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Fighting vacation rental tax evasion through warnings to potential evaders

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Abstract

This paper uses differences-in-differences to analyze the effectiveness of messages sent by the Spanish Tax Agency to deter tax evasion by owners of vacation rentals. The results suggest that these messages were effective in the aggregate, as there was an increase both in the declared amount of such income (6–8.5%, depending on the line item under which it is declared) and in the number of filers (29.7–64.2%), and this effectiveness became more marked over time. Notably, there was more response to the intervention from the self-employed. However, in some collectives, the intervention produced the opposite of the intended effect.

KEYWORDS

differences-in-differences, messages, tax compliance, vacation rentals

1 | INTRODUCTION

In a tax-like personal income tax, in which taxpayers are required to self-report their income, several different strategies are available to the tax agency to ensure taxpayers meet their tax obligations, forming part of one or other of the three paradigms proposed by Alm (2012). The first is the "enforcement" paradigm, based on the prosecution and punishment of evasive behaviour,

which seeks to act on the probability of evasion detection and penalties, according to the classic model of Allingham and Sandmo (1972). The second is the "service" paradigm, which aims to make it easier for citizens to comply with their tax obligations, improving assistance and information for taxpayers and simplifying the material and formal aspects of the tax. The third is the "trust" paradigm, which emphasizes the importance of such factors as ethics and social norms in tax compliance, with instruments including tax education and greater participation by individuals in budgetary decision-making processes. The tax agencies of many (mostly developed) countries have taken action in all these spheres to combat tax evasion, and increasing numbers of papers are now testing the effectiveness of these actions.

In Spain, rental income is the main focus of personal income tax evasion, just behind income from movable capital (Domínguez et al., 2015, 2017). In 2016, the Spanish Tax Agency (AEAT), as a measure to combat evasion, set up warnings on the online program *Renta Web* used by taxpayers to file their income tax returns, informing the owners of properties offered for rental that it was aware of this circumstance. This action can be included in the "enforcement" paradigm, as it affects taxpayers' subjective probability that their noncompliance will be detected by the tax agency. With this warning system, AEAT hoped that landlords would voluntarily declare rental income because they perceived that their noncompliance was more likely to be detected.

In this paper, we will empirically test how this intervention affected tax compliance in Spain relating to a specific type of income: vacation apartment rentals, which was one of AEAT's priority objectives. AEAT's initiative using the warning system described above provided a kind of natural experiment that can be used to test the effectiveness of this type of intervention. For this, we will use one of the most frequent methods for evaluating the impact of a policy or treatment, differences-in-differences (DiD).

Our paper is part of a recent, but already large and growing line of research that analyzes the use of nonfinancial instruments (including nudges) to encourage tax compliance. The most widely used and studied of these instruments are messages addressed to random groups of taxpayers, with deterrent content (e.g., informing them about penalties for noncompliance or warning that the tax return will be audited) or with appeals to moral issues or social norms. There is already extensive evidence on the effects of these measures for a variety of taxes and countries.[1] Recently, Antinyan and Asatryan (2020), using meta-analytical methods for about a thousand treatment effects, concludes that, on average, deterrence interventions are modestly effective in curbing tax evasion, but interventions pointing to elements of individual tax moral are ineffective. Other instruments used to encourage tax compliance include public disclosure of taxpayers or tax delinquents ("shaming programs") and recognition of compliant taxpayers. These measures combine elements of deterrence and appeals to moral issues and social norms, and the literature has shown their effectiveness.[2]

However, there is hardly any literature analyzing actions of the type carried out in Spain, specifically directed at potential tax evaders of a particular kind of income where the evasion rate is

[1] For the personal income tax, see Schwartz and Orleans (1967), McGraw and Scholtz (1991), Coleman (1997), Meiselman (2018), Blumenthal et al. (2001), and Slemrod et al. (2001) for the United States; Kleven et al. (2011) for Denmark; De Neve et al. (2021) for Belgium; and Hallsworth et al. (2017) for the United Kingdom. For companies, see Ariel (2012) for Israel; Hasseldine et al. (2007) for the United Kingdom; and Gangl et al. (2014) for Austria. See also Del Carpio (2014) and Castro and Scartascini (2015) for property taxes in Peru and Argentina, respectively; Pomeranz (2015) for the Chilean VAT; and Dwenger et al. (2016) for a local church tax in Germany.

[2] See Hasegawa et al. (2013) for Japan; Bø et al. (2015) for Norway; Hoopes et al. (2018) for Australia; Dwenger and Treber (2022) for Slovenia; and Slemrod et al. (2022) for Pakistan.

known to be high, with the intention of making such income visible. Wenzel and Taylor (2004), in a controlled experiment in partnership with the Australian Taxation Office, analyze the effectiveness of sending out forms to a random group of owners of rental properties whom they had identified as potential tax evaders, so that they would report in detail the revenues and costs of such properties. The forms were accompanied by letters, some mild and others harsher in tone, asking the taxpayers to report the requested information accurately, so that the expenses deducted from rental income when filing their tax returns would be accurate. The results of the experiment showed that the intervention was effective. Similarly, in a controlled experiment for Finland, Eerola et al. (2019) analyze the responses of potential landlords of rental housing to letters notifying them of stricter tax enforcement. The authors find letters effective, and also find positive spillover effects of tax enforcement between spouses and among landlords who did not report any rental income in the previous year. Bott et al. (2019) conducted an experiment in partnership with the Norwegian Tax Administration, in which a random group of taxpayers and likely evaders of taxes on foreign income were sent a letter informing them that the tax administration knew that in previous years, they had obtained income or held assets abroad. This intervention was also effective. And while it did not focus on a specific income type, the controlled experiment by Meiselman (2018), also conducted with a random sample of suspected income tax evaders (nonfilers), shows that deterrent measures are more effective than those facilitating tax compliance. Boning et al. (2020), with a randomized large-scale experiment in the United States, examine the effect on compliance, both direct and network (i.e., for other taxpayers linked by geographical proximity, business connections, or shared advisers), of sending letters and visiting a group of corporations suspected of tax evasion. While visits have both direct and network effects, letters have a lesser direct effect and no network effect.

Our paper makes several novel contributions in this field. First, it focuses on tax evasion relating to a specific type of income, vacation rentals, which in popular tourist destinations such as Spain represent a significant part of GDP, and have not previously been the focus of an academic paper. Also, no third-party information on this income existed for the period studied, so that taxpayers perceived a very low probability of detecting evasion, and thus, evasion levels were high. All of this means that vacation rentals present a relevant and timely context for a study on combating tax evasion.

Second, the type of intervention used by Spain's tax agency (AEAT) and analyzed in our study is somewhat different to what has previously been used in the empirical literature. On the one hand, because rather than the traditional letters or emails used in the controlled experiments of other countries, this was a "pop-up" alert that appeared to the taxpayer in the software program used for filing their tax return, while they were in the process of filing, which probably influenced its effectiveness. And on the other hand, because most existing papers use deterrent messages that report the penalties for noncompliance, warn that a tax return will be reviewed, ask for information on certain income and expenses, or inform taxpayers that the tax administration knows that in other years, they have obtained the type of income it is trying to encourage them to declare. However, with the message used in Spain, we could say that the AEAT is "bluffing": The tax administration simply tells the taxpayers it knows they have put a rental on the market, but not whether it knows if they have actually let it, or for how much. In fact, as the tax on this type of income is not withheld at source, the income is not reported by third parties, and the taxpayers know that AEAT does not have direct information on it.

Third, our paper was conducted through a natural experiment in which intervention is exogenous—in other words, not controlled or manipulated by the researchers—and was directed to a group of taxpayers identified by AEAT as probable tax evaders in this specific type of income.

In contrast, existing papers carry out experiments controlled by the researchers in which the intervention is directed at a random group in a selected sample.[3]

Given the nature and characteristics of the natural experiment on which our analysis is based and the information available about it, the design of our DiD exercise is unusual for this type of study, as there is incomplete compliance in the treatment. However, this simply means that our estimate is capturing the intention to treat (ITT), rather than the usual average treatment on treated (ATT), and our results are underestimating the actual effect of the intervention.

The results we have obtained show that the intervention mechanisms used by AEAT have brought to light both taxpayers and volume of income arising from vacation rentals, and that this effectiveness has increased over time. The collectives that responded best to the efforts of AEAT were the self-employed, singles, and those with the most leased properties. However, salaried workers and those paying high marginal tax rates had the opposite response to what the tax administration had expected, which shows that taxpayers' interpretations of the AEAT message may be contrary to what it intended.

To sum up, our research shows that the most veiled threat to the taxpayer by the tax administration was able to both increase the perceived detection probability of tax evasion and improve tax compliance in both the intensive and the extensive margin, indicating the influence on behavior of this type of deterrent messages. This result has an important implication for economic policy, as insofar as the analyzed warning can be effective and is inexpensive, it could become a cost-effective complement to other measures governments may adopt to improve compliance, be it tax or otherwise.

The paper is structured as follows. The next section describes the context of the intervention and the sample used. The third section describes the technique employed to analyze the intervention and the variables used. The fourth section presents the results obtained. The paper ends with a section of final considerations.

2 | CONTEXT OF THE INTERVENTION AND SAMPLE

2.1 | Context of the intervention

The individual owners of vacation rental apartments must declare the income arising from these rentals in the IRPF (Spanish personal income tax), in the category of "property income" (hereinafter, "rent"). However, if the rental includes the provision of services typical of the hotel industry, or if a person is employed on a full-time contract to organize the activity, then rental income must be declared as "business income" in National Classification of Economic Activities (CNAE) group 685 (nonhotel vacation accommodation, that is, those that provide the complementary services of the hotel industry, without being hotels), or CNAE group 861 (rentals of homes without hosting services, industrial premises, and others). Furthermore, in periods when these properties are not rented out or attached to business rental activity, the taxpayer must declare as "imputed property income" (hereinafter, "imputed income") a percentage of their administrative (cadastral) value, without the possibility of deducting any expenses.

