood that if you are found to default in paying your taxes, your case will be referred to distrainment proceedings and, among other things, your driver's license may be revoked or the arrears may be taken from your pension, wages or account." In the defaulter, this information is intended to induce a state known as fear of loss [11] and of the possible consequences resulting from non-payment of taxes.

A randomized controlled experiment was conducted by mailing leaflets including a simple infographic to reinforce their effect. The leaflets were sent to defaulters assigned to each intervention group (Intervention group 1 - Moral norm leaflet, Intervention group 2 - Social norm leaflet, Intervention group 3 - Fear of loss intervention leaflet), along with an invitation to pay the tax arrears. The first and second intervention groups were sent a leaflet with information about moral and social norms and how other residents comply with regulations and meet their tax obligations. The third intervention group was sent a deterrent leaflet informing them of the high likelihood of having their case

referred to distrainment proceedings or having their driver's license revoked if they were found to have irregularities in paying taxes. Only a reminder, so no leaflet, was sent to the control group and this group will be used to compare effectiveness with the three intervention groups.

Taxpayers who had outstanding local tax (real estate tax, dog tax) and/or local municipal garbage charges were randomly allocated to the intervention groups. In this way, we eliminated predictable effects and each of the defaulters had an equal chance of being included in the sample. The sample consists of 520 taxpayers to whom the Banská Bystrica City Council sent notices for payment of tax arrears in October 2021.

We used the following methods to process the data:

- Descriptive statistics (e.g., the number of defaulters who paid the tax after the summons, the total value of summonses paid, etc.),
- Cramer's V to determine the degree of dependence (e.g., the existence of a statistically significant relationship between the version of the leaflet sent and the payment of the arrears, the amount of the arrears and the payment of the arrears, etc.).

4 Results and Discussion

The experiment collected basic data from all 520 taxpayers. The type of tax for which the taxpayer is in arrears (real estate tax, dog tax or municipal garbage tax), the amount of the arrears (also the amount of the paid and unpaid part of the arrears) and whether or not the taxpayer took the leaflet sent by the municipality. Out of a total of 520 tax subjects, 190 tax subjects were in arrears on property tax, 77 tax subjects were in arrears on dog tax and 253 tax subjects were in arrears on municipal garbage tax. Municipal garbage tax arrears represented the highest amount of total arrears in each group.

In the control group of the experiment, the value of the arrears totaled € 16,741.91. 75 arrears totaling € 8,471.26 were paid and 30 arrears totaling € 8,270.65 remained unpaid. In this group, no intervention was sent with the reminder.

In Intervention Group 1, a leaflet with a moral standard was sent to taxpayers together with the notice to pay the arrears. 66 notices were paid, representing 51%, the total amount of arrears paid was € 6,457.23 and the total amount of unpaid arrears was € 5,727.78.

In Intervention Group 2, a leaflet with a social standard was sent to taxpayers together with the notice to pay the arrears. Although the number of paid notices was higher than the number of unpaid notices in this group, the amount of € 4,487.28 paid is lower than the number of unpaid notices and represents 43.76% of the total amount of arrears.

In Intervention Group 3, taxpayers were sent a payment notice together with a leaflet informing them that there was a high probability of distrainment proceedings if irregularities in tax payments were detected. In Intervention Group 3, the total amount of arrears was € 11,591.22. During the course of the experiment, 53 notices were paid in this group, amounting to € 3,956.19. The collection success rate was 34.13%. Of all the groups, Intervention Group 3 had the lowest number of calls paid and therefore the highest number of outstanding calls, totaling € 7,635.03.

The results are summarized in Table 3.

Table 3. Experimental results in the control and intervention groups. Source: own.

	Control group			
	Amount in €	Amount in %	Number of calls	Number of calls in %
Calls paid	8,471.26	50.6	75	58%
Calls unpaid	8,270,65	49.4	55	42%
Total	16,741.91	100	130	100%
	Intervention group 1			
	Amount in €	Amount in %	Number of calls	Number of calls in %
Calls paid	6,457.23 €	52.99	66	51%
Calls unpaid	5,727.78 €	47.01	64	49%
Total	12,185.01 €	100	130	100%
	Intervention group 2			
	Amount in €	Amount in %	Number of calls	Number of calls in %
Calls paid	4,487.28 €	43.76	69	53%
Calls unpaid	5,767.88 €	56.24	61	47%
Total	10,255.16 €	100	130	100%
	Intervention group 3			
	Amount in €	Amount in %	Number of calls	Number of calls in %
Calls paid	3,956.19 €	34.13	53	41%
Calls unpaid	7,635.03 €	65.87	77	59%
Total	11,591.22 €	100	130	100%

On the basis of the data obtained from the experiment, we found that 188 out of 390, i.e., 48.20%, were paid arrears, to whom the intervention leaflet was sent with the reminder. In the control group that did not receive the leaflet with the reminder, 75 out of 130, i.e., 57.69%, of the arrears were paid. From these results, the behavioral intervention appears to have been unsuccessful, but we cannot know for sure whether the leaflet sent was the reason for the non-payment of the arrears. We therefore also statistically verified the association between the receipt of the reminder and the payment of the arrears. We used Cramer's V (Table 4) to find the correlations.

