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THE IMPACT OF TAX AUDITS ON SUBSEQUENT TAX REPORTING

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Abstract

The crisis due to the Covid-19 pandemic will surely have repercussions in world economies and their public finances, and it has already led governments worldwide to take exceptional measures to support taxpayers. Therefore, new and unforeseen challenges may lie ahead for the main enforcement policy instruments of governments - tax audits.

Following the growing trend of empirical research concerning tax compliance and enforcement, this thesis aims to provide a contribution to the understanding of the effects of tax audits on subsequent tax compliance. We tested whether this effect is consistent with the well-known standard economic model of tax compliance, which predicts that tax compliance depends on evasion detection probability and penalty.

Following a strategy based on the difference-in-differences (DID) comparison, which is one of the most common designs used to evaluate causal effect of policy interventions, we compared firms who had experienced a tax audit (treatment group) with firms who had not been subjected to a tax audit (control group). This study focuses on tax audits conducted by the tax authority during its ordinary auditing activity using an innovative approach based on surveys, which made it possible to obtain perceptions directly from firms.

The main results are in line with traditional theory of tax compliance. We found evidence that tax audits have a positive effect on tax compliance; however, this effect could be limited in time. Five years after the tax audit, it seems that there is no further effect on tax compliance.

Furthermore, the benchmark standard economic model of tax compliance seems to corroborate that tax audits are key deterrent instruments available to governments. Despite this evidence, it might not fully explain tax compliance nowadays. This may be due to information reported by third parties or by non-deterrence drives like the moral and civic duty to pay taxes.

Keywords: Target Tax Audit, Random Tax Audit, Tax Compliance, Tax Evasion.

Resumo

A crise devido à pandemia da Covid-19 poderá ter repercussões nas economias e nas finanças públicas, tendo já levado a governos em todo o mundo a tomarem medidas excecionais para apoiar os contribuintes. Novos e imprevistos desafios podem estar à frente do principal instrumento de promoção do cumprimento tributário à disposição dos governos, que são as auditorias tributárias.

Seguindo a tendência crescente dos estudos empíricos sobre o cumprimento tributário, esta tese tem como objetivo contribuir para a compreensão dos efeitos das auditorias tributárias sobre a cumprimento tributário subsequente. Testamos se este efeito é consistente com o conhecido modelo base da teoria fiscal, que prevê que a conformidade tributária depende da probabilidade de deteção da evasão fiscal e as penalidades associadas.

Seguindo uma estratégia baseada na comparação das diferença-das-diferenças, que é uma das técnicas mais comuns para avaliar o efeito causal das intervenções políticas, comparamos empresas que foram alvo de uma auditoria tributária (grupo de tratamento) com empresas que não foram sujeitas a auditoria tributária (grupo de controlo). Este estudo centra-se nas auditorias tributárias realizadas pela autoridade tributária no âmbito da sua atividade normal de auditoria, com uma abordagem inovadora baseada em inquéritos, que permitiu obter perceções diretamente das empresas.

Os principais resultados estão de acordo com a teoria tradicional do cumprimento tributário. Nós encontramos evidências de que as auditorias tributárias têm um efeito positivo sobre o cumprimento tributário. No entanto, este efeito pode ser limitado no tempo. Cinco anos após a auditoria parece que não há efeito sobre o cumprimento tributário.

Apesar de não explicar plenamente o cumprimento tributário nos nossos dias, o que pode ser devido a informações reportadas por terceiros ou por fatores não-económicas como o dever moral ou cívico, esse modelo parece corroborar que as auditorias tributárias são um dos principais instrumentos promoção do cumprimento tributário disposição dos governos.

Palavras-chave: Auditoria Tributária, Auditoria Tributária Aleatória, Cumprimento tributário, Evasão Fiscal.

Over and over again courts have said that there is nothing sinister in so arranging one's affairs as to keep taxes as low as possible. Everybody does so, rich or poor, and all do right, for nobody owes any public duty to pay more than the law demands;

taxes are enforced exactions not voluntary contributions. To demand more in the name of morals is mere cant.

Commissioner v. Newman, 159 F.2d 848, 851 (2d Cir. 1947)

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1. Introduction

Governments, through tax authorities, use tax audits as the main instrument to promote tax compliance, with particular interest since the financial crisis of 2008 started a period of large deficits in several countries including Portugal. Nowadays, the health crisis due to the Covid-19 pandemic will have important repercussions in EU economies and their public finances so new and unforeseen challenges lie ahead.

In general, firms pay taxes for years so it is important to understand the long-term impact of tax audits. The collection of taxes is the most visible and direct effect of a tax audit, since it contributes to tax compliance in the year of inquiry if non-compliance is detected. Besides this first effect, which is simple to measure, a second effect related to the future behavior of firms is also expected.

Indeed, there are indirect effects that also influence firms' lives, although these are more challenging to observe. These effects can be sorted in two ways: deterrence and spillover effects. Deterrence effects relate to variations in the future behavior of taxpayers (firms) subjected to a tax audit, also known as the corrective/preventive effect or the direct deterrent effect as mentioned by Gemmell and Ratto (2012, p. 52), while spillover effects relate to the impact of a tax audit on the behavior of other taxpayers (Slemrod, 2016). This study focuses on the analysis of deterrence effects of tax audits.

To assess the future behavior of the audited firms, we use a benchmark economic model of tax compliance developed by Allingham and Sandmo (1972). This model has been tested several times over the past decades (Perez-Truglia et al., 2019; Slemrod, 2007), and predicts that tax compliance depends on the probability of tax evasion detection and penalty. In other words, firms choose the level of tax compliance according to the likelihood of being caught. It is a trade-off between lower tax burden and penalties, if caught.

However, empirical studies show that tax compliance is high in sophisticated tax systems despite very low audit probabilities and modest penalties, which signals some inconsistencies in this model. In addition, some social scientists argue that the standard economic model of tax compliance does not address important elements of the tax evasion

decision, such as willingness to comply, tax morale or even behavioral factors (Slemrod, 2018).

Actually, empirical evidence on the effects of tax audits has found contradictory results. On the one hand, taxpayers may assume that the probability of being audited a second time is low, a phenomenon known as a "bomb-crater effect[1]," that means that taxpayers are less likely to comply in the following years. In this way, DeBacker et al. (2015b) concluded that, unlike common expectations, tax audits may increase subsequent corporate misbehaviour.

On the other hand, taxpayers can review their probability of tax evasion being detected and punished, which may lead to more tax compliance in the following years after a tax audit. For instance, Advani et al. (2015) found that tax auditing led to an increase of reported income. In sum, the future firms' behavior after a tax audit is unclear.

Therefore, the purpose of this study is to understand variations in firms' behaviour following tax audits. Our main objective is to test whether the tax behaviour of small and medium-sized firms, which are more sensitive to the threat of a tax audit, is consistent with the deterrence model.

We find that our study is a novelty in Portugal, since we have no knowledge of similar studies. Even in international terms, where there is a large amount of literature on tax compliance, this specific topic of the effect of tax audits has still been little studied although it is growing. One of the main reasons for this scarcity of literature is the lack of tax data.

To perform our study on this recent strand of literature on the effects of tax audits, we used a difference-in-difference strategy, which has become one of the most common designs used to assess the causal effect of political interventions. Further, we chose a sample of small and medium firms that may generate different tax compliance behaviors instead of individuals taxpayers who are most studied (DeBacker et al., 2015a). Indeed,

[1] The concept is believed to have originated during the bombardments of World War I, where soldiers would take shelter in bomb craters in the faith that it was hard for a bomb to fall in the same place twice.

this type of taxpayer is less studied and the results in the literature are contradictory (DeBacker et al., 2015b; Mazzolini et al., 2017).