To fight tax evasion, starting in 2016, AEAT established a system of warnings on the *Renta Web* program, giving the following information: *"According to the data available to AEAT, you have advertised properties to let, in different advertising media, including the internet. This is a reminder*

[3] Only the papers referred above analyzing the effect of public disclosure tax data are based on natural experiments.

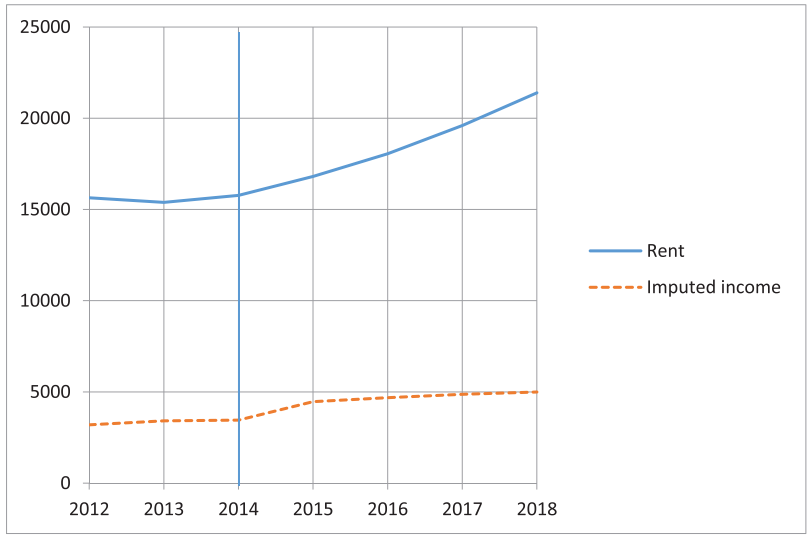


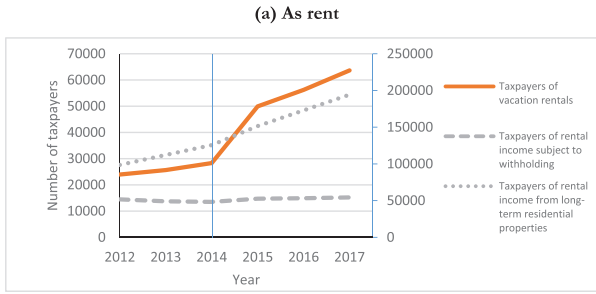
FIGURE 1 Evolution of income from properties (millions of euros) [Color figure can be viewed at wileyonlinelibrary.com]

that if you have received any income from rentals, this must be included in your tax return, as well as any type of income for which you are liable for tax and which does not appear in your tax information." This warning, which was introduced without previous notice in the 2015 income tax campaign and can thus be considered an exogenous shock, reached 21,000 taxpayers in that campaign, but continued to expand over time, reaching 1.5 million taxpayers in the IRPF 2019 campaign. With this warning system, AEAT hoped that taxpayers would voluntarily declare income from vacation rentals.

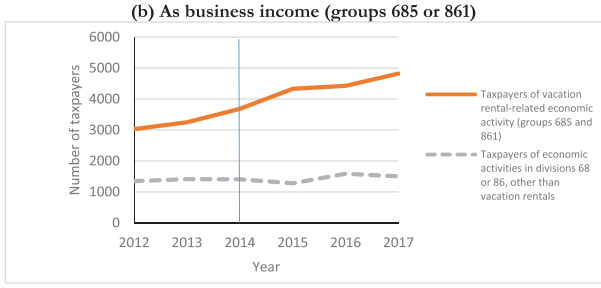
The data appear to indicate that the warning system is working, leading to an increase in declared rental income and in the number of taxpayers declaring rental income. The AEAT's *Estadística de los declarantes del Impuesto sobre la Renta de las Personas Físicas*[4] shows that self-reported income in the category of "rent" in the IRPF, which amounted to around 15 billion euros per year between 2012 and 2014, rose to 21.4 billion euros in 2018 (Figure 1). In contrast, "imputed income" is much more stable. These figures can be seen as a first indication of the effectiveness of AEAT's intervention.

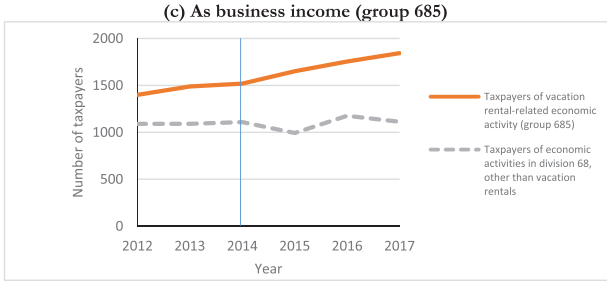
Also, according to the information obtained from the *Samples of IRPF Filers* provided by the Spanish Institute of Fiscal Studies (IEF), the number of taxpayers declaring income from vacation rentals clearly rose after 2015, in the categories of both "rent" (which as Figure 2 shows is more common) and "business income." In 2015, 49,945 taxpayers in the sample declared income from vacation apartments as "rent", compared to 28,316 in 2014 (an increase of nearly 76%), whereas 4329 taxpayers declared it as "business income," compared to 3684 the year before (an increase of 17.5%). A breakdown of taxpayers according to the CNAE group of economic activity under which they declare rental income (panels *c* and *d* of Figure 2, for groups 685 and 861, respectively) also shows a large increase in the number of taxpayers declaring this type of income.

[4] https://www.agenciatributaria.es/AEAT/Contenidos_Comunes/La_Agencia_Tributaria/Estadisticas/Publicaciones/sites/irpf/2018/jrubika4e6e626fb4162de0657eeebfef731c4d94e36.html.



*Taxpayers declaring rental income from long-term residential properties and properties subject to withholding are represented on the secondary axis





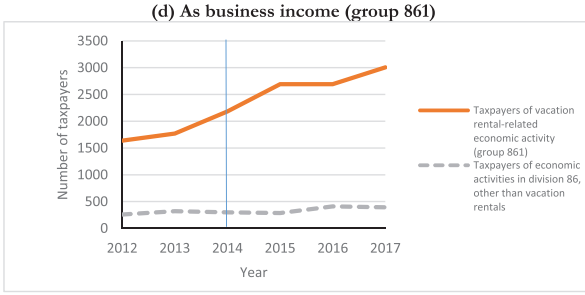


FIGURE 2 Evolution of the number of taxpayers declaring vacation rental income
Source: By the authors, based on the *Samples* of *IRPF Filers*.
[Color figure can be viewed at wileyonlinelibrary.com]

The data therefore again seem to indicate that AEAT's system of warnings to incentivize tax compliance for vacation rentals was effective, as it brought to light people obtaining this type of income.

2.2 | The sample

In the absence of sufficiently disaggregated data to carry out the analysis with panel data, we have used the cross-sectional annual data in the *Samples of IRPF Filers* for 2012–2017. These *Samples*

contain detailed information on the self-reported income of representative samples of taxpayers in all Spanish territory except Navarre and the Basque Country, which manage their own IRPF. We therefore use repeated cross-sectional data.

3 | EMPIRICAL ANALYSIS

3.1 | Theoretical framework

The theoretical model underlying our estimates is the classic Allingham–Sandmo–Yitzhaki model of tax evasion (Allingham & Sandmo, 1972; Yitzhaki, 1974), according to which a risk-adverse individual will evade the amount of income that maximizes his/her expected utility, which will basically depend on his/her true income, the income tax rate, the (subjective) probability that the tax agency detects the evasion, and the penalty imposed for noncompliance. In this framework, the intervention mechanism which AEAT establishes in Spain seeks to increase the potential evader's subjective probability of being audited (Bott et al., 2019; Meiselman, 2018), thus making the tax evasion option more costly than compliance and incentivizing the voluntary declaration of vacation rental income. However, the intervention could also have the opposite effect, if the owners of vacation rentals were to interpret the AEAT warning as a signal that AEAT does not know the income from such rentals and has no good way of auditing this information. This is a reasonable interpretation, as these rentals are not subject to withholding and thus do not appear in the tax information which AEAT provides to taxpayers. In such cases, the subjective probability of the taxpayer being detected may be reduced, and the result could be an increase in tax evasion (Konda et al., 2020; Slemrod et al., 2001). Consequently, the expected effect of the intervention is undetermined, which highlights the importance of empirical evidence of the kind which we provide in this paper.

3.2 | Empirical strategy

To estimate the effect of the strategy adopted by AEAT to bring income from vacation rentals to light, we use the DiD technique. With the information provided by the *Samples of IRPF Filers*, we can create a treatment group and control group(s) for each year, depending on how this income was declared—rent or business income—and estimate the effects of the treatment using standard linear regression techniques.

Our initial objective is to determine whether AEAT's warnings affected the amount of self-reported income by the recipients of vacation rental income, that is, intensive margin. To do this, we have specified the following model:

$$R_{kit} = \beta_0 + \beta_1 P_t + \beta_2 T_{kit} + \alpha * (P_t * T_{kit}) + \beta_3 X_{kit} + u_{kit}, \quad (1)$$

where R_{kit} is the dependent variable. Depending on how income from vacation rentals is declared, that variable will be constructed as the weight of "rent," or "business income," in the taxpayer's

general taxable income (i.e., excluding savings income).[5] Subscript k indicates if such income is declared as "rent" ($k = R$) or as "business income" ($k = BI$). Subscript i specifies the observation unit—in this case, the individual. Subscript t specifies the year, with t = 2012–2017.

P_t identifies the posttreatment period (2015–2017), during which this variable takes the value 1.

