Nudging delinquent motor vehicle taxpayers: A randomized controlled trial in Krabi province, Thailand

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Abstract

This study investigates whether nudging interventions can improve compliance in the collection of overdue motor vehicle taxes in a developing country context. While behavioral approaches to tax compliance have demonstrated effectiveness in advanced democracies, empirical evidence from fiscally constrained institutional settings remains limited. This study seeks to test the external validity of behavioral interventions in Thailand. A randomized controlled trial (RCT) was conducted across eight districts in Krabi Province, Thailand. Six variants of tax-reminder letters, grounded in behavioral tax compliance theory, were administered to treatment groups, while two districts served as control groups receiving no behavioral intervention. Compliance outcomes were measured by comparing post-intervention payment rates across experimental and control groups. The results show that nudging interventions increased motor vehicle tax compliance by an average of 2.58 percentage points relative to the control groups. Among the tested messages, a deterrence-based reminder emphasizing statutory penalties produced the strongest effect, increasing compliance by 5.01 percentage points. The findings suggest that while behavioral framing mechanisms are effective, expected utility considerations remain highly influential in taxpayer decision-making. The study confirms the contextual robustness of behavioral interventions beyond advanced Western democracies and demonstrates that deterrence theory retains explanatory power when embedded within behavioral communication strategies. The findings highlight a cost-effective and administratively feasible strategy for enhancing revenue collection in decentralized governance systems. Policymakers in middle-income countries can employ behaviorally informed reminder letters to improve tax compliance without increasing enforcement costs.

1. Introduction

Tax compliance remains one of the central challenges in tax administration and public finance. While classical economic theory models tax evasion as a rational choice under risk [1] more recent research in behavioral tax administration recognizes bounded rationality, cognitive biases, and norm-based motivations as influential determinants of tax compliance [2, 3]. To date, several behavioral tax compliance experiments have been conducted in advanced democracies with strong tax enforcement capacity and tax morale [4, 5]. However, little is known about whether such behavioral interventions can be generalized to developing countries like Thailand, where enforcement mechanism and tax compliance may be weaker, fiscal institutions are less robust, and social norms often influence undesirable compliance behavior.

In Thailand, motor vehicle taxes constitute an important revenue source for local government organizations (LGOs), collected by the Department of Land Transport (DLT) in accordance with the National Decentralization Committee's guidelines. These revenues are used to finance local road construction and maintenance, transportation infrastructure, and other public services within local jurisdictions. In fiscal year 2024, LGOs received 40,046.08 million Thai baht (approximately 1.3 billion USD) in motor vehicle taxes, representing approximately 5.3 percent of total local government revenue.

Despite long-standing administrative arrangements, tax delinquency has become a growing concern. In June 2019, 9.9 million vehicles—24.8 percent of the 40.19 million registered vehicles—were overdue in tax payments. By June 2021, the number of delinquent vehicles increased to 12.2 million out of 41.98 million registered vehicles, or 29.1 percent. Consequently, accumulated overdue taxes rose from 6.2 billion baht in 2019 to 9.2 billion baht (approximately 300 million USD) in 2021. This situation represents a significant opportunity loss for LGOs to finance essential local public services.

Hence, this study explores whether a behavioral approach can help enhance voluntary compliance without requiring legal amendments or stricter enforcement mechanisms, which are often costly and time-consuming [3, 6]. International evidence suggests that nudging interventions are cost-effective in improving tax compliance [4, 7, 8]. A randomized controlled trial (RCT) was conducted in all eight districts of Krabi Province, Thailand, due to their representative characteristics of the nation and data accessibility for the research, to test whether behavioral nudges can improve overdue vehicle tax collection.

2. Literature Review

2.1. Legal Framework of Motor Vehicle Taxation in Thailand

Motor vehicle taxes are levied under Land Transport Act B.E. 2522 (1979) and Motor Vehicle Act B.E. 2522 (1979). While the Land Transport Department administers tax collection, Section 24(5) of the Decentralization Act B.E. 2542 (1999) assigns motor vehicle tax revenues to local governments. Each year, the National Decentralization Committee determines revenue allocation proportions. Vehicle owners are required to pay annual taxes. To date, multiple payment channels are available, including provincial transport offices, online platforms, DLT vehicle tax applications, commercial banks, counter service outlets, drive-through services, post offices and kiosks

Despite these conveniences, compliance remains problematic due to several reasons, namely limited taxpayer awareness or willingness, outdated contact information, high enforcement costs, or weak tax deterrence measures. Between 2019 and 2021, overdue vehicle registrations increased significantly, from 25 to 29 percent, while registered vehicle growth remained modest (approximately 2–3 percent annually). That the delinquency growth rate rose sharply signals the need for effective policy interventions.

2.2. International Experiences with Behavioral Tax Collection

Motor vehicle taxes are widely used as a local revenue instrument globally [9, 10]. Like Japan, motor vehicle revenues in Thailand support road infrastructure and are allocated to local government authorities. In Singapore, however, vehicle taxation is primarily used as a quota mechanism to control vehicle ownership and environmental externalities. Rates and bases of motor vehicle taxes vary dramatically, but mostly are determined by engine size, types of vehicles, and usages.