Also, in a study on the behavior of large firms in Spain which are followed by a special unit of the tax authority as in Portugal, it was suggested that this special monitoring should be extended to small firms. This study concludes that firms are strategically grouped below the threshold to avoid stricter tax enforcement (Almunia & Lopez-Rodriguez, 2018).

Finally, this study is not part of any tax experiment. On the contrary, the reaction of firms was assessed using real experience with the tax authority, when an ordinary tax audit was carried out. This study reflects the real context in which the operations were carried out, without any manipulation.

We measured the tax audit effect on tax compliance based on financial data while also using survey data. In others words, we used information from secondary sources (financial statements) and primary sources (survey-based) inspired by the experience of other tax authorities (for example from Canada) and publications that use surveys to collect tax data (Graham et al., 2017). This study is innovative in nature since it results from the combination of several approaches that were adapted to the specific reality of a country. It should be noted that each country has its own tax design, which is often complex and limits international comparisons (Slemrod, 2018) or simple replications of studies.

We selected a survey-based research model because it is more adequate for sensitive issues, like tax avoidance, and still allows access to long distance, large number of firms and generates quantitative data for statistical analysis. Another advantage of the survey is getting a direct perception about the motivation of managers, which is more difficult to obtain through quantitative studies.

In regards to limitations, to get honest answers about dishonest behaviour is a huge challenge and presents a drawback on survey-based studies (Mascagni, 2018). To address these concerns, we adopted an indirect approach to capture tax behaviour (Gërxhani, 2007) that targets firms with a subtle difference from other surveys: it is not anonymous and respondents could clarify issues that may come up while completing the survey. Despite these concerns, we anticipated a low response rate.

In sum, our study aims to contribute to the understanding of tax audits on subsequent tax compliance by directly asking audited taxpayers; this is an understudied subject, though it may be relevant to determine the optimal extent of tax enforcement and raise awareness to the importance of tax risk management on reporting frameworks. We tested whether the audited firms' reaction was consistent with the standard economic model of tax compliance and we found evidence that tax audits have a positive effect on tax compliance.

The results found are in line with the standard economic model of tax compliance (D'Agosto et al., 2018). Despite not fully explaining tax compliance, this model continues to prove that tax audits are the main deterrent instrument available to governments. However, in certain contexts the alternative approach to deterrence model, known as risk-as-feelings, could explain others factors that influence tax compliance (Perez-Truglia et al., 2019).

The rest of this thesis is organized as follows: Chapter 2 presents the literature review; Chapter 3 describes the theoretical framework and model of analysis; Chapter 4 presents the research design and methodology; Chapter 5 provides results; Chapter 6 provides discussion while Chapter 7 concludes.

2. Literature Review

The standard economic model of tax compliance, also known as the deterrence model, predicts that tax compliance depends on the evasion detection probability and penalty (Allingham & Sandmo, 1972). Following this seminal paper there has been a large amount of literature that addresses tax compliance and enforcement (Slemrod, 2019).

In general, literature can be split into three major fields: the most recent explores tax experiments, another explores microdata from individual taxpayers, and finally there is a field that explores aggregate data. This study is within the scope of specific deterrence papers that study the long-term effects of tax audits on audited taxpayers meaning that it belongs to the branch of literature that relies on microdata but is inspired by the latest tax experiments (Pomeranz & Vila-Belda, 2019).

In the following points, we first make a short review of the tax experiments, which have gained notoriety with some large-scale experiences in collaboration with tax authorities. Next, we make a brief review of the deterrent effects of tax audits, where our study fits, as well as provide some definitions to avoid semantic confusions. We conclude by describing possible contextual issues.

2.1 Tax experiments

Tax experiments have progressively moved from the lab to the field because new methods have been developed and more data is available. This progress has permitted important advances in experimental literature on tax compliance although the number of published studies remains small (Mascagni, 2018) which is basically due to the lack of real field data.

However, there are some exceptions. For instance, Perez-Truglia et al. (2019) conducted a large-scale field experiment with over 20,000 small and medium sized firms in collaboration with Uruguay’s tax authority to test the canonical model by Allingham and Sandmo (1972). These authors' findings are consistent with an alternative model, risk-as-feelings, in which letters sent to firms with generic information about tax audit generates emotions (fear) that can lead to a less rational tax decision-making process. This study also suggested some inconsistencies in fundamental assumptions of the deterrent model.

Further, a large natural field experiment was conducted in the UK using administrative data from more than 200,000 individuals in collaboration with the United Kingdom's tax authority (Hallsworth et al., 2017). It evaluated the effect of social norms and public goods with messages on tax compliance. One message sent to taxpayers in standard envelopes from the tax authority was: "Nine out of ten people pay their taxes on time."

Finally, another field experiment performed with data from Denmark's tax authority was pioneering in this area through the use of tax experiments to assess taxpayer behavior, randomly chosen, based on threatening tax audit letters (Kleven et al., 2011). They found that tax audits led to an increase in report income, although taxpayers were influenced by non-economic reasons too, which may contradict the deterrent model.

However, we must be cautious when extending these conclusions to the general population as tax authority resources are scarce. Further, Kleven et al. (2016) suggest that third-party information improves tax enforcement which is more in line with the assumptions of the deterrence model.

In sum, these kinds of studies suggest that tax authorities can increase compliance with negligible costs and they show inconsistencies between the standard economic model of tax compliance and the observed tax compliance. This is primarily related to the importance of non-monetary motivations for tax compliance such as civic duty or tax morale.

The growing number of large-scale fields tax experiments has been criticized for not being universal, but they have exposed some inconsistencies of the deterrence model. In addition, these studies suggest that sending letters with information on tax audits may increase tax compliance at a low cost to the tax authority.

Despite the influence of tax experiments literature described above, our research fits within the investigation studies on the effect of tax audits on tax compliance (specific deterrence) which are discussed next.

2.2 Specific deterrent effects of tax audits

An increasing number of investigations have been studying the impact of an audit threat (general deterrence), but also the effect of actually being audited (specific deterrence). However, these studies have been performed mainly on high-income countries (Pomeranz & Vila-Belda, 2019). A recent empirical contribution to this growing literature using data from small businesses in Italy shows a positive effect on tax compliance in line with the deterrence model (D'Agosto et al., 2018).

Another paper studied the effect of tax audits over a period of 10 years (DeBacker et al., 2015b) and concluded that audited firms tend to pay less taxes. Firms increase their tax aggressiveness by lowering the effective tax rate in the first few years after being audited which they later decrease progressively thus leading to a negative and U-shaped impact of tax audits on subsequent tax payments. These main findings are contrary to common expectations, namely our deterrence model, and call for a reassessment of the theory and policy of legal enforcement.

Another study from the United Kingdom, Gemmell and Ratto (2012) investigated individual and business changes in tax compliance behavior when responding to random tax audits. The study shows that behavior depends on the outcome of the tax audit. For example, those who were found to be noncompliant increased their tax compliance. Although this study used a small sample, the results found seem to be important, namely for the separation of taxpayers by level of tax aggressiveness. In our research, we closely follow the approach used in this study.

Finally, Niu (2011) shows a positive association between voluntary compliance and tax audits. Their findings of audited firms report a higher sales growth rate in the year of the audit than that of non-audited firms. These findings suggest that the impact of a tax audit goes beyond tax audit corrections which is also the object of this research.