T_{kit} identifies the treatment group, and given that with the available information, we cannot know who has really received the warning, it takes the value 1 when the individual declares income from vacation rentals in the cross section of year t, and 0 otherwise. Working with repeated cross-sectional data requires the assumption that as individuals are randomly extracted from the same population sample, the individuals in the treatment group (control) of the earliest cross section can be substitutes for the individuals in the treatment group (control) in the later cross section (Stock & Watson, 2019). Thus, T_{kit} is a binary variable identifying whether an individual is in the treatment group (or in the substitute treatment group, if the observation is in the pretreatment period).

When we estimate the effect of the treatment on "rent," R_R, the treatment group T_R includes the recipients of rental income from real estate other than long-term residential properties or properties subject to withholding (offices, business premises, industrial buildings). The control group includes only lessors of properties subject to withholding, which do not appear to be the main targets of AEAT's action, as their income is mostly monitored by AEAT itself, both through tax withholding and because, as the tenants are business owners or professionals, it is in their interests to declare the rent they pay to be deducted as an expense in their personal or corporate income tax returns. Thus, given the characteristics of the intervention, in our model, an individual can belong to the treatment group, T_R, whether or not they have received a warning from AEAT—that is, there is a situation of noncompliance or imperfect compliance in the treatment.

When we estimate if AEAT's action has had an effect on "business income" R_{BI}, the treatment group T_{BI} includes all the business owners declaring vacation rental-related economic activities (in CNAE groups 685 or 861). In this case, we formed the control group with business owners carrying out activities in division 68 or 86, other than vacation rentals.[6] However, taking into account that taxpayer behavior may be different according to the classification of their economic activity, we also created a treatment group, T_{BI685}, comprising taxpayers declaring vacation rental income in group 685, and another, T_{BI861}, of taxpayers declaring vacation rental income in group 861. In these cases, the control groups were made up of taxpayers declaring economic activities in the same division (68 and 86, respectively), but different from those of the treatment groups. Figure 2 shows changes over time in the members of each treatment and control group.

The interpretation of parameters β_0, β_1 y β_2 is the usual one in DiD models. The parameter α, capturing the interaction of explanatory variables P and T, is the coefficient of interest or DiD estimator. As mentioned above, in our estimates, this estimator, rather than measuring the ATT, is capturing the ITT, given the nature of the intervention and the situation of noncompliance in the treatment arising from it. Thus, it reports the average effect of the intervention, but underestimating it (Gertler et al., 2017), such that if all the individuals in the treatment group had received the warning, the effect would have been greater. Therefore, if the warning system strategy established

[5] The denominator does not include business income when rent is being evaluated, nor rent when we are analyzing business income, to isolate increased compliance in both income sources. We also left "imputed income" out of the denominator, as this may vary in the opposite direction to declared rental income.

[6] Specifically, hosting services in hotels and motels, hostels and pensions, and so on (division 68); and rentals of homes to entities or persons who use them commercially as nonhotel establishments, and rentals of rural properties (division 86).

by AEAT works, the sign of the coefficient α should be positive. u_{kit} is the error term, with a zero mean.

X_{kit} are the additional regressors included in the estimates, which let us control for the fact that the sample populations may vary over time. In line with the Allingham–Sandmo–Yitzhaki tax evasion model, these regressors are intended to capture: (i) the effect of the marginal IRPF rate (***mtr24***, ***mtr30***, and ***mtr37***); (ii) the taxpayer's income (***income***)[7] and its source (***business*** or ***labor***); (iii) the probability of obtaining income from vacation rentals, because the taxpayer has more rental properties, ***numrentedprop***, or performs more than one rental or hosting-related economic activity, ***numrentalbusiness***, depending on how vacation rental income is estimated, R_R or R_{BI}, respectively, or because they reside in one of the four autonomous communities (Spanish political regions) where there are more owners of vacation apartments, ***residence***; (iv) the control of the vacation rental activity by the Autonomous Community (***regul***);[8] (v) variables relating to income control by the tax agency, such as ***bigcity***, which captures whether the taxpayer lives in a large city, and ***otheractiv***, indicating whether the taxpayer performs other economic activities as well as vacation rentals, although this last variable is included only in the estimation of R_{BI}; and finally, various characteristics of the taxpayer (***familyrespons***, ***single***, ***age)***. All the continuous variables are measured in natural logarithms. Table 1 shows the definition of each variable and its expected effect, and the source of the information used to construct it. Table 2 shows the main descriptive statistics.

Figure 3 shows the evolution of the dependent variable for the different treatment and control groups. However, a visual inspection is not always enough to see a greater response in the form of a larger increase in the weight of rental income for the treatment group during the postintervention period. For this reason, an econometric analysis is needed to allow us to take into account the standard error and the effect of the control variables.

3.3 | Parallel trends and other hypotheses

The key assumption underlying the DiD estimator is that there are parallel trends between the treatment and control groups, as it enables causal analysis despite the lack of randomization. To test this hypothesis, placebo tests can be run to see if the treatment was effective before its implementation (Fredriksson & Magalhaes de Oliveira, 2019), so that if the DiD estimator is found to be significant in the pretreatment period, this will indicate that the results of the treatment and control groups were diverging even before the intervention. In our case, models 3 and 6 in Table 4 show that the coefficient of the variable of interest was not significant during the pretreatment period (*Tk*year2013* and *Tk*year2014)*, which would support the assumption of parallel trends. The test devised by Mora and Reggio (2015), shown in the last row of Table 4 (MR test), also suggests the presence of common dynamics in the pretreatment period, insofar as the estimates are not significantly different from a statistical point of view.

Also, the usual selection bias problems found when groups are not paired at random did not appear here. The results of Table 3 show that the treatment and control groups are observationally similar during the pretreatment period, insofar as the covariables are reasonably balanced from an economic point of view. Although the differences (column Diff.) are significantly different from

[7] We opted to measure progressivity and income with dummies, to avoid endogeneity problems.

[8] By requiring an occupation license, with the obligation of presenting an affidavit stating the start of the activity, an entry in a register, and so forth.

TABLE 1 Variables of the model

Variable	Definitions for the estimate of the weight of income from vacation rentals	Definitions for the estimate of the number of taxpayers declaring income from vacation rentals	Expected effect	Source
Dependent Variables				
R_R	Rental income *100/ General taxable income, excluding business income and imputed income.	Number of taxpayers declaring rental income		IRPF *Filers Samples*
R_{BI}	Income from economic activity *100/ General taxable income, excluding rental income and imputed income.	Number of taxpayers declaring income from economic activity		
Explanatory variables: treatment and control groups and pre- and posttreatment periods				
T_R	=1 if the individual obtains rental income other than long-term residential properties and properties subject to withholding (garages, storage facilities, industrial buildings)= 0 if the individual obtains rental income subject to withholding		Positive for the interaction P * T	IRPF Filers Samples
T_{BI}	= 1 if the business owner conducts activities in groups 685 or 861= 0 if the business owner conducts activities in division 68 or 86, other than vacation rentals.			
T_{BI685}	= 1 if the business owner conducts activities in group 685= 0 if the business owner conducts activities in division 68, other than vacation rentals.			
T_{BI861}	= 1 if the business owner conducts activities in group 861= 0 if the business owner conducts activities in division 86, other than vacation rentals.			
P	=1 in the period 2015–2017= 0 in the period 2012–2014			AEAT
Explanatory variables: tax progressivity				
mtr24	=1 if 24 % < marginal tax rate ≤ 30%= 0 otherwise	= 1 if 24% < average marginal tax rate of the province ≤ 30%= 0 otherwise	Undetermined	Samples of IRPF Filers

(Continues)

TABLE 1 (Continued)

Variable	Definitions for the estimate of the weight of income from vacation rentals	Definitions for the estimate of the number of taxpayers declaring income from vacation rentals	Expected effect	Source
mtr30	=1 if 30 % < marginal tax rate ≤ 37%= 0 otherwise	=1 if the average marginal tax rate of the province > 30%= 0 otherwise		
mtr37	=1 if the marginal tax rate ≥ 37%= 0 otherwise			
Explanatory variables: income and its source				
income	= 1 if the taxpayer's total taxable income is > €150,000	= 1 if the average total taxable income of the province is > €28,000	Undetermined	Samples of IRPF Filers
labor	=1 if $\frac{wage\ income}{total\ taxable\ income}$>0.5= 0 otherwise	=1 if the average $\frac{wage\ income}{total\ taxable\ income}$ of the province is > 0.7= 0 otherwise	Negative	
business	=1 if $\frac{business\ income}{total\ taxable\ income}$>0.5= 0 otherwise	=1 if the average $\frac{business\ income}{total\ taxable\ income}$ of the province is > 0.2= 0 otherwise	Positive	
Explanatory variables: probability of obtaining income from vacation rentals				
numrentedprop	Number of properties rented out	Average number of properties rented out per capita in the province	Positive	Samples of IRPF Filers
numrentalbusiness	Number of economic activities of group 68, and 86 performed by the taxpayer	=1 if more than one economic activity of group 68 and 86 is performed by the business owners of those CNAE groups in the province, on average= 0 otherwise	Positive	
residence	In the model explaining R_R:= 1 if Andalusia, Catalonia, Madrid, and Castilla-León; = 0 otherwise In the model explaining R_{BI}:= 1 if Catalonia, Balearic Islands, Castilla-León, and Castilla la Mancha; = 0 otherwise		Positive	

(Continues)

TABLE 1 (Continued)