We found that receipt of the reminder affected the payment of arrears in each group. This was least in Intervention Group 3 ($p = 0.001$, Cramer's $V = 0.304$). We found that payment of arrears in Intervention Group 2 depended on the amount of arrears ($p = 0.021$, Cramer's $V = 0.243$), i.e., there was a low to medium dependence between the two groups.

To determine the percentage effectiveness of the behavioral intervention, we examined the number of reminders received and also how many of these reminders were paid. According to the results summarized in Table 5, the behavioral intervention was most effective in Intervention Group 2, in which we worked with the social norm. Of

Table 4. Interdependencies between selected data from the experiment. Source: own.

Variant of leaflet	Selected data	Selected data	P-value	Cramer's V
Control group - No leaflet	Payment of arrears	Reminder received	0.000	0.529
Intervention group 1 – Moral norm	Payment of arrears	Reminder received	0.000	0.509
Intervention group 2 – Social norm	Payment of arrears	Reminder received	0.000	0.518
		Amount of arrears	0.021	0.243
Intervention group 3 – Fear of loss	Payment of arrears	Reminder received	0.001	0.304

the 98 reminders received, 69 were paid, representing 70.41%. This was followed by Intervention Group 1, which was 12.71% less effective. In monetary terms, the arrears in Intervention Group 2 amounted to € 10,255.16, of which € 4,487.28, i.e., 43.76%, were paid.

Table 5. Interdependencies between selected data - effectiveness.

Variant of leaflet	Number of paid reminders	Number of reminders received	Effectiveness (%)	Comparison of effectiveness (%)		
Intervention group1	66	98	67.35		3.06	-12.71
Intervention group2	69	98	70.41	-3.06		-15.77
Intervention group3	53	97	54.64	12.71	15.77	

The total amount of arrears paid amounted to € 23,372. The total amount of arrears amounted to € 50,773.30. The arrears paid represent 46.03% of the total amount owed.

Although our experiment did not confirm the success of the behavioral intervention in the form of a nudge, we cannot know with certainty whether the leaflet sent was the real reason for the (non−)payment of the arrears in our observation period, i.e., from the sending of the reminder (October 2021) to the end of the experiment (November 2021). Other factors influenced the payment of the arrears, among which we can mention the difficulty in communicating with the city, the heterogeneity of the groups in the research

sample, the lack of information about the research sample, the premature disclosure of information about the experiment, and last but not least the situation of COVID-19.

Communication with the city of Banská Bystrica was promising at the beginning, with both the mayor and the deputy-mayor pledging support for the experiment. However, when it came to the implementation of the experiment, officials from the economic department declared that they could not provide the necessary information and that participation in the experiment would be contrary to the legislation of the Slovak Republic. The research team had to argue with fact that similar experiments were conducted in the municipality of Prievidza and therefore there is nothing illegal. Apparently, the civil servants, overloaded with their duties, were resistant to participate in the research since it meant extra tasks for them. We might observe here so-called civil servant resistance [8, 16]. The civil servants eventually agreed to participate, but we also encountered resistance when evaluating the results and the deputy-mayor had to intervene to provide the data in a format that could be further worked with.

The heterogeneity of the groups was conditioned by the fact that the city of Banská Bystrica decided to combine three types of taxes and fees that were to be the subject of the experiment: real estate tax, dog tax and municipal garbage tax. The city divided the research sample of 520 defaulters into 4 groups (1 control, 3 intervention) and although they tried to maintain an approximately equal share of defaulters of each tax and fee, this distribution was no longer even with respect to the amount owed. For example, in each group there were between 61 and 70 non-payers for municipal garbage, but the total amount owed varied from €7,111 to €12,159. These differences could then be reflected both in the number of reminders paid and in the total amount owed, which skewed the results of the nudge.