Moreover, Niu (2011) focused on a particular sector of activity, food services and drinking establishments in New York which used a dependent variable (reported sales and some variations, such as difference or growth rate, of the reported sales). This seemed appropriate to measure tax compliance despite the existence of other alternatives as described in the next section. We also explored this measure of tax compliance. Next, we develop this subject further.

2.3 Measurement of tax compliance/aggressiveness

An important concern in empirical literature on tax compliance is related to definitions and measurements because there are no universally accepted concepts. The terms mean different things to different people (Hanlon & Heitzman, 2010).

The concept of tax compliance is based on the social contract between citizens and the state. Nevertheless, taxpayers may be tax aggressive by either avoiding or evading. The distinction between tax avoidance and tax evasion depends on the legality of the taxpayer's avoidance activities. Tax avoidance, according to the study of Dyreng et al. (2008), reflects all the transactions that have any effect on the explicit tax burden of firms.

Indeed, empirical analysis faces challenges in defining concepts. Slemrod and Weber (2012) suggested that the credibility revolution has not fully reached the empirical analysis of tax evasion, because serious measurement problems affect the empirical analysis given the nature of the object. The next table illustrates this reality.

Table 1. Tax compliance measures I

Author (s)	Tittle	Journal	Dependent variable	Proxy
Perez-Truglia et al. (2019).	Tax Audits as Scarecrows: Evidence from a Large-Scale Field Experiment (Uruguay).	Paper presented at the 112th Annual Conference on Taxation. National Tax Association	Subsequent tax payments. Ex: Value-added tax (VAT) payments.	Tax compliance.
D'Agosto et al. (2018).	The Effect of Audit Activity on Tax Declaration: Evidence on Small Businesses in Italy.	Public Finance Review	The value of net production (VNP) in logarithm.	Tax compliance.
Mazzolini et al. (2017).	The deterrence effect of real-world operational tax audits (Italy).	University of Milan Bicocca Department of Economics, Management and Statistics Working Paper(359)	Reported income obtained from self-employment and from sole proprietorships.	Tax compliance.
Hallsworth et al. (2017)	The behavioralist as tax collector: Using natural field experiments to enhance tax compliance (UK).	Journal of Public Economics	Pay tax.	Tax compliance.

Recent studies have started using some variants of paid taxes to measure the effect of the intervention (tax audit). For instance, Hallsworth et al. (2017) argued that the focus on payment of taxes helps to decrease measurement complications. However, this type of study is only possible with the collaboration of the tax authority that provides the tax data, which is not a recurring situation in most cases, despite its recent increase.

In general, tax literature focuses on honest declarations of income. The dependent variable is often the amount of tax declared as a proxy for compliance. The next table shows more examples.

Table 2. Tax compliance measures II

Author (s)	Tittle	Journal	Dependent variable	Proxy
DeBacker et al. (2015b)	Legal enforcement and corporate behavior: An analysis of tax aggressiveness after an audit (US).	The Journal of Law and Economics	Corporate effective tax rate (ETR). Twelve Measures of Effective Tax Rate.	Tax compliance; Corporate tax avoidance.
DeBacker et al. (2015a)	Once bitten, twice shy? The lasting impact of IRS audits on individual tax reporting (US).	Journal of Financial Economics	Taxable Income.	Tax compliance.
Advani et al. (2015)	How long-lasting are the effects of audits?(UK)	Tax Administration Research Centre	Reported tax liability	Tax compliance.
Gemmell, N., & Ratto, M. (2012).	Behavioral responses to taxpayer audits: evidence from random taxpayer inquiries (UK).	National Tax Journal	Declared tax (including National Insurance Contributions).	Tax compliance.
Kleven et al. (2011)	Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark.	Econometrica	Total Income Reported.	Tax compliance.
Niu, Y. (2011)	Tax audit impact on voluntary compliance (US).	Journal of Economic and Social Measurement	Reported sales revenue.	Voluntary tax compliance.
Hanlon & Heitzman, 2010.	A review of tax research.	Journal of Accounting and Economics	Book-tax differences; ETR; Tax shelter Activity; Marginal tax rate.	Tax avoidance.

Indeed, there are several tax compliance measures. For instance, The ETR that results from tax expense divided by a pre-tax income (Armstrong et al., 2012). When it is lower, it can be a predictor of better tax planning carried out within the legal parameters or may be the result of practice related to tax evasion. A related approach was used by DeBacker et al. (2015b) to examine the impact of tax audits on corporate taxpaying behavior. However, the limitations of the financial statements to estimate the real taxation of firms has been highlighted by several authors (Hanlon & Heitzman, 2010).

In sum, to evaluate subsequent tax compliance following a tax audit, we can use several measures such as ETR's variants, reported sales or some other variants, such as the difference or growth rate of the reported sales (Niu, 2011). There are no perfect measures and each one may better capture a certain effect. In our study, we took into account the contextual issues we explore next.

2.4 Contextual issues

According to a report by the Organization for Economic Co-operation and Development (OECD), most taxpayers comply with their tax obligations, but some are determined not to. This conduct is associated with tax evasion that may defraud tax revenue and create an unlevel playing field with compliant taxpayers OECD (2017b). To deal with this phenomenon, governments have at their disposal a fiscal policy that they can adapt to the reality of each country, but this can lead to a certain complexity of the tax system.

This investigation addresses contextual issues because the tax system is very specific and complex in each country. The tax behavior may differ from country to country, either by the specific design of the tax system or by mere cultural or socio-economic factors. Eurozone countries, such as Portugal, no longer have monetary policy and exchange rate policy at their disposal as governance instruments, thus leaving only the fiscal policy which thereby assumes critical importance.

Most of the literature on tax audits has been produced using samples from the USA or UK, focused on previous literature. Taxation is very specific to each country, which limits international comparisons. We are not aware of publications on the effect of tax audits in Portugal. There is also no doctoral course in taxation, unlike other countries, although there are already several courses in this area at master's degree level.

Further, there was an increase in the academic community's interest in tax compliance inspired by access to tax data. This has been occurring lately, often using the whole country´s population. Use of data from tax returns by researchers is a relatively new development in many countries and can explain the scarcity of literature[2] on the subject. Still, administrative data from tax returns requires a high degree of commitment from tax authorities and has some limitations related with causal relationships (Gangl et al., 2014). In Portugal, the tax authority does not follow this trend and, yet does not allow access to tax data.

[2] Indeed, this trend started in the Nordic countries and extended to other countries like the United Kingdom, United States, Canada and many other European countries. More recently, other less developed countries have followed this trend like Brazil, Chile, China, Costa Rica, Ecuador, India, Pakistan, Rwanda, Tunisia, Uruguay and Uganda (Slemrod, 2018).

In sum, the specificity of the tax system, the lack of doctoral courses in taxation and the lack of collaboration by the tax authority may justify the small amount of literature on the effect of tax audits in Portugal. These contextual issues make this investigation even more challenging.

Furthermore, the effect of tax audits on subsequent tax compliance is an area of knowledge not yet fully explored and there is still a gap with contradictory results published. The deterrence model predicts that tax compliance rises after a tax audit and seems to remain a benchmark model. Yet it has been criticized for not justifying tax compliance today.

The view that tax enforcement mitigates tax avoidance in the medium and long term is not clear in the literature. Taxpayers can increase their level of tax compliance or not. The literature offers several explanations for this puzzle. Some authors suggest that taxpayers do not evade taxes because they do not want to do so, for example for moral tax reasons (Luttmer & Singhal, 2014). Other authors suggest that taxpayers do not evade taxes because they cannot do so, for example due to third-party information (Kleven et al., 2016).