Variable	Definitions for the estimate of the weight of income from vacation rentals	Definitions for the estimate of the number of taxpayers declaring income from vacation rentals	Expected effect	Source
Explanatory variables: control				
regul	=1 in the Region of Valencia, Balearic Islands, and Catalonia in the period 2012–2017; in Cantabria and Madrid in the period 2014–2017; in Aragón and Canary Islands in the period 2015–2017; in Andalusia and Asturias in the period 2016–2017; and in Galicia, Castilla-León, and La Rioja in 2017.= 0 otherwise		Positive	EY (2015) and Magro (2017)
bigcity	= 1 if in Madrid, Barcelona, Valencia, Seville, Málaga, and Zaragoza= 0 otherwise	Provincial average taxpayers resident in a big city	Undetermined	Samples of IRPF Filers
otheractiv	= 1 if the taxpayer performs other economic activities apart from vacation rentals= 0 otherwise	= 1 if the provincial average taxpayers performing other economic activities apart from vacation rentals are > 0.5= 0 otherwise	Positive	
pop		Population of the province	Positive	National Statistics Institute
Explanatory variables: taxpayer characteristics				
familyrespons	Income not taxed based on dependent family members	Provincial average income not taxed based on dependent family members	Undetermined	Samples of IRPF Filers
age	Age	Average age of taxpayers in the province	Undetermined	
single	= 1 if single;= 0 otherwise	Average single taxpayers in the province	Undetermined	
Variable explaining imputed property income				
numprop	Number of properties available for the taxpayer's use		Positive	Samples of IRPF Filers

TABLE 2 Descriptive statistics of the variables

	Entire period				Pre-treatment period								Post-treatment period							
	Entire sample				Treatment group				Control group				Treatment group				Control group			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Sample for estimating R_R																				
R_R	39.10	36.41	0	100	34.84	37.10	0	100	45.17	36.18	0	100	31.18	35.21	0	100	43.76	35.72	0	100
mtr24	0.056	0.231	0	1	0.056	0.229	0	1	0.064	0.245	0	1	0.049	0.216	0	1	0.058	0.234	0	1
mtr30	0.188	0.390	0	1	0.129	0.336	0	1	0.147	0.354	0	1	0.222	0.416	0	1	0.217	0.413	0	1
mtr37	0.408	0.491	0	1	0.460	0.498	0	1	0.451	0.498	0	1	0.408	0.491	0	1	0.342	0.474	0	1
income	0.084	0.277	0	1	0.080	0.272	0	1	0.074	0.262	0	1	0.093	0.290	0	1	0.085	0.280	0	1
business	0.093	0.291	0	1	0.089	0.284	0	1	0.086	0.280	0	1	0.094	0.291	0	1	0.102	0.303	0	1
labour	0.597	0.491	0	1	0.648	0.478	0	1	0.528	0.499	0	1	0.688	0.463	0	1	0.541	0.498	0	1
numrentedprop	1.699	1.165	1	6	1.858	1.259	1	6	1.579	1.084	1	6	1.875	1.256	1	6	1.552	1.052	1	6
regul	0.572	0.495	0	1	0.345	0.475	0	1	0.346	0.476	0	1	0.754	0.431	0	1	0.700	0.458	0	1
residence	0.540	0.498	0	1	0.587	0.492	0	1	0.492	0.500	0	1	0.606	0.489	0	1	0.492	0.500	0	1
bigcity	0.198	0.398	0	1	0.230	0.421	0	1	0.183	0.386	0	1	0.227	0.419	0	1	0.167	0.373	0	1
familyrespons	7756.56	3222.14	4486.30	68415.89	7282.40	2858.24	4486.30	57967.13	7077.40	2692.15	5107.11	49691.6	8252.20	3440.92	5443.84	65200	8092.63	3450.56	5443.84	68415.89
age	59.92	13.80	0	113	58.58	14.00	3	113	60.67	13.29	0	112	57.86	14.12	0	104	62.01	13.45	0	105
single	0.279	0.448	0	1	0.264	0.441	0	1	0.274	0.446	0	1	0.282	0.450	0	1	0.287	0.452	0	1
Observat.	525,548				73,495				140,229				158,513				153,305			
Sample for estimating R_{BI}																				
R_{BI}	62.006	39.179	0	100	63.295	38.418	0	100	66.680	38.599	0	100	59.771	39.404	0	100.822	64.864	39.943	0	100
mtr24	0.036	0.185	0	1	0.041	0.197	0	1	0.027	0.161	0	1	0.035	0.185	0	1	0.031	0.174	0	1
mtr30	0.131	0.337	0	1	0.099	0.299	0	1	0.052	0.223	0	1	0.166	0.372	0	1	0.114	0.318	0	1
mtr37	0.428	0.495	0	1	0.506	0.500	0	1	0.220	0.414	0	1	0.454	0.498	0	1	0.271	0.444	0	1
income	0.129	0.335	0	1	0.149	0.356	0	1	0.037	0.189	0	1	0.148	0.355	0	1	0.061	0.239	0	1
business	0.572	0.495	0	1	0.563	0.496	0	1	0.658	0.475	0	1	0.541	0.498	0	1	0.665	0.472	0	1
labour	0.348	0.476	0	1	0.322	0.467	0	1	0.347	0.476	0	1	0.359	0.480	0	1	0.365	0.482	0	1
	1.053	0.247	1	5	1.052	0.238	1	3	1.021	0.177	1	4	1.068	0.279	1	5	1.021	0.144	1	2
numrentalbusiness																				
otheractiv	0.233	0.423	0	1	0.299	0.458	0	1	0.000	0.000	0	0	0.290	0.454	0	1	0.000	0.000	0	0
regul	0.586	0.493	0	1	0.388	0.487	0	1	0.231	0.421	0	1	0.735	0.442	0	1	0.686	0.464	0	1
residence	0.395	0.489	0	1	0.403	0.491	0	1	0.392	0.488	0	1	0.398	0.490	0	1	0.364	0.481	0	1
bigcity	0.223	0.416	0	1	0.258	0.438	0	1	0.092	0.289	0	1	0.249	0.433	0	1	0.122	0.327	0	1
familyrespons	7698.40	3220.96	5107.11	39869.03	7154.53	2718.68	5107.11	35660.59	6874.01	2633.15	5107.11	28862.8	8131.03	3455.04	5443.84	38989.7	7777.48	3389.02	5443.845	39869.03
age	57.596	15.125	2	105	58.924	15.006	2	98	51.789	14.209	9	97	58.973	15.164	16	105	52.664	13.874	14	99
single	0.377	0.485	0	1	0.349	0.477	0	1	0.401	0.490	0	1	0.380	0.485	0	1	0.418	0.493	0	1
Observat.	18,593				5,626				1,507				9,236				2,224			

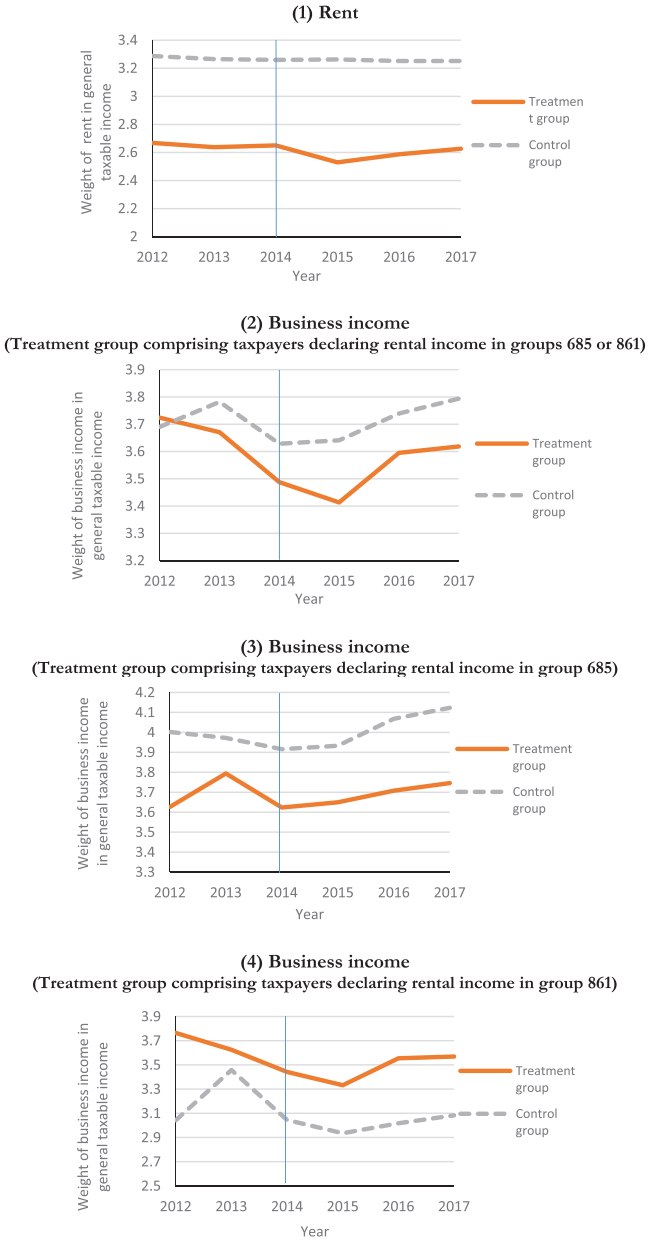


FIGURE 3 Evolution of the weight of vacation rental income in general taxable income
Source: By the authors, based on the *IRPF Filers Samples*.
[Color figure can be viewed at wileyonlinelibrary.com]

zero, the *standardized mean difference or Cohen's D* is always below 0.3, which would indicate that there are no major problems in the composition of the control and treatment samples (Cohen, 1988; Schacht et al., 2008).