Traditional enforcement mechanisms for motor vehicle tax collection in Thailand are determined by laws and regulations, for example; fines and penalties, and the suspension of vehicle registration. Nonetheless, the current approaches face limitations due to high administrative costs and increasing public resistance [2, 3]. Behavioral approaches offer an alternative rooted in libertarian paternalism [3]. For example, one of the notable experiments includes nudge letters in enhancing council tax compliance in the UK. Social norm messaging increased tax compliance by 11 percentage points compared to conventional letters [11]. Likewise, tax reminding letters incorporating moral suasion and foreign income detection warnings in Norway more than doubled income reporting compliance compared to baseline nudge letters [5]. These findings support the potential adoption of behavioral interventions across fiscal institutional contexts.

3. Research Methodology

This study employed a randomized controlled experimental design [12-14]. Six districts out of eight in Krabi Province, Thailand were randomly assigned to treatment groups, and two districts served as control groups. The average amount of tax overdue ranges between 2,149.1 to 2,437.3 Thai baht (between 72 to 82 USD) per vehicle. Initial test reveals no statistically significant differences between all eight districts (p-value > .10).

Districts are used as the primary unit of analysis rather than individuals, due primarily to practical research consideration. Assigning a single nudge message at the district level helps prevent treatment contamination. Individuals

within a district are likely to interact in their daily lives and may share information, including tax reminder letters. If different nudge-framing messages were assigned to individuals within the same district, such interactions could lead to contamination across treatment conditions. Therefore, assigning an entire district to a single type of nudge framing reduces the risk of contamination and strengthens internal validity.

A total of 14,176 nudge letters were mailed in October 2021. A follow-up assessment was conducted in December 2021, approximately two months after the intervention. Nudge messages were designed in accordance with Behavioural Insight Team (BIT)'s EAST principles [15] namely Easy, Attractive, Social, and Timely. Six types of nudge letters were tested (i) Conventional administrative letter informing tax payment amount and methods; (ii) Good citizen message (or moral suasion framing) stating that tax payment is a civic duty [16, 17] (iii) Social norms message indicating that majority of Krabi residents (about 70 percent) paying motor vehicle taxes on-time; (iv) Public goods message illustrating that motor vehicle taxes are used for road construction and improvements in Krabi; (v) Public bads message showing that the shortage of motor vehicle tax revenues result in deterioration of local roads in Krabi [4, 7] and (vi) Threat of punishment message stipulating the legal consequences of tax delinquency by the Motor Vehicle Act B.E. 2522 (1979) [8].

4. Results

Table 1 shows the results of motor vehicle tax nudging measures. Overall, during the experimental period in which the nudge intervention was implemented to follow up on outstanding vehicle tax liabilities, a total of 7.79 million Thai baht (about 260 thousand USD) was collected, representing 21.22 percent of the total outstanding vehicle tax amount of 36.7 million Thai baht (about 1.2 million USD). When focusing specifically on the experimental group—comprising six districts in which tax reminder letters were issued—the collected arrears amounted to 6.93 million Thai baht (about 231 thousand USD), equivalent to 21.41 percent of the outstanding vehicle tax liabilities in those areas. Comparative data from the control groups provide a baseline for analysis, indicating that vehicle owners in Koh Lanta and Lam Tap districts exhibited an average arrears repayment rate of 23.25 percent.

Table 1.
Results of Nudge Approach in Collecting Motor Vehicle Tax Overdue

Districts	Nudge messages	Numbers of Vehicle Overdue	Average Overgdue Amount (Thai baht)	Number of Vehicle Tax payment (%)	Marginal response increases
1. Koh Lanta	Control group (No letter)	1,828	2,347.40	425 (23.25%)	-
2. Lam Tap					
3. Khao Panom	Social norms	1,830	2,412.90	427 (23.35%)	+0.10%
4. Klong Tom	Good citizens	2,419	2,149.09	585 (24.18%)	+0.93%
5. Aou Luk	Public goods	1,693	2,221.02	412 (24.34%)	+1.09%
6. Nue Klong	Conventional	2,241	2,265.16	574 (25.61%)	+2.36%
7. Plai Praya	Public bads	1,162	2,182.57	298 (25.65%)	+2.40%
8. Muang Krabi	Threat of Punishment	4,831	2,359.38	1,365 (28.26%)	+5.01%
Average response rates in six experimental groups				25.83%	+2.58%

By contrast, the issuance of tax reminder letters to vehicle owners across the six experimental districts appears to have moderately stimulated tax repayment behavior, ranging from 23.35 percent (social norms nudge message) to 28.26 percent (threat-of-punishment nudge message). On average, the experimental group achieved a response rate of 25.83 percent, representing an increase of 2.58 percentage points relative to the baseline rate.

However, the effectiveness of the nudge intervention varied across message types. The reminder letter emphasizing potential legal penalties for non-compliance generated the most pronounced behavioral response. In this condition, the repayment rate increased to 28.26 percent, representing an approximate 5.01 percentage-point improvement relative to the baseline rate. These findings suggest that deterrence-oriented messaging may exert a stronger compliance effect than other nudge formulations within this policy context.