Lately, some studies suggest there are emotional factors that can influence the tax decision process that is of a special nature. For example, taxpayers may overreact to the audit threat without objective reasons to do so. In others words, as taxpayers are not sure what the probability of being audited is, there may be a "fear of an audit" that does not correspond to the true probability of an examination that is low in modern societies (Perez-Truglia et al., 2019).

Indeed, there is a puzzle in the literature because tax compliance rates seem to be high giving the low detection probabilities, especially among smaller firms that are the object of our study (Luttmer & Singhal, 2014). The theory of tax compliance based on economic factors has shown the difficulties of explaining this reality.

However, the literature, with some recent exceptions, found no direct evidence that other instruments (intrinsic motivations or non-economic factors), such as sending letters appealing to civic duty morals, have an impact on tax compliance (Slemrod, 2016). In the next chapter, we provide some insight into the theoretical framework to address this gap.

3. Theoretical framework and model of analysis

Within the scope of the literature discussed in the previous chapter, this investigation explores the effects of tax audits on subsequent tax compliance. This chapter describes the theoretical framework in which the research was conducted that supported the hypotheses formulated. The choice of data collection technique, which is a critical part in our study, is described in the final part.

3.1 Objectives, research question and model of analysis

In general, tax audits have two effects on tax compliance. The first is a direct effect related to tax audit outcome, while the second is an indirect effect related to taxpayer's future behaviour, also known as a deterrent effect (Gemmell & Ratto, 2012). Our study, quantitative in nature and inspired by recent tax experiments, focuses on this specific deterrent effect.

We intend to exploit data obtained directly from real taxpayers.Through the research question, we intend to examine the effects of tax audits on subsequent tax compliance by audited firms. Our main research question is as follows:

> *Is the tax behaviour of small and medium-sized firms consistent with the standard economic model of tax compliance, which predicts that tax compliance will increase after a tax audit?*

We followed the deterrence model based on the theory of tax compliance by Allingham and Sandmo (1972), which is one of the most tested tax evasion models despite its longevity. This model predicts that tax compliance depends on evasion detection probability and penalty.

A direct test of the deterrence model was carried out by Perez-Truglia et al. (2019), using a large-scale field experiment. With the same purpose, the assessment of the effect of tax audits on subsequent tax compliance by audited taxpayers, we explored a Difference-in-differences (DID) regression using the Ordinary Least Squares (Mazzolini et al., 2017).

As we have said before, it is a recent and understudied topic despite the growing number of studies that investigate the specific deterrence effect (Pomeranz & Vila-Belda, 2019). From this theoretical framework, we will formulate two hypotheses of investigation in the next section.

3.2 Hypotheses formulated

The theory on tax compliance, described above, predicts low compliance under low tax audit probabilities or penalties. However, this theory is not in line with recent empirical studies that show that tax compliance is high in sophisticated tax systems despite very low audit probabilities and penalties (Slemrod, 2016).

A recent investigation conducted by Perez-Truglia et al. (2019) sent messages with general information about tax audits to small and medium sized firms (the same type of firms used in our sample) in order to test the fundamental assumptions of theory on tax compliance. They suggested an alternative model because this kind of information can generate reactions which can lead to a less rational tax decision-making process. For instance, the information sent decreased the perceived probability of detection of tax evasion; yet, still the effect of tax audits on tax compliance is positive. The results found show some inconsistencies in the fundamental assumptions of the deterrent model.

Another investigation, also using data from small businesses, shows a positive effect of tax audits on tax compliance (D'Agosto et al., 2018), which is in line with the theory on tax compliance. In the same direction, Advani et al. (2015) and Kleven et al. (2011) found that tax audits led to an increase in report income and Niu (2011) shows a positive association between voluntary compliance and tax audits. In a different direction, DeBacker et al. (2015b) concludes that tax audits may increase subsequent corporate misbehaviour which suggests the existence of intrinsic or moral factors that influence firms' behaviour beyond the economic factor (Slemrod, 2004) .

In sum, the traditional theory on tax compliance predicts that tax compliance depends on evasion detection probability and penalty; however, it is not clear how firms respond in real world situations. As described above, studies published have contradictory results. Some results are consistent with the predictions of the theory on tax compliance, that is, a tax audit has a positive effect, but others argue that tax audits can have a negative effect on tax compliance. Therefore, our theoretical hypotheses can be formalized as follows:

H0: The level of tax compliance of firms increases after a tax audit;

H1: The level of tax compliance of firms does not increase after a tax audit.

With these hypotheses of investigation formulated, we intend to test if firms report income to maximize its expected utility considering the probability of an audit and related

penalties. In other words, by evaluating the effect of tax audits on the real life of taxpayers audited, we intend to conduct a direct test of assumptions on the standard economic model of tax compliance.

Despite not fully explaining tax compliance nowadays, this model continues to prove that tax audits are a key deterrent instrument available to governments to promote tax compliance. Next, the research hypotheses were confronted with data and theoretical framework. In the subsequent chapter, we define the general process of analysis, namely the appropriate procedures and methods of treatment of the information aiming to test the formulated hypotheses.

However, before that we had to choose the most appropriate data collection technique. This was a critical choice for the success of this investigation because there was a need to collect sensitive information from taxpayers, which had never been done before in Portugal.

3.3 Data collection technique (Questionnaire)

Data collection methods are a key part of any research and there are several techniques that each have advantages and disadvantages. A suitable choice to address an issue can be a benefit, especially in our research.

Despite several requests, the tax authority in Portugal did not provide the necessary tax data. This subsequently influenced the choice of our data collection technique. This lack of collaboration is not exclusive to our country and it is also seen internationally despite the increasing collaboration between tax authorities and academia in recent years. Thus, given the lack of tax data and the sensitive nature of the information that we wanted to obtain, we chose the questionnaire as our data collection method. We did not find another suitable alternative to study the impact of tax audits in Portugal.

Indeed, questionnaires are an efficient mechanism for collecting data regarding sensitive issues such as taxation, particularly when the researcher knows exactly what is needed and how to measure the variables of interest. Online questionnaires can be sent to a large number of respondents simultaneously thus generating sufficient data for statistical analysis (Sekaran & Bougie, 2003).

Despite the sensitive nature of data, some studies on taxation used the survey. For instance, Graham et al. (2017) surveyed corporate executives to observe the manner in which their firms incorporated taxes into their decisions. Earlier, the same authors used an online survey to enquire approximately 600 tax executives about their firms' experiences with respect to tax planning and avoidance (Graham et al., 2014). After the data collection, an estimated regression model was used through the Ordinary Least Squares, within the context of panel data. These authors contributed to literature on determinants of tax evasion by finding evidence that corporate reputation is an important factor in making tax planning decisions.

A survey is particularly useful to obtain data directly from taxpayers without the need to use secondary sources. Also, this technique allows the collection of qualitative data associated with the tax decision process, which is not directly observed through archival-based studies. However, there are some limitations when using this methodology, such as the possible reluctance to obtain realistic answers even though confidentiality is guaranteed (Gërxhani, 2007).

We are aware of these concerns, so we chose an online confidential questionnaire with a set of pre-formulated questions to which respondents provided their answers. The survey was designed to obtain very specific information at the least possible cost to the firm. Then we combined this evidence obtained from the original source with data from secondary sources (for example, financial statements).

In sum, this chapter describes the theoretical framework that supports the present study. It started with the deterrence model and ended with choosing the online questionnaire as the data collection technique. In the next chapter, we present the research design and the methodology used to assess the shape of firms' behaviour following tax audits in order to test the hypothesis formulated.