4 | RESULTS

The results obtained with the estimates of the specification (1), as shown in Table 4, are as intended by AEAT and are also in line with those obtained from most of the available empirical literature. First, results suggest that the system of warnings set up by AEAT brought to light income

TABLE 3 Characteristcs of the treatment and control groups in the pretreatment period

	Sample for estimating R_R		Sample for estimating R_{BI}	
Variable	*Diff*	*Standardized diff. (Cohen's D)*	*Diff*	*Standardized diff. (Cohen's D)*
mtr24	−0.008**	−0.088	0.014*	0.090
mtr30	−0.017**	0.007	0.047**	0.006
mtr37	0.009**	0.015	0.286**	0.034
income	0.006**	0.022	0.112**	−0.022
business	0.003*	−0.005	−0.095**	−0.175
labor	0.120**	0.259	−0.025	0.096
numrentedprop	0.279**	0.293		
numrentalbusiness			0.031	−0.005
otheractiv			0.299**	0.30
regul	−0.001	0.215	0.157**	0.061
residence	0.096**	0.211	0.011	0.194
bigcity	0.047**	0.119	0.166**	−0.036
familyrespons	205.011**	0.122	280.52**	0.046
age	−2.092**	−0.152	7.135**	−0.054
single	−0.010**	0.007	−0.052	−0.096

*indicates significance at 5%,
**at 1%.

from vacation rentals. It seems therefore that, because of these warnings, taxpayers have understood that the AEAT has them on its radar (Slemrod, 2019) and, moreover, they understand this at the time of filing their personal income tax return (McGraw & Scholtz, 1991; Slemrod et al., 2001). Specifically, the DiD estimator, P^*T_k, of models 1 and 4 in Table 4, shows that the weight of income from vacation rentals in general taxable income increased in the posttreatment period by 6% if declared as "rent," and by 8.5% if declared as an economic activity in group 685. If we also consider the income declared in group 861, the coefficient of the variable of interest is not found to be significant, perhaps because these owners, who let vacation homes without providing the complementary services of the hotel industry, are less likely to advertise for customers, and thus do not perceive any change in the probability of detection, so we have omitted these results. Wenzel and Taylor (2004), Bott et al. (2019), and much of the literature analyzing the effectiveness of different actions to deter tax evasion (e.g., Blumenthal, 2001 or De Neve et al., 2021), also find these measures to be effective. And although their way of measuring effectiveness often differs from ours (whether in methodology or how the response is measured), our results are within the range obtained in this literature: for example, Wenzel and Taylor (2004) find that compliance increases by 5–7.5%; Meiselman (2018) by 4.66%; Bott et al. (2019) by 13%; and De Neve et al. (2021) by 2.8 percentage points. The coefficients of the control variables were also found to be significant.

With the information provided by our natural experiment, we cannot differentiate the short- and long-term effects of the treatment (De Neve et al., 2021). Nor can we identify how much of the effect is due to the treatment being repeated over time (or if repetition leads to fatigue),[9] and how

[9] Blumenthal et al. (2001), Hallsworth (2014), and Brockmeyer et al. (2019) argue that for the measures to be effective, they should be repeated over time. Similarly, De Neve et al. (2021) did not find a fatigue effect for the deterrent measures applied in Belgium.

TABLE 4 Results of the estimates of the weight of vacation rental income in general taxable income: Differences-in-differences method

	Panel A: R_R			*Panel B: R_{BI685}*		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
P	−0.070**	−0.069**	−0.069**	0.005	0.010	0.011
Tk	−0.532**	−0.532**	−0.528*	−0.208**	−0.207**	−0.267**
P * Tk	0.060**			0.085*		
Tk * year2013			−0.005			0.087
Tk * year2014			−0.008			0.082
Tk * year2015		0.045**	0.040**		0.043	0.102
Tk * year2016		0.053**	0.048**		0.079	0.138**
Tk * year2017		0.077**	0.072**		0.122**	0.182**
mtr24	−0.888**	−0.888**	−0.888**	−0.219**	−0.220**	−0.218**
mtr30	−0.828**	−0.828**	−0.828**	−0.319**	−0.320**	−0.317**
mtr37	−0.971**	−0.971**	−0.974**	−0.315**	−0.315**	−0.315**
income	−0.498**	−0.498**	−0.498**	−0.224**	−0.225**	−0.224**
business	0.601**	0.601**	0.601**	0.896**	0.897**	0.897**
labor	−1.506**	−1.506**	−1.506**	−1.658**	−1.657**	−1.657**
numrentedprop	0.643**	0.643**	0.643**			
numrentalbusiness				0.055	0.058*	0.057
otheractiv				0.212**	0.210**	0.210**
regul	0.038**	0.035**	0.035**	0.143**	0.132**	0.130**
residence	−0.007*	−0.006*	−0.006**	−0.006	−0.005	−0.005
bigcity	−0.034**	−0.034**	−0.034**	0.005	0.006	0.007
familyrespons	0.037**	0.037**	0.037**	−0.074*	−0.073*	−0.072*
age	−1.247**	−1.248**	−1.248**	−1.860*	−1.866*	−1.865*
age2	0.172**	0.172**	0.172**	0.257*	0.258*	0.258*
single	0.177**	0.177**	0.177**	0.012	0.012	0.011
cons	6.317**	6.318**	6.317**	7.759**	7.758**	7.755**
R^2	0.5181	0.5181	0.5181	0.631	0.631	0.631
No. observations	525,548	525,548	525,548	6.517	6.517	6.517
MR test (common trends)	3.981 (0.1366)			1.775 (0.4118)		

*indicates significance at 5%,

**at 1%.

Notes: Panel A shows the estimates when the dependent variable is R_R; that is, the weight of rental income in general taxable income. Panel B shows the estimates when the dependent variable is R_{BI685}; that is, the weight in general taxable income of income from vacation rental-related economic activities (in CNAE group 685).

Models 1 and 4 show the global effect of the intervention. Models 2 and 5 show the effect of the intervention in each year of the posttreatment period. Models 3 and 6 include the pretreatment period as a placebo, and show that the intervention did not have an effect before its implementation.

much is due to extending the treatment to a larger number of taxpayers.[10] However, given that these last two events took place, it would be reasonable to expect an increased coefficient during

[10] As we do not know what year each taxpayer receives the message and we do not have a data panel, we cannot carry out an analysis with variation in treatment timing (e.g., Callaway & Sant'Anna, 2021; or Goodman-Bacon, 2021).

the posttreatment period. To check this, in models 2 and 5 in Table 4, we interacted our variable of interest with dummies that captured each year of the posttreatment period, whose coefficients for R_R (*Tk*year2015, Tk*year2016*, and *Tk*year2017)* show that, as expected, response intensified over time. Although when comparing the growth of the response with the increasing intensity of the intervention, the marginal effect would appear to be dissipating, this conclusion cannot be drawn, as the increase in the number of warnings affected all landlords, not just those with tourist apartments. However, when we estimate R_{BI685} (model 5), taxpayers react significantly only in the last year of the observed period, probably reflecting the fact that business owners have only reacted to the intervention when they have seen the agency's ability to audit the compliance of the owners of vacation rental properties.

The above results for our variable of interest aggregate the behavior of very diverse taxpayers, so we cannot draw conclusions about which collectives reacted most strongly to the treatment, nor which reacted in the opposite way to that intended by the AEAT. However, this is essential for making these interventions as effective as possible. For this reason, we repeated the previous estimates, including the interaction of the variable of interest, *P*Tk*, with the different control variables that capture the characteristics, *X*, of the taxpayers. The result of this triple interaction (*P*Tk*X)* can be seen in Tables 5 and 6, showing that when vacation rental income is declared as "rent," R_R, the response to the treatment differs according to the characteristics of the taxpayer (Table 5), while when it is declared as business income, R_{BI685}, the response is hardly associated with these characteristics at all (Table 6).

When the taxpayer declares vacation rentals as "rent," R_R (Table 5), the self-employed or business owners, *business*, are the group reacting most intensely in a positive way to the treatment, as the weight of declared "rent" increases 28.3 percentage points over the mean of 3.2 (as indicated by the corresponding coefficients in Table 5).[11] These taxpayers, who have more instruments for concealing income and thus probably have more income from rental properties, perceive a real threat in the warning, as they now declare significantly more "rent" that was previously hidden. This may be because they perceive that the administration could be more interested in auditing them, as this is traditionally a tax-evading collective; besides, if evasion also applies to income other than rentals, the threat of the warning could be perceived more intensely, as the consequences of an audit would also be more serious.

There is also a strong response from taxpayers who have more rental properties, *numrentedprop* (10.4* 1.699 = 17.66 percentage points higher than the average of 1.3), and thus, are more likely to earn this type of income. As it is probable that the evader conceals more than just the rental of one property, the probability of detection would be greater for these subjects with several rental properties; and as the consequences of detection would be harsher, the perceived threat would also be greater. Unmarried persons also responded more intensely to the AEAT warnings (4.7 percentage points over the mean).

Although positive, the response is lower than average in regions with more owners of vacation apartments, *residence* (6.1 percentage points lower), probably because they believe that the administration cannot monitor all the properties.

This disaggregated analysis also allows us to identify that the response of some collectives to the intervention was the opposite to that desired—that is, with the same message, the signal that some taxpayers perceive is that AEAT does not have reliable knowledge of that income nor the

[11] When X_k is a dummy, the total effect of the intervention for subjects with the characteristic X_k will be the sum of the coefficients of *P*Tk* and *P*Tk*X*$_k$,; while the coefficient of the triple interaction must be multiplied by the average value of the variable X_k when this is continuous.

TABLE 5 Heterogeneity of the response for vacation rental income declared as rent, R_R

	mtr24	*mtr30*	*mtr37*	*income*	*business*	*labor*	*numrentedprop*	*regul*	*Residence*	*bigcity*	*familyrespons*	*age*	*single*
$P * T_k$	0.057**	0.062**	0.107**	0.060**	0.032**	0.233**	0.013*	0.061**	0.096**	0.059**	−0.655**	0.290**	0.046**
$P * T_k * X$	0.041**	−0.010	−0.122**	−0.000	0.283**	−0.256**	0.104**	−0.001	−0.061**	0.002	0.080*	−0.057**	0.047**
R2	0.5181	0.5181	0.5184	0.5181	0.5188	0.5195	0.5184	0.5181	0.5182	0.5181	0.5182	0.5181	0.5181

Note: To simplify, only the relevant coefficients are presented.