5. Discussion and Policy Implications

This study contributes to the advancement of local revenue administration by examining the effectiveness of behavioral interventions in improving the collection of outstanding vehicle taxes in Krabi province. The findings demonstrate that nudge strategies constitute a relatively simple and low-cost instrument that helps to complement conventional enforcement mechanisms. More importantly, the results suggest that behavioral approaches can be meaningfully applied in developing country contexts such as Thailand, where fiscal institutional capacity remains comparatively weak.

Overall, the experimental intervention generated an average compliance rate of 25.83 percent. Compared with traditional follow-up practices, the six nudge variants implemented in this study increased repayment rates by 2.58 percentage points. Notably, the reminder letter emphasizing the legal consequences of non-payment (i.e., a threat-of-punishment message) produced the strongest effect, increasing compliance to 28.26 percent—an improvement of 5.01 percentage points relative to the baseline. This deterrence-oriented nudge represents a negative framing strategy designed to heighten taxpayers' awareness of the costs associated with non-compliance and thereby discourages undesirable behavior. These findings are consistent with prior research by Slemrod, et al. [18]. Hallsworth, et al. [4] and Antinyan and Asatryan [19] which suggest that the deterrence-based nudge or negatively framed messages often produce stronger compliance effects, albeit potentially at the expense of taxpayer satisfaction.

Theoretical logic underlying the effectiveness of deterrence nudges can be traced to the expected utility framework proposed by Allingham and Sandmo [1] and subsequently elaborated by Andreoni, et al. [20]. Under this model, individuals weigh the expected gains from tax evasion—such as higher disposable income—against the probability of detection and the severity of sanctions. Tax compliance decisions are therefore shaped by a comparison between expected gains and expected losses, moderated by individual risk preferences. When the perceived benefits of non-compliance outweigh the anticipated penalties, and when the perceived probability of detection is low, individuals are more likely to evade or delay tax payment. Deterrence-based reminder letters function as signaling mechanisms, clarifying the potential legal and financial costs of non-payment and hence recalibrating taxpayers' perceptions of expected costs and benefits [21].

At this juncture, questions concerning internal validity and reliability may arise. One might argue that variations in compliance rates could be attributable to confounding factors—such as the number of delinquent taxpayers, the magnitude of outstanding liabilities, or individual-level characteristics—rather than the nudge intervention itself. However, the use of random assignment strategy and preliminary tests indicating no statistically significant differences between control and experimental districts in terms of outstanding tax amounts strengthen the credibility of causal inference. Accordingly, the evidence suggests that the nudge interventions achieved a meaningful degree of effectiveness and underscore the potential value of behavioral instruments in revenue administration within developing country settings.

Several important lessons emerge from this study. First, the prompt recovery of outstanding vehicle taxes is essential not only for improving revenue performance but also for preventing the accumulation of arrears that may undermine long-term local fiscal capacity and citizen's tax morale. Second, although behavioral interventions are not a panacea, they represent a cost-effective complement to structural and legal enforcement mechanisms. Nonetheless, such interventions may produce primarily short-term effects, necessitating periodic redesign of nudge strategies to maintain salience and effectiveness, particularly as taxpayers become habituated to reminder communications [22].

A further critical lesson concerns the role of deterrence messaging. The Krabi case demonstrates that communications emphasizing legal sanctions can generate substantial improvements in tax compliance. However, scaling up such measures requires transparent and balanced communication regarding both the benefits of timely tax payment and the statutory penalties for non-compliance. Sustained implementation of such measures may reinforce desired compliance norms over time. In this regard, behavioral nudge letters shall be institutionalized within the Land Transport Department and legal deterrence messaging shall be clearly communicated but framed constructively. Besides, behavioral trials should be replicated in other provinces of Thailand or other developing countries alike in order to test external validity and their applicability. Integration with some other nudging tools or digital communication (SMS) may further enhance cost-effectiveness tax compliance schemes.

From a broader governance perspective, continuous monitoring and follow-up of tax arrears remain indispensable. As long as public authorities retain responsibility for delivering public services and maintaining urban infrastructure, ensuring adequate revenue generation is imperative. Effective enforcement not only produces a deterrence effect that prevents widespread non-compliance but also mitigates perceptions of inequity between compliant taxpayers and those who evade tax payment. Behavioral approaches thus constitute a viable supplementary instrument for enhancing the effectiveness and efficiency of tax administration.

In conclusion, this experimental study represents a concrete effort to develop an evidence-based behavioral strategy for improving the collection of outstanding vehicle taxes. Given the substantial volume of unpaid vehicle taxes in Thailand—which generates both revenue losses and distributive inequities among taxpayers—the need for innovative compliance strategies is pressing. The field experiment conducted in Krabi Province demonstrates that differentiated reminder letters significantly increased repayment rates. Relevant stakeholders should therefore consider scaling and replicating this intervention in other jurisdictions, while adapting or innovating message designs as appropriate. The evidence indicates that behavioral approaches offer a practical, and contextually suitable instrument for strengthening revenue administration in Thailand and elsewhere.

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