4. Research design and methodology

The research design for this thesis followed a quantitative approach based on some recent tax experiments to assess the effect of tax audits on subsequent tax compliance. In this chapter, we explain the methodology adopted which includes the policy context, presentation of the model used to obtain the results and data collection procedures.

4.1 The policy context (Tax Audits in Portugal)

A helpful model in the role of law enforcement suggests two routes to promote tax compliance: One is related to tax audits and the other to taxpayers' trust (Kirchler et al., 2008). We explore the first route. Indeed, tax audits play an essential role in tax compliance that goes beyond the revenue collection, namely through the deterrent effect which increases confidence in the tax system and/or strengthens social norms.

To explore the effect of a tax audit on subsequent tax compliance, we used a difference-in-differences (DID) approach. We tested whether the behavior of the treatment group (audited firms) differed from the control group (no audited firms), as a whole. But, to carry out our study, different time points were necessary, one before the tax audit (2007 to 2011) and another after (2013 to 2017). The following figure provides an overview.

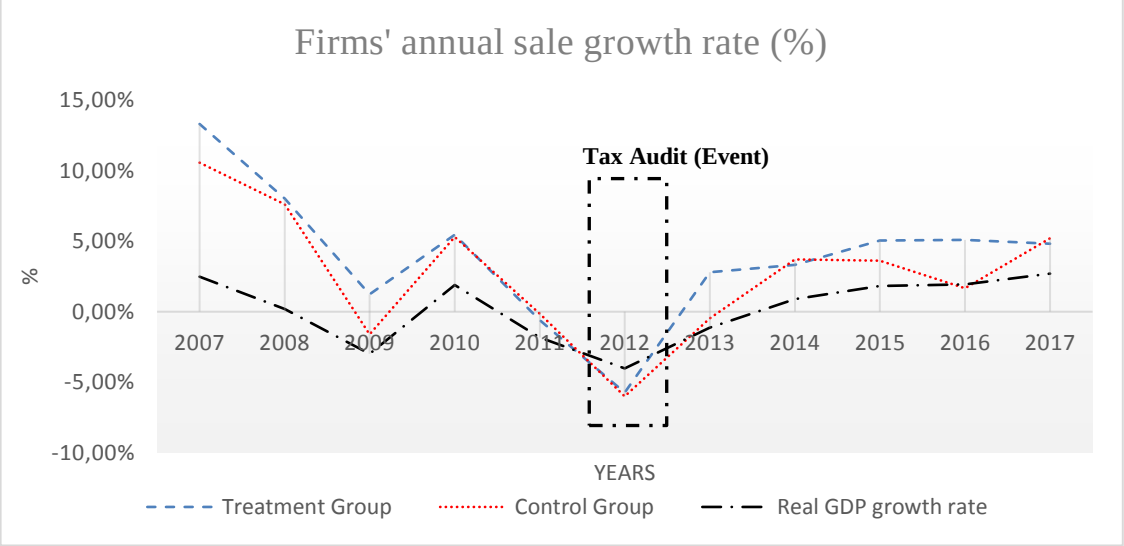

Figure 1. Research Overview I

Our first advanced indicator that intends to measure the change in behavior of the groups is the sales growth rate. This indicator is the dependent variable for the treatment group and can be compared to the change in outcome for the control group under the

presumption that the difference is due to tax audit and the impact is measured by the DID method. In others words, if the lines on the right of the graph are not parallel, this could suggest a positive impact of the tax audit on tax compliance as expected. We also placed Portugal's Gross Domestic Product (GDP) growth rate to provide context.

The global crisis that began in 2008 had a negative impact on Portugal's economy, which resulted in a call for financial assistance from the International Monetary Fund, the European Central Bank and the European Commission in 2011. This became known as "The Troika". Finally, in 2010 an important change in accounting rules was made in Portugal[3].

Using a second indicator, the next figure provides an overview, where we compare the ETR of firms in the treatment and control groups.

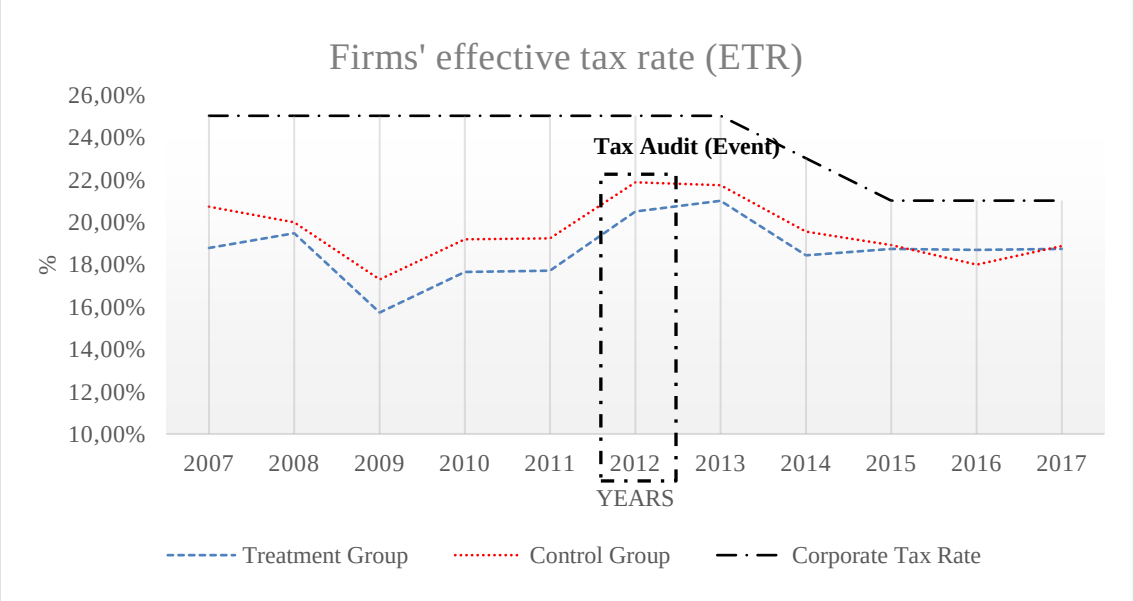

Figure 2. Research Overview II

We also included the line of Statutory Corporate Income Tax Rate to provide context. In a simple comparison with ETR, it seemed to us that there could be room for a reduction in this rate. An interesting and rare contribution to the reality of taxation in Portugal was

[3] The accounting standardization system, which entered into force in early 2010, is characterized by its affinity with European Union (EU) accounting legislation associated with International Accounting Standard (Bérgolo et al., 2017) and International Financial Reporting Standards (IFRS).

recently published (Pires & Pereira, 2020). This study suggests that a reduction in corporate income taxation could increase the competitiveness of the tax system.

In sum, the political context is important since it can influence audited firms' behavior, either through the design of the tax system or by other non-economic factors specific to each country. Next, we study the different types of tax audits since there are several and not all of them have the same impact on the future behavior of firms.

4.1.1 Types of tax audits

Several terms such as tax inspection, examination, verification actions, control, or simply tax audit, are used by tax authorities to designate the routine reviews conducted either by field or desk inquiry. Generally, a tax audit can be defined as an inspection of whether a taxpayer has properly assessed and reported their tax liability and fulfilled other tax obligations (OECD, 2006). Tax audits can be divided into three broad types, according to intensity and scope:

- Limited scope tax audits;
- Desk tax audit or review;
- Comprehensive tax audits or full tax audits.

Limited scope tax audits and desk tax audits are targeted at specific issues and consume relatively fewer resources, but they may allow an increase in population coverage. However, the comprehensive tax audits or full tax audits have a global impact on the taxpayer.