*indicates significance at 5%,

**at 1%.

TABLE 6 Heterogeneity of the response for vacation rental income declared as business income, R_{B685}

	Mtr24	*mtr30*	*Mtr37*	*income*	*business*	*labor*	*numrental-business*	*otheractiv*	*regul*	*residence*	*bigcity*	*familyrespons*	*age*	*single*
$P * T_k$	0.083*	0.082*	0.082*	0.092*	0.143*	0.049	0.132**	0.125*	0.027	0.071	0.075	−0.119	0.342	0.085
$P * T_k * X$	0.031	0.017	0.010	−0.124	−0.092	0.117	−0.42**	−0.105*	0.084*	0.029	0.115	0.023	−0.065	−0.001
R2	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631

Note: To simplify, only the relevant coefficients are presented.
*indicates significance at 5%,
**at 1%.

capacity to audit it, as suggested by Konda et al. (2020). In these cases, the message reduces the taxpayer's perceived probability of being detected. Specifically, the progressivity of the tax is an obstacle to bringing vacation rental income to light: to be concrete, the response to the treatment is negative for taxpayers with marginal tax rates of at least 37%, as it is 12.2 percentage points below the mean of 10.7. A similar result was obtained by Slemrod et al. (2001).

The response from employees, *labor*, is also negative, and thus, the opposite of what AEAT was hoping for, as it is 25.6 percentage points below the mean of 23.3. Employees are used to AEAT knowing in detail about their labor income, as it is subject to withholding, but they do not seem to feel threatened by the warnings. This may be due to not believing that they will be audited because of rental income, or they may believe that if they were to be audited, the rentals would not be discovered. This result would support the idea that deterrents appear to be more effective with traditional tax evaders (Hallsworth, 2014).

And the older taxpayers, *age*, also have the opposite reaction to that intended by the administration, with a coefficient 341 percentage points (5.7*59.92) below the average of 29.[12]

When the vacation rental is declared as business income, R_{BI685}, the response to the treatment is not usually associated with the taxpayers' characteristics (Table 5). Our results show that those who respond with the most positive intensity to the treatment live in autonomous communities that regulate vacation rentals, *regul*; while the response was negative among those with a greater number of vacation rental activities, *numrentalbusiness* as it was 44 percentage points (= 1.053*0.42) below the mean of 13.2.

4.1 | Robustness of the results

We have tested for the sensitivity of the results to the choice of the control groups, without finding any relevant change in the results. For this, we first replicated the estimates using propensity score matching. The aim was to reduce treatment assignment bias and imitate randomization, creating a sample of units in the treatment group that would be comparable to the sample of units in the control group. To do this, we matched a treated individual with the control individual most likely to participate in the program, given a series of observable characteristics. As suggested in Villa (2016), we did this implementing the Kernel-based propensity score matching diff-in-diff, following Heckman et al. (1998) and Leuven and Sianesi (2014). Table A.1 of the Annex shows that the DiD estimators obtained after matching, shown in the right-hand panel of the table, differ hardly at all from the original estimators (without matching) summarized in the left-hand panel of the same table.

In a second robustness exercise, we changed the construction of control groups. The results of these alternative estimates can be seen in Table A.2 of the Annex, where Panel A shows the estimates of R_R when the control group comprises all the recipients of nonvacation rental income, that is, including long-term residential use. Although this alternative control group is not optimal, as the landlords of long-term residential properties could also have received the AEAT warning, it does allow us to test the estimate's sensitivity to the choice of control group. Moreover, it must be realized that these landlords have previously been subjected to both, control measures, such as requiring tenants to include the ID number of the landlord in their IRPF returns, and incentives, such as introducing a deduction for the landlord and a tax credit for the tenant in IRPF. Panel

[12] De Neve et al. (2021) found deterrence messages are most effective for younger taxpayers, although Meiselman (2018) found the opposite result.

TABLE 7 Results of the estimates of the number of taxpayers declaring vacation rental income: Differences-in-differences method

	Panel A: Filers of R_R			*Panel B: Filers of R_{BI}*		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
P	0.098	0.111	0.122	0.041	0.058	0.086
Tk	−0.741**	−0.750**	−0.841**	0.967**	0.969**	0.838**
P * Tk	0.642**			0.297**		
Tk * year2013			0.160			0.162
Tk * year2014			0.107			0.261
Tk * year2015		0.499**	0.584**		0.213	0.343*
Tk * year2016		0.697**	0.784**		0.285*	0.423**
Tk * year2017		0.709**	0.797**		0.383**	0.528**
mtr24	0.350	0.321	0.315	0.474**	0.481**	0.467**
mtr30	0.584**	0.516*	0.491*	0.742**	0.750**	0.748**
income	−0.094	−0.103*	−0.105	−0.201	−0.189	−0.169
business	−2.152	−2.130	−2.160	−0.056	−0.053	−0.040
labor	0.052	0.071	0.077	0.076	0.084	0.091
numrentedprop	−0.449	−0.501*	−0.498			
numrentalbusiness				0.011	0.007	0.003
otheractiv				0.000	−0.025	−0.023
regul	−0.041	−0.079	−0.078	0.020	−0.010	−0.019
residence	−150,419**	−151,832*	−151,336*	139,896*	138,943*	139,958*
bigcity	0.070	0.069*	0.069*	−0.051	−0.051	−0.052
familyrespons	−1,036	−0.968	−0.981	0.076	0.076	0.075
age	168,562	156,392	160,190	−43,580**	−42,973**	−41,712**
age2	−20,435	−18,970	−19,435	5549**	5471**	5304**
single	0.317**	0.306*	0.306*	−0.072	−0.071	−0.065
pop	0.415	0.932	1.474	0.106	0.528	2.179
cons	−334,413	−316,385	−331,004	87,183*	80,552	56,863
R^2	0.93	0.93	0.93	0.80	0.80	0.80
No. observations	353	353	353	353	353	353
MR test (common trends)	1391 (0.49)			1896 (0.3894)		

*indicates significance at 5%,

**at 1%.

Notes: Panel A shows the estimates when the dependent variable is the number of taxpayers declaring rental income. Panel B shows the estimates when the dependent variable is the number of taxpayers declaring vacation rental-related economic activities in CNAE group 685 or 861.

Models 1 and 4 show the global effect of the intervention. Models 2 and 5 show the effect of the intervention in each year of the posttreatment period. Models 3 and 6 include the pretreatment period as a placebo, and show that the intervention did not have an effect before its implementation.

B shows the estimates of R_{BI685} when the control group comprises people performing any economic activity other than vacation rentals. The results of the baseline estimates are substantially maintained.

Another good way to test the robustness of our results is to analyze how "imputed income" has responded to the warning system set up by AEAT, given that during the time that the property is not rented out or attached to an economic activity, it accrues imputed income for which tax is payable. If, before the treatment, the owner had (improperly) self-reported imputed income for a property being rented out, after the intervention, imputed income should decrease while rent should increase.[13] To carry out this robustness test, we considered the same treatment and control groups as in the estimate of R_R. The results of this estimate are shown in Table A.3 of the Annex, where it can be seen that, in fact, taxpayers reacted to the intervention by reducing the weight of "imputed income." Also, the coefficient (response) became slightly stronger as the posttreatment period went on, in line with the observed increase in "rent."

Finally, we ran an alternative exercise in which we estimate the evolution of the weight of nonwage income in general taxable income, using a treatment group consisting of taxpayers who declare vacation rentals as "rent," and a control group of taxpayers who do not receive "rent." The results of this estimate, which can be seen in Table A.4 of the Annex, show that the weight of nonwage income grew more in the treatment group than in the control group.

4.2 | The extensive margin

As well as estimating the effect of the AEAT warning on the weight of declared vacation rental income (the intensive margin), we have also estimated the effect of this intervention on the number of taxpayers declaring this type of income (the extensive margin), which Figure 2 shows to be noticeable. To do this, we have again estimated the specification (1), using as dependent variable the number of taxpayers in each Spanish province (the local level of government below the region) declaring income k, that is, rent or business income. The observation unit i is therefore the province. The control variables were redefined to fit them to this estimate at the provincial level (see Table 1) and the population of the province, ***pop*** was added. All the continuous variables are again expressed in natural logarithms.

The results of the estimates are shown in Table 7, and show (columns (1) and (4)) that the intervention brought to light 64.2% taxpayers declaring vacation rental income as rent, and 29.7% taxpayers declaring business income from this type of rentals (in this case, regardless of whether the activity fell under CNAE group 685 or 861). Columns (2) and (5) in Table 7 also suggest that this recruitment of filers intensifies over time. These results are clearly higher than those obtained in the literature: for example, Bott (2019), Eerola et al. (2019), and Slemrod (2019) find the intervention increased the number of filers between 1% and 13%.

5 | CONCLUSIONS

In the 2015 IRPF campaign, as a measure to fight income tax evasion, the Spanish Tax Agency set up a warning system on the *Renta Web* program, informing the owners of properties offered

[13] It is also possible that some taxpayers would not declare imputed income before the treatment, and their response to the AEAT would be to improperly report imputed income instead of rental income.

for rental that it was aware of this circumstance. According to the Allingham–Sandmo–Yitzhaki model of tax evasion, with this action, the AEAT was trying to increase the taxpayer's subjective probability of any evasion being detected, with the purpose of leading them to voluntarily declare such income. But this could also have had the opposite effect, if taxpayers had interpreted AEAT's warning as a signal that AEAT was not able to audit these undisclosed incomes. In this paper, we have used the difference-in-differences technique to empirically analyze how that intervention affected tax compliance in a specific type of income: rentals of vacation apartments.

The obtained results reveal that the intervention mechanism was effective. Specifically, the weight of vacation rental income in general taxable income increased in the posttreatment period by at least 6% if it was declared as rent, and 8.5% if declared as business income. Meanwhile, the number of filers declaring vacation rental income in these two categories of income increased by 64.2% and 29.7%, respectively.

Also, the effectiveness of the measure increased over time, although we cannot know whether this was due to the growing number of individuals treated over time, the repetition of the intervention on the same taxpayers, or the features of the intervention itself: taxpayers received a warning; initially, some of them perceived that the probability of detection had not increased, and continued to conceal their income; over time, the repetition of the warning, audits being carried out, and their impact on other taxpayers, made them see that, in fact, the probability of evasion being detected had increased, and they decided to self-report this income.