Lack of information about the research sample - in processing the results of the experiment, we encountered the additional limitation of a lack of information about the research sample, such as gender, age, length of outstanding arrears, regularity of payment of fees, and whether they were in arrears in only one or more areas. If we had these data, it would be possible to better assess whether the individual is a 'regular defaulter' on whom no intervention is likely to be effective, or just an 'occasional defaulter' who could be nudged by an intervention to pay the arrears. However, this data was not provided by the city, whereas in Prievidza it helped to reveal other contexts. According to the results of the experiment in Prievidza, the most effective type of reminder to municipal garbage fee debtors was Intervention A, i.e., letter + social norm, and they also found that the intervention was more effective on men than on women, but this result is difficult to interpret as it may be related to income inequality or single-parent families with a more difficult economic situation.

Premature disclosure of information about the experiment was made by the city. As local elections are approaching, the city leadership used the information about the experiment as an opportunity to promote itself as an innovative smart city that engages in projects and research and uses the latest findings of behavioral economics. By publishing the information before the leaflets were sent out, they were able to influence non-payers in a negative direction in the sense that people do not like to be 'manipulated' [20], i.e., they chose to ignore the invitation with the leaflet and did not pay the tax/fee on purpose.

The COVID-19 pandemic, persisting from March 2020, could have a negative impact on the ability of individuals to pay local taxes and fees, in which case no intervention, however framed, would be effective.

Research in 2017 showed that messages with social norms or other behavioral nudges work, but cannot be applied everywhere and in every circumstance [7, 9]. In the case of the Guatemala intervention, there was no increase in tax payments [19]. Similarly, in Nebraska an informational nudge was not likely to be sufficient to substantially change tax reporting behavior [2]. Findings from studies in the UK suggest that it may be the case that interventions successful at the national level are not necessarily successful at the local level [7, 10]. Therefore, when introducing behavioral interventions, it is essential to take into account the particular characteristics of the area where the intervention will be implemented and to identify potential problems with the introduction of the intervention.

Although the experiment in Banská Bystrica did not bring the desired effect in the form of a higher number of paying tax subjects, we can include the UK, Canada (Ontario) and Slovakia (Prievidza), as well as other examples that we have presented in the theoretical section, among the countries that have successfully tried to improve tax collection from tax subjects and on-time tax payment.

At the same time, however, it should be said that relevant conclusions can only be formulated after a more detailed examination of the impact of heterogeneity in the composition of tax subjects in each intervention group. It is also necessary to consider the possibility of using another form of behavioral intervention, e.g., changing the wording of the call to the arrears office, simplifying the provision of a form of payment data for payment via QR codes, etc.

5 Conclusion

The main objective of the proposed experiment was to solve the problem of non-payers of local real estate tax and local fees in the city of Banská Bystrica. The intervention took the form of sending differently formulated leaflets to citizens assigned to the intervention groups. We expected that the share of tax defaulters would decrease as a result of this intervention (RQ1: Did the implemented nudge help to change the behaviour of non-payers and contribute to the timely and correct payment of local taxes and fees in the city of Banská Bystrica, compared to the control group?). On the basis of the data obtained from the experiment, we found that 188 out of 390, i.e., 48.20%, who were sent the intervention leaflet with the reminder, paid their arrears. In the control group that did not receive the leaflet with the reminder, 75 out of 130, i.e., 57.69%, of the arrears were paid. This expectation was not met and in the discussion we gave a number of reasons why this might have been the case. We consider the main reason to be the heterogeneity of the research sample. The fact that it was not only non-taxpayers, but also non-payers of local dog and municipal garbage fees were in the sample affected whether they paid or not (it makes a difference whether the taxpayer has to pay € 15 for the dog or € 150 for the garbage).

The aim of RQ2 (Which of the three versions of the leaflet sent out most influenced the behavior of non-payers in the desired direction?) was to determine the effectiveness of the behavioral intervention implemented. The experiment involved taxpayers who

were in arrears in one of the local taxes and were therefore sent reminders or notices to pay their arrears. With the behavioral intervention, we wanted to nudge the tax subjects to make the right decision - to pay the arrears. To determine the percentage effectiveness of the behavioral intervention, we examined the number of reminders received and also how many of them were paid. According to the results, the behavioral intervention was most effective in Intervention Group 2, in which we worked with the social norm. Of the 98 reminders received, 69 were paid, which is 70.41%.

For RQ3 "Which of the three versions of the leaflet sent out was not effective or did not influence the behavior of the defaulters in the desired direction", it can be answered from the data obtained from the experiment that the intervention in Intervention Group 3 was the least effective. Out of a total of 130 taxpayers, 53 taxpayers (41%) paid their debt.

The presented research has its limitations, especially the focus of the analysis on only one municipality. The experiment was conducted on a relatively small research sample with a sizeable heterogeneity. In future research we will focus on examining the composition of types of arrears in the different groups. Nevertheless, it has shown several aspects why a behavioral intervention can fail and this can be an issue of further research. Why and when nudges do not meet expected results and what can we learn from such failures?

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