Indeed, full tax audits are in-depth examinations of all the information used to calculate a taxpayer's tax liability for a given period and will usually take place on the taxpayer's business premises. Given their broad scope, full tax audits are usually costly and may require a considerable amount of resources. Thus, this type of tax audit can only cover a small number of taxpayers. Our interest is specifically in full tax audits.

The difference between diverse types of tax audits may be important. For instance, data from the OECD database does not make this distinction clearly (OECD, 2017a). This limitation on country level data was noted in a study related to the effect of auditing on tax compliance (Mendoza et al., 2017). With the available data in Portugal, it is also not

possible to distinguish the different types of tax audits. However, by collecting data directly from audited firms, our study has the opportunity to make that distinction.

Indeed, our focus is on full tax audits, because they are one of the most complete instruments to support tax compliance and may have the capacity to influence firms' behavior in the future. Next, we explore these types of tax audits.

4.1.2 Full Tax Audits in Portugal

In Portugal, firms are audited based on several criteria by the tax authority (Autoridade Tributária e Aduaneira, AT). When carrying out a full tax audit, the tax auditor must strictly follow the legal code[4]. All procedures are expressly provided by the tax law and the tax authority applies a firm policy concerning the obligation of confidentiality.

Usually, full tax audits are conducted within a limited period. In general, this is a period of up to four tax years prior[5]. After that, tax evasion becomes no longer prosecutable unless it is in the scope of a criminal act. In this case, the expiration period can be extended. A tax audit can focus on one tax year or cover multiple tax years.

Generally, full tax audits must be concluded within six months. A prorogation of the deadline for one year may apply under certain conditions. The tax law imposes a maximum duration to protect the taxpayer. This is just one of the taxpayer's rights provided in the tax law, given the sensitive, restrictive and instructive nature of full tax audits. This feature signals the impact that a full tax audit can have on firms' behaviour.

After conducting a full tax audit, the tax authority must notify the firms of the preliminary conclusions reached when these findings may lead to tax assessment acts that are unfavorable. After this, taxpayers may present their arguments. Finally, the tax authority must prepare a final report of the tax audit performed identifies the facts detected. A copy of the report is subsequently sent to the taxpayer and the firm is not allowed to directly lodge an objection or appeal.

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[4] Supplementary Rules of Procedure of the Tax Audit (*Regime Complementar do Procedimento de Inspeção Tributária e Aduaneira*, RCPITA), approved by Dec.-Law n.º 413/98 of December 31.

[5] Article 45.º of the General Tax Law (*Lei Geral Tributária*), approved by Dec.-Law n.º 398/98 of December 17.

As stated previously, full tax audits are not very common procedures due to their cost, therefor their correct identification can be an added challenge. We used several approaches to achieve this goal. First, we identified full tax audits through very specific requirements like the advance notice, which only happens in this type of tax audit.

Indeed, the full tax audits have several mandatory procedures that are different from other types of tax audits (limited scope or desk tax audit), namely:

- As a rule, the full tax audits must be announced in writing (advance notice) [6]. The taxpayer must have at least 5 days to prepare for the tax auditor's arrival at the firm's offices. In other types of audits, this announcement is not mandatory by law;
- Usually within 5 days after a full tax audit begins, there is the formality of the signature of a service order required by the tax auditor. As a rule, this first meeting takes place at the taxpayer's premises. In the remaining types of tax audit, the signature of this document is not required, nor is it required during any initial meeting with the firms;
- The full tax audit is carried out in the firm's business office. In other types of tax audits, diligences usually take place in the tax authority's offices.

In sum, there are some pre-requisite features and requirements that need to be in place to ensure the correct identification of the type of tax audit that we intend to study. After choosing our type of tax audit, we needed to identify when it took place, in order to measure its effect.

Next, we explored the tax audits started in 2012, but not necessarily concluded in that year, as they can usually last up to 6 months and some may have only ended in 2013. However, the start date of tax audits is more relevant for the purpose of our analysis than the end date.

[6] Article 49. º of the Supplementary Rules of Procedure of the Tax Audit.

4.1.3 When do we start measuring the effect of a tax audit?

Portugal's tax authority carries out tax audits each year to deter non-compliance and 2012 was no exception. We tried to explore the effects of target tax audits carried out throughout in this year on future tax compliance using operational data.

Indeed, in 2012 the tax authority carried out more than 80,000 verification actions for all taxpayer categories, with more than half having a purely preventive or informative nature. The rest, less than 40,000 refer to full tax audits (these are of interest to us), limited scope tax audits and desk tax audits or reviews (FISCAIS, 2012; OECD, 2015).

With these statistics, it seems that there is a low probability of a tax audit in Portugal, but figures are similar to what happens in countries with sophisticated tax systems (Slemrod, 2018). For instance, in the United Kingdom, over the period of 1996 to 2010, the chances of being selected for an audit for individuals was 1,8%, on average (Advani et al., 2015). Actually, this low probability of detection found in modern tax systems, where levels of tax compliance are high, is not fully explained by the standard economic model of tax compliance which considers only economic factors.

To support regular tax audit activity, every year firms are required to make financial and tax reports of the previous year. For instance, the annual Corporate Income Tax (CIT) return must be submitted before the last day of May of the year following the year of income (general rule). The information in this statement is not available to the public.

Another mandatory statement to firms, the annual return of accounting and tax information, must be sent up until the 15th of July of the following year of income[7]. Unlike CIT return, the information in this statement is public and was one of the sources of information used in the present work.

Some of these tax years may be audited later by the tax authority. For example, the 2008 tax year, or other years prior to the ordinary expiration period, can be audited during 2012. In our study, the tax auditor began to carry out the full tax audit at the firms business

[7] All firms are required to deliver such in order to fulfill their tax accounting and statistical obligations. The information provided in the returns should, where appropriate, agree exactly with those obtained from the accounts or records.

premises in 2012 (our event), usually in one of the following years – 2008, 2009, 2010 or 2011.

The year in which the tax audit was performed is important because it defines the timing of a firm's reaction; however, choosing the precise date can be tricky. As a firm only delivers tax returns from 2012 until June 2013, the firm may change its behavior in 2012 or in 2013. The next figure gives an overview of tax audits performed in 2012 by the tax authority.

Period before event						**Event**	**Period after event**				
Treatment Group (audited firms)											
Possible tax years audited						**Tax Audit Performed**	Tax audit effect				
Y	2007	2008	2009	2010	2011	**2012**	2013	2014	2015	2016	2017
	No longer prosecutable			Accounting event		Start of tax audit. Location: firm's business premises. Maximum Duration: 6 months.	Submission tax returns for fiscal year 2012. Deadline: June.				
N*	500	500	500	500	500	500	500	500	500	500	500
Control Group (no audited firms)											
No tax audit						**No Tax Audit**	No tax audit				
Y	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	No longer prosecutable			Accounting event			Submission tax returns for fiscal year 2012.				
N*	639	639	639	639	639	639	639	639	639	639	639

* Number of Firms per year

Figure 3. Tax audit performed (2012)

The audited firms may change their behaviour as early as 2012, that is, since they became aware of the tax audit, as they only report results in the following year. It may also happen that the beginning of the tax audit only occurs in 2013 despite being announced in 2012. These were two possible situations but there could be others, so the tax audit performed may, therefore, be challenging to study.

We are aware that information about the precise start date of the tax audit can be important to establish the timing of the firm's future behavior. For instance, D'Agosto et al. (2018) define this timing as the perception year, that is, the period over which taxpayers receive a communication from the tax authority that an auditing activity is beginning. Starting from this time, firms become aware that a tax auditing process is taking place.