In any case, the results suggest that as the tax agency's knowledge when planning its intervention was not complete (it only had clues indicating unreported rental income), the intervention was all the more successful, because without it, the cost of the audits would have been higher, and the outcome more uncertain.

Meanwhile, the disaggregated results of the estimates show that business owners, singles, and taxpayers who have more rental properties responded to the alerts most intensely and in the desired manner, when vacation rental is declared as rent. However, the AEAT warning system produced the opposite result to that desired among employees, taxpayers with high marginal tax rates, and older taxpayers. When the vacation rental is declared as business income, there was a greater positive effect in the autonomous communities that regulate vacation rentals, whereas the response was negative in regions with a greater number of vacation rental activities. For these reasons, AEAT should perhaps focus its attention on and establish deterrent measures for these collectives and regions.

To conclude, a simple action such as AEAT's warnings in the software used for filing tax returns, which our paper shows can be effective, could be a cheap and simple tool to fight tax evasion, even on other income and taxes. Its cost-effectiveness means it could also be considered in other, nontax areas.

Although the dynamics of the property market are complex, the increased tax compliance that seems to be associated with the warnings that AEAT sends to owners of properties offered as rentals could have some implications in that market. Data published by the Spanish Statistics National Institute (Instituto Nacional de Estadística, INE)[14] show an accelerated growth in the prices of vacation rentals in 2016 and 2017, when the AEAT warning campaign began. Those years also saw a significant increase in the estimated number of available vacation apartments. Although we cannot state that the price rises are exclusively or mainly due to increased tax compliance (as other relevant factors such as tourism demand must be considered), this rise may indicate

[14] "Apartamentos turísticos: encuesta de ocupación e índice de precios": See https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176962&menu=resultados&idp=1254735576863#!tabs-1254736195412.

that the owners of vacation properties affected by the AEAT warnings have passed on at least part of the cost of the tax to their customers in their prices. Meanwhile, the increase in the number of vacation apartments could be showing that the sharp rise in prices has probably attracted owners of former residential or other properties to the vacation rental market.[15] There is some empirical evidence of this reallocation of real estate, and also that the presence of vacation rentals in some cities and territories (such as Barcelona, Madrid, Valencia, and the Andalusian coast) has raised the sale price and rent of residential properties (see Pastor et al., 2022, which also surveys the literature).[16]

The price index of vacation apartments fell sharply in 2018 and 2019 (exacerbated in 2020 due to the COVID-19 pandemic). These years also saw a slight decrease in the number of available vacation apartments, from a maximum of 167,193 in 2017 to 163,964 in 2018. In addition to the adjustments occurring in the market, one of the factors that might have contributed to this change is the introduction, from 2018, of a new measure to combat evasion in vacation rentals: people or entities who act as intermediaries in letting homes for tourism purposes are now obliged to report the characteristics of the lets to the administration (Form 179): owner of the property, identification of the property, length of the let, amount of the rent, and so on.

However, although this dataset points toward the direction we have indicated, establishing the existence of empirical evidence requires a full causality analysis that would be beyond the scope of this paper.

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REFERENCES

Allingham, M., & Sandmo, A. (1972). Income tax evasion: A theoretical analysis. *Journal of Public Economics*, *1*(3–4), 323–338.

Alm, J. (2012). Measuring, explaining, and controlling tax evasion: Lessons from theory, experiments, and field studies. *International Tax and Public Finance*, *19*, 54–77.

Antinyan, A., & Asatryan, Z. (2020). Nudging for tax compliance: A meta-analysis. *CESifo Working Papers*, 8500.

Ariel, B. (2012). Deterrence and moral persuasion effects on corporate tax compliance: Findings from a randomized controlled trial. *Criminology*, *50*(1), 27–69.

Blumenthal, M., Christian, C. W., & Slemrod, J. (2001). Do normative appeals affect tax compliance? Evidence from a controlled experiment in Minnesota. *National Tax Journal*, *54*(1), 125–138.

[15] It has also attracted investment funds that have detected potential high returns: See RED2RED consultores (2017).

[16] All this may generate other cross-cutting effects related to the location of the tourist population in certain areas and the progressive expulsion of the resident population from these areas, which can lead to urban phenomena such as gentrification (Sorando & Ardura, 2016) and touristification (Red2Red Consultores, 2017), as well as generating significant negative externalities in terms of noise, dirt, and safety where there is a large floating population.

Bø, E., Slemrod, J., & Thoresen, T. O. (2015). Taxes on the Internet: Deterrence effects of public disclosure. *American Economic Journal: Economic Policy*, *7*(1), 36–62.

Boning, W. C., Guyton, J., Hodge, R., & Slemrod, J. (2020). Heard it through the grapevine: The direct and network effects of a tax enforcement field experiment on firms. *Journal of Public Economics*, *190*, 104261.

Bott, K. M., Cappelen, A. W., Sørensen, E., & Tungodden, B. (2019). You've got mail: A randomized field experiment on tax evasion. *Management Science*, *66*(7), 2801–2819.

Brockmeyer, A., Smith, S., Hernandez, M., & Kettle, S. (2019). Casting a wider tax net: Experimental evidence from costa rica. *American Economic Journal: Economic Policy*, *11*(3), 55–87.

Callaway, B., & Sant'anna, P. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, *225*(2), 200–230.

Castro, L., & Scartascini, C. (2015). Tax compliance and enforcement in the pampas: Evidence from a field experiment. *Journal of Economic Behavior & Organization*, *116*(C), 65–82.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates Publishers.

Coleman, S. (1997). Income tax compliance: A unique experiment in Minnesota. *Government Finance Review*, *13*, 11–15.

De Neve, J. E., Imbert, C., Spinnewijn, J., Tsankova, T., & Luts, M. (2021). How to improve tax compliance? Evidence from population-wide experiments in Belgium. *Journal of Political Economy*, *129*(5), 1425–1463.

Del Carpio, L. (2014). Are the neighbors cheating? Evidence from a social norm experiment on property taxes in Peru. http://scholar.princeton.edu/sites/default/files/Are_the_neighbors_cheating_Apr2014_0.pdf

Domínguez-Barrero, F., López-Laborda, J., & Rodrigo-Sauco, F. (2015). El hueco que deja el diablo: una estimación del fraude en IRPF con microdatos tributarios. *Revista de Economía Aplicada*, *68*, 81–102.

Domínguez-Barrero, F., López-Laborda, J., & Rodrigo-Sauco, F. (2017). Tax evasion in Spanish personal income tax by income sources, 2005–2008: From the synthetic to the dual tax. *European Journal of Law and Economics*, *44*(1), 47–65.

Dwenger, N., Kleven, H., Rasul, I., & Rincke, J. (2016). Extrinsic and intrinsic motivations for tax compliance: Evidence from a field experiment in Germany. *American Economic Journal: Economic Policy*, *8*(3), 203–232.

Dwenger, N., & Treber, L. (2022). Shaming for tax enforcement. *Management Science*, *68*(11), 8202–8233.

Eerola, E., Konosen, T., Kotakorpi, K., Lyytikäinen, T., & Tuimala, J. (2019). *Tax compliance in the rental housing market: Evidence from a field experiment*. Discussion paper 126, Aboa Centre for Economics.

EY. (2015). *Alojamiento turístico en viviendas de alquiler: Impactos y retos asociados*. https://www.exceltur.org/wp-content/uploads/2015/06/Alojamiento-tur%C3%ADstico-en-viviendas-de-alquiler-Impactos-y-retos-asociados.-Informe-completo.-Exceltur.pdf

Fredriksson, A., & Magalhaes de Oliveira, G. (2019). Impact evaluation using difference-in-differences. *RAUSP Management Journal*, *54*(4), 519–532.

Gangl, K., Torgler, B., Kirchler, E., & Hoffmann, E. (2014). Effects of supervision on tax compliance: Evidence from a field experiment in Austria. *Economic Letters*, *123*(3), 378–382.

Gertler, P. J., Martínez, S., Premand, P., Rawlings, L., & Vermeerrsch, C. (2017). *Impact evaluation in practice*. World Bank.

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, *225*, 254–277.

Hallsworth, M. (2014). The use of field experiments to increase tax compliance. *Oxford Review of Economic Policy*, *30*(4), 658–679.

Hallsworth, M., List, J. A., Metcalf, R. D., & Vlaev, I. (2017). The behavioralist as tax collector: Using natural field experiments to enhance tax compliance. *Journal of Public Economics*, *148*, 14–31.

Hasegawa, M., Hoopes, J., Ishida, R., & Slemrod, J. (2013). The effect of public disclosure on reported taxable income: Evidence from individuals and corporations in Japan. *National Tax Journal*, *66*(3), 571–608.

Hasseldine, J., Hite, P., James, S., & Toumi, M. (2007). Persuasive communications: Tax compliance enforcement strategies for sole proprietors. *Contemporary Accounting Research*, *24*(1), 171–94.

Heckman, J., Ichimura, H., & Todd, P. (1998). Matching as an econometric evaluation estimator. *The Review of Economic Studies*, *65*(2), 261–294.

Hoopes, J., Robinson, L., & Slemrod, J. (2018). Public tax return disclosure. *Journal of Accounting and Economics*, *66*(1), 142–162.

Kleven, H. J., Knudsen, M. B., Kreiner, C. T., Pedersen, S., & Saez, E. (2011). Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark. *Econometrica*, *79*(3), 651–692.

Konda, L., Patel, E., & Seegert, N. (2020). Tax enforcement and the intended and unintended consequences of information disclosure. Available at SSRN: https://ssrn.com/abstract=3592114 or http://doi.org/10.2139/ssrn.3592114)

Leuven, E., & Sianesi, B. (2014). *PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing*. Statistical Software Components S432001, Boston College Department of Economics.