These authors consider that tax audits carried out between July and June of the next year are included in the same perception year. For instance, that a tax audit is carried out between July 2012 and June 2013, indicates 2012 as being the auditing perception year.

In our study, an official document is signed during this initial meeting that represents the formal start of the tax audit. This is the first moment when the firm is aware of the tax audit and can change its future behaviour.

However, other studies suggest that the effect of a tax audit may take some time to be assimilated and that it may depend on the end of the tax audit (Gemmell & Ratto, 2012). Thus, the year of the tax audit could be excluded from the sample (in our case, 2012). Consequently, we measured the effect of tax audits from January 1, 2013. The next figure summarizes the strategy followed in our investigation.

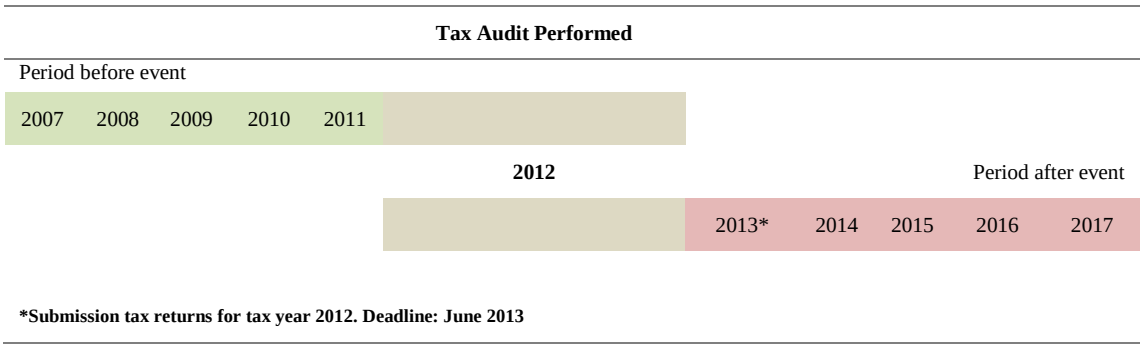


Figure 4. Tax audit effect 2013

In sum, in this section we chose our type of tax audit (full tax audit), when it was carried out (2012), what type of data was used (operational) and when we started to measure the effect of an audit (2013). Next, we investigated a critical assumption of the model that we used to assess the effect of full tax audits on subsequent tax compliance.

4.2 Parallel trend assumption

As we said before, in order to analyse the causal effect of a tax audit on subsequent tax behaviour, we followed a strategy based on the difference-in-differences (DID) approach. We compared firms that experienced a tax audit (treatment group) with firms that were not subject to tax audit (control group).

The DID model can be used to obtain causal estimates of policy change that affected different subgroups at different points in time. The parallel trend assumption between the treatment and control group is critical in this approach (Beer et al., 2015; DeBacker et al., 2015a; Mazzolini et al., 2017). The next graph shows the desirable situation.

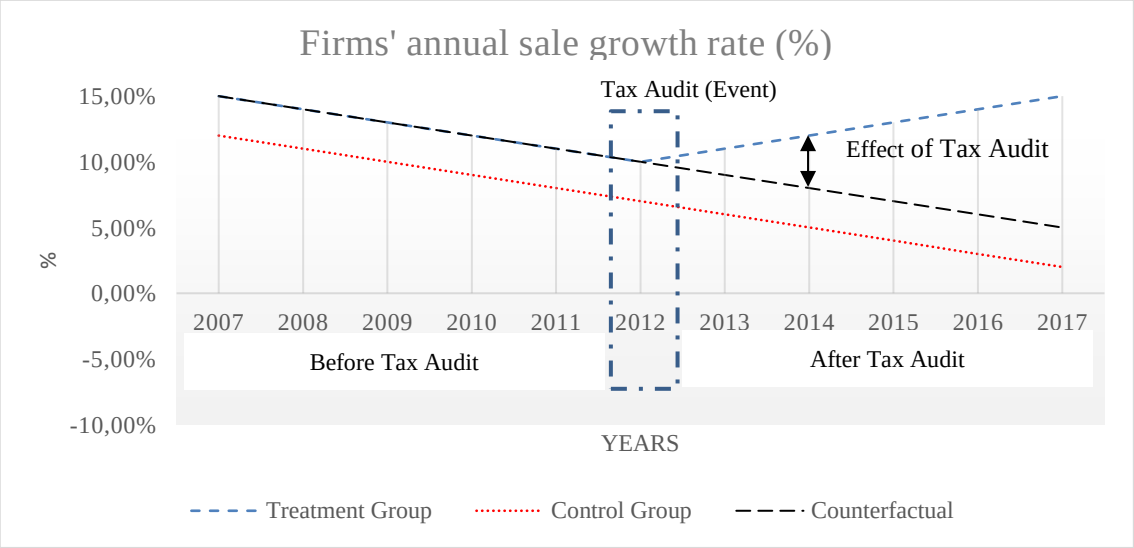


Figure 5. Parallel trend assumption

In the absence of treatment, outcomes in treatment and control groups should display equivalent trends. If this assumption is contradicted violated, DID can produce biased estimates

Yet, the validity of parallel trend assumption cannot be adequately proven. In the next sections, we will try to validate the existence of this assumption through graphical analysis, which is expected to be similar to the previous shown graph. We also carried out some formal tests of statistical analysis.

4.2.1 Graphical analysis of pre-treatment periods

As stated earlier, one way of testing the parallel trend assumption is by visual inspection of pre-treatment trend periods (2007 to 2011) for treatment and control groups (Wing et al., 2018). To this end, we needed to have more than one pre-treatment period and the annual averages calculated in the two groups should be similar. Otherwise it would be difficult to validate this critical assumption for the DID approach.

The next graph represents the trend verified in our sample from 2007 to 2011 (the pre-treatment trend periods of our event that occurred in 2012).

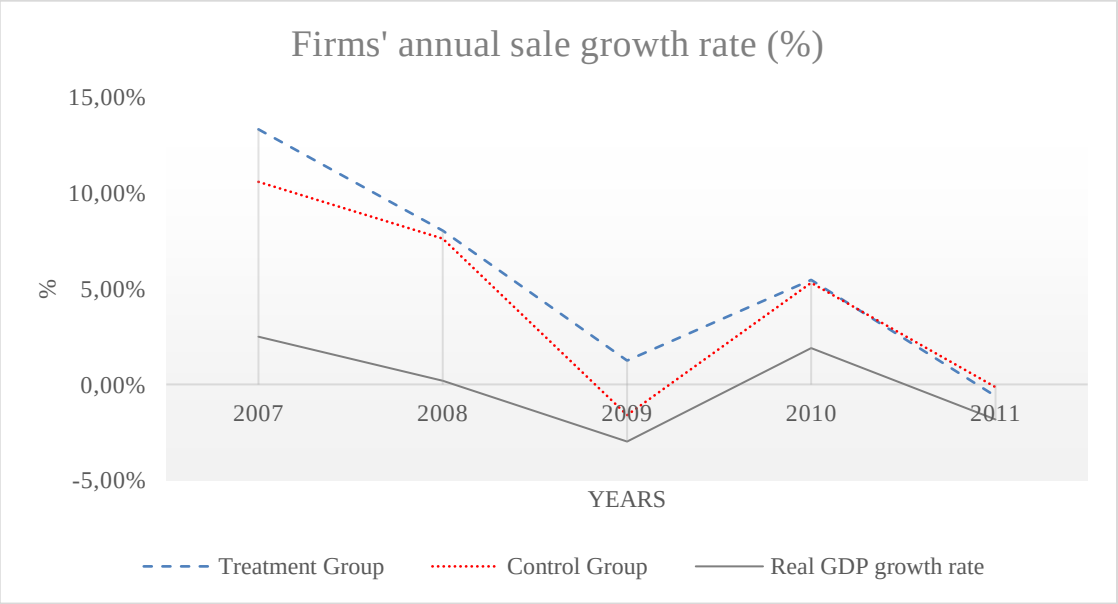


Figure 6. Parallel trend assumption (pre-treatment periods)

The graphical evidence above suggests that the trend during the pre-treatment era (2007 to 2011) is similar for both treatment and control groups. It seems that the assumption of the parallel trend holds.