Magro, V. (2017). Sobre la necesaria unificación en la regulación legal del alquiler vacacional y normativa autonómica. *Revista de Jurisprudencia*, 1, December.

McGraw, K., & Scholz, J. T. (1991). Appeals to civic virtue versus attention to self–interest: Effects on tax compliance. *Law and Society Review*, *25*(3), 471–498.

Meiselman, B. (2018). Ghostbusting in Detroit: Evidence on nonfilers from a controlled field. *Journal of Public Economics*, *158*, 180–193.

Mora, R., & Reggio, I. (2015). didq: A command for treatment-effect estimation under alternative assumptions. *The Stata Journal*, *15*(3), 796–808.

Pastor, J. M., Morillas, F., Morala, J. F., & Serrano, L. (2022). *El impacto de los apartamentos turísticos en el precio de los alquileres en Valencia: Estudio comparado con Madrid y Barcelona*. Documento de Trabajo DT 05/2022, Càtedra Model Econòmic Sostenible València I Entorn. https://www.uv.es/mesval/Informes-2022/MESVAL_2022_DT_05-AIRBNB.pdf

Pomeranz, D. (2015). No taxation without information: Deterrence and self-enforcement in the value added tax. *American Economic Review*, *105*(8), 2539–69.

RED2RED consultores. (2017). *Análisis del impacto de las viviendas de uso turístico en el distrito centro*. Ayuntamiento de Madrid. https://www.madrid.es/UnidadesDescentralizadas/UDCMedios/noticias/2017/05Mayo/05viernes/Notasprensa/ficheros/Informe_final_5_mayo%20vivendas%20uso%20tur%C3%ADstico%20(1).pdf

Schacht, A., Bogaerts, K., Bluhmki, E., & Lesaffre, E. (2008). A new nonparametric approach for baseline covariate adjustment for two-group comparative studies. *Biometric*, *64*(4), 1110–1116.

Schwartz, R., & Orleans, S. (1967). On legal sanctions. *University of Chicago Law Review*, *34*, 274–300.

Slemrod, J. (2019). Tax compliance and enforcement. *Journal of Economic Literature*, *57*(4), 904–954.

Slemrod, J., Blumenthal, M., & Christian, C. (2001). Taxpayer response to an increased probability of audit: Evidence from a controlled experiment in Minnesota. *Journal of Public Economics*, *79*(3), 455–483.

Slemrod, J., Rehman, O. U., & Waseem, M. (2022). How do taxpayers respond to public disclosure and social recognition programs? Evidence from Pakistan. *The Review of Economics and Statistics*, *104*(1), 116–132.

Stock, J., & Watson, M. (2019). *Introduction to econometrics.* Pearson Education, Inc.

Sorando, D., & Ardura, A. (2016). *First we take Manhattan. La destrucción creativa de las ciudades*. La catarata.

Yitzhaki, S. (1974). A note on 'Income tax evasion: a theoretical analysis. *Journal of Public Economics*, *3*(2), 201–202.

Villa, J. M. (2016). diff: Simplifying the estimation of difference-in-differences treatment effects. *Stata Journal*, *16*, 52–71.

Wenzel, M., & Taylor, N. (2004). An experimental evaluation of tax-reporting schedules: A case of evidence-based tax administration. *Journal of Public Economics*, *88*, 2785–99.

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APPENDIX

TABLE A.1 Sensitivity of the estimate to the use of propensity score matching

	Without matching			After matching		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Panel A: R_R						
P * Tk	0.060**			0.061**		
Tk * year2013			−0.005			−0.003
Tk * year2014			−0.008			−0.008
Tk * year2015		0.045**	0.040**		0.047**	0.043**
Tk * year2016		0.053**	0.048**		0.054**	0.050**
Tk * year2017		0.077**	0.072**		0.077**	0.073**
	Model 4	**Model 5**	**Model 6**	**Model 4**	**Model 5**	**Model 6**
Panel B: R_{BI685}						
P * Tk	0.085*			0.091**		
Tk * year2013			0.087			0.081
Tk * year2014			0.082			0.070
Tk * year2015		0.043	0.102		0.049	0.092
Tk * year2016		0.079	0.138**		0.085*	0.129*
Tk * year2017		0.122**	0.182**		0.129**	0.171**

Note: To simplify, only the relevant coefficients are presented. The left-hand panel shows the differences-in-differences estimators of Table 4.

* indicates significance at 5%, ** at 1%.

TABLE A.2 Sensitivity of control group estimates: Differences-in-differences method

	Panel A: R_R			***Panel B: R_{BI685}***		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
P	−0.064**	−0.064**	−0.064**	0.014**	0.014**	0.014**
Tk	−0.331**	−0.331**	−0.328**	−0.182**	−0.182**	−0.253**
P * Tk	0.046**			0.100**		
Tk * year2013			−0.002			0.109
Tk * year2014			−0.007			0.095
Tk * year2015		0.027**	0.024**		0.039	0.111*
Tk * year2016		0.038**	0.035**		0.091**	0.162**
Tk * year2017		0.068**	0.065**		0.158**	0.229**
mtr24	−0.968**	−0.968**	−0.968**	−0.070**	−0.070**	−0.070**
mtr30	−0.983**	−0.983**	−0.983**	−0.185**	−0.185**	−0.185**
mtr37	−1.202**	−1.202**	−1.202**	−0.133**	−0.133**	−0.133**

(Continues)

TABLE A.2 (Continued)

	Panel A: R_R			*Panel B: R_{BI685}*		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
income	−0.533**	−0.533**	−0.533**	−0.031**	−0.031**	−0.031**
business	0.736**	0.735**	0.735**	1.063**	1.063**	1.063**
labor	−1.418**	−1.418**	−1.418**	−1.488**	−1.488**	−1.488**
	0.559**	0.559**	0.558**			
numrentedprop						
				0.122**	0.122**	0.122**
numrentalbusiness						
otheractiv				0.123**	0.122**	0.122**
regul	0.041**	0.040**	0.040**	0.019**	0.019**	0.019**
residence	0.013**	0.013**	0.013**	0.008**	0.008**	0.008**
bigcity	0.050**	0.050**	0.050**	0.027**	0.027**	0.027**
	0.086**	0.087**	0.087**	−0.057**	−0.057**	−0.057**
familyrespons						
age	−1.552**	−1.552**	−1.552**	0.084	0.084	0.084**
age^2	0.216**	0.216**	0.216**	−0.004	−0.004	−0.004**
single	0.190**	0.190**	0.190**	−0.008**	−0.008**	−0.008
cons	6.257**	6.257**	6.257**	3.815**	3.814**	3.814**
R^2	0.577	0.577	0.577	0.6022	0.6022	0.6022
Obser	1388.763	1,382,805	1,382,805	1,116,796	1,116,796	1,116,796
MR test	5.493 (0.0641)			1.775 (0.4118)		

* indicates significance at 5%, ** at 1%.

Note: In Panel A, the control group comprises the recipients of rental income other than vacation rentals, and in Panel B, those performing any economic activity other than vacation rentals.

Models 1 and 4 show the global effect of the intervention. Models 2 and 5 show the effect of the intervention in each year of the posttreatment period. Models 3 and 6 include the pretreatment period as a placebo, and show that the intervention did not have an effect before its implementation.

TABLE A.3 Results of the estimates of imputed income: Differences-in-differences method

	Imputed income	***Imputed income***
P	0.191**	0.191**
Tk	−0.104**	−0.104**
P * Tk	−0.097**	
Tk * year2015		−0.093**
Tk * year2016		−0.090**
Tk * year2017		−0.106**
mtr24	−0.983**	−0.983**
mtr30	−1.170**	−1.170**
mtr37	−1.457**	−1.457**
income	−0.259**	−0.259**
business	1.212**	1.212**

(Continues)

TABLE A.3 (Continued)

	Imputed income	*Imputed income*
labor	−1.091**	−1.091**
numprop	1.128**	1.128**
regul	0.017**	0.018**
residence	0.006	0.006
bigcity	0.053**	0.053**
familyrespons	0.015*	0.014*
age	0.505	0.505
age^2	0.003	0.003
single	0.055**	0.055**
cons	−0.944	−0.943
R^2	0.4885	0.4885
Obser	389,194	389,194

* indicates significance at 5%, ** at 1%.

TABLE A.4 Alternative estimates for vacation rental income declared as rent

	Model 1	**Model 2**	**Model 3**
P	−0.022**	−0.022**	−0.022**
Tk	−0.009**	−0.009**	−0.016**
P * Tk	0.019**		
Tk * year2013			0.011
Tk * year2014			0.010
Tk * year2015		0.016**	0.023**
Tk * year2016		0.024**	0.031**
Tk * year2017		0.016**	0.023**
mtr24	−0.666**	−0.666**	−0.666**
mtr30	−0.334**	−0.334**	−0.333**
mtr37	−0.147**	−0.147**	−0.147**
income	−0.174**	−0.174**	−0.174**
business	0.132**	0.132**	0.132**
labor	−1.823**	−1.823 **	−1.823**
numrentedprop	−0.041**	−0.041**	−0.041
numrentalbusiness			
otheractiv			
regul	−0.023**	−0.023**	−0.023**
residence	−0.014**	−0.014**	−0.014**

(Continues)

TABLE A.4 (Continued)

	Model 1	Model 2	Model 3
bigcity	−0.055**	−0.055**	−0.055**
familyrespons	0.023**	0.023**	0.023**
age	0.813**	0.813**	0.813**
age²	−0.120**	−0.120**	−0.120**
single	−0.015**	−0.015**	−0.015**
cons	3021**	3021**	3021**
R^2	0.675	0.675	0.675
Obser	662,138	662,138	662,138
MR test		3.22 (0.1999)	

* indicates significance at 5%, ** at 1%.

Note: The estimated dependent variable is the weight of non-labor income in general taxable income. The treatment group comprises taxpayers declaring vacation rentals as rental income, and the control group those who do not declare rental income.

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