In addition to graphical analysis, which is a broader issue for DID methodologies, there are other strategies for assessing the parallel trend assumption, which we will discuss in the next point.

4.2.2 Statistical analysis of pre-treatment periods

We performed some formal tests to check if the two independent groups (treatment and control) have equal means/medians during the pre-treatment era. If the parallel trend assumption is valid, these tests should be statistically non-significant.

The next table presents some descriptive statistics regarding the average growth rates across treatment and control groups during the pre-treatment era (2007 to 2011).

Table 3. Descriptive statistics pre-treatment periods

Description	Firms' annual sales growth rate Control Group	Firms' annual sales growth rate Treatment Group
Mean	4.35%	5.51%
Median	1.94%	2.24%
Maximum	166.29%	214.50%
Minimum	-68.72%	-76.59%
Standard Deviation	0.216562	0.245694
Skewness	1.316752	1.409055
Kurtosis	8.020427	8.788882
Jarque-Bera	4278.643	4318.010
Probability	0.000000	0.000000
Sum	138.9099	137.7224
Sum Sq. Dev.	149.7958	150.8537
Sample	2007-2011	2007-2011
Number of observations	3195	2500

In general, descriptive statistics of pre-treatment periods in control and treatment groups show relatively close values. For instance, the mean (4.35% and 5.51%) and median (1.94% and 2.24 %) present relatively similar values in the two groups - the same being applied to the maximum and minimum values of sales grow rate.

Furthermore, the measures of skewness and kurtosis characterize the sample distribution of elements around the mean. For a normal distribution the values of skewness and kurtosis coefficients must be close to zero. Since values obtained in our study for these coefficients are greater than one, it can be assumed that our distribution is not of the normal type. Still, it is noted that the asymmetry of coefficients only provide an indication.

Finally, the jarque-bera test also suggests that the data has no normal distribution (Marôco, 2014). Normality is a requirement to use parametric methods. When some assumptions are not fully checked, we can use non-parametric tests in addition to parametric statistical tests.

In the next table, we present some common tests of hypotheses for the differences in average growth rates across the treatment and control groups, during the multiple pre-treatment periods (2007 to 2011). We hope that the results of these tests will not require us to reject the Null Hypothesis (H0).

Table 4. Tests of Hypotheses

Method	Degrees of Freedom	Value	Probability
T-Student Test	5693	-1892322	0.0585
Anova F-Test	(1.5693)	3580883	0.0585
Welch F-Test (Allows for unequal cell variances)	(1.5011)	3472794	0.0624
Wilcoxon/Mann-Whitney		0.877354	0.3803
Med. Chi-Square	1	0.242413	0.6225
Kruskal-Wallis	1	0.769764	0.3803

For instance, the t-student test aims to verify whether the treatment and control groups have equal averages in sales growth rates during the pre-treatment period (2007 to 2011). The null hypothesis in this parametric test is to test if the average of the two groups is equal. If the level of significance is 5% (α) then the rule is to reject HO if p-value $\leq \alpha$.

The first line of the previous table shows a probability of 0.0585 (p-value> α), so the decision is to not reject the null hypothesis, which suggests that the means in the two groups are the same. We are aware that if our decision is not to reject H0 and if in reality H0 is false, we are making a type II error.

In sum, the graphical and statistical analyses suggest the existence of a common trend in pre-treatment periods. Therefore, we can conclude that the behaviour of both groups is similar between 2007 and 2011. As stated previously, this assumption is critical in the DID approach that we have followed.

In the next section, we describe the process of choosing the dependent variables which is always a challenge in the tax area as there are no universal accepted definitions (Hanlon & Heitzman, 2010).

4.3 Dependent variable definition

In this study, in order to capture the impact of a tax audit on tax compliance we explored two measures used in the literature: sales growth rate and effective tax rate.

4.3.1 Sales growth rate

The first measure of this study is based on sales and has been used in literature for a specific purpose. We choose sales revenue as a dependent variable because this is an advanced indicator that measures the change of behavior of firms, whether imposed by the market or by their own choice. In a similar study conducted by Niu (2011), sales revenue was used as a dependent variable to analyse the effect after a tax audit since it is a suitable indicator for tax compliance.

However, in order to mitigate variations in sales caused by the market, only firms with at least 5 years in business were selected. Another prerequisite was that they did not operate in areas of business that are more influenced by economic conditions. This decision to choose stable firms, without major variations in sales, can lead to smoother future behavior changes, so it is more challenging to detect and evaluate behavior changes using our model.

Also, we used the growth rate rather than the level, since it avoids the requirement of normalizing the level data to make statistics comparable among different groups.

4.3.2 Effective tax rate (ETR)

The second measure is more used in the literature. The concept of ETR can be defined as total income tax expense divided by pretax book income and has often been used as a proxy for tax compliance strategies (or level of tax aggressiveness) and to analyse the effect after a tax audit (DeBacker et al., 2015b).

Despite, the ETR's approach being widely used, the inclusion in the samples of firms with negative pre-tax income may interfere with the interpretation of results (Gupta & Newberry, 1997). For example, if a firm pays taxes (positive numerator) but has negative results (denominator), ETR has a negative value and can be hard to interpret.

Taxation in Portugal can lead to this kind of situation. Even so, as stated previously, our sample contains only stable firms in the market, which means that the majority did not present negative results.

4.4 Difference-in-differences strategy

The empirical approach to estimate firms' behaviour after tax audits, during the 2007 to 2017 period, relies on the difference-in-differences (DID) strategy often used in the literature (Gemmell & Ratto, 2012; Perez-Truglia et al., 2019), which uses the statistical method Ordinary Least Squares (Greene, 2012; Wing et al., 2018).

We compared changes in tax compliance between firms that were audited and firms that were not audited. To determine the most suitable association between tax audit and tax compliance, we tested several approaches. For instance, in the first approach we used two five-year periods, before and after tax audit. The general form of the models can be written using the following equation:

$$Y_{it} = \beta_0 + \beta_1 D_G + \beta_2 D_T + \alpha D_G D_T + \varepsilon_{it} \quad (1)$$

where the outcome variable Y_{it} is the sales growth rate or ETR, our proxies for tax compliance, of firm *i* in year *t;* D_G is a dummy for firms being in a group (1= treatment group; 0= control group); D_T is a dummy equal to "1" for all periods after event (tax audit) and "0" before event.

Under the parallel trend assumption, which we tested in various ways at the previous section, D_G captures the time-invariant difference in outcomes between the treatment group and the control group (audit vs non-audit). D_T captures the combined effects of any unmeasured covariates that change between two periods (after/before tax audit) but affect outcomes the same way in both groups. The regression disturbance (ε_{it}) captures the effect of unobserved factors.

In other words, the interpretation of the coefficients β_0 is the expected average outcome for the controls before tax audit. We include a constant in all regressions to account for a common influence of economic conditions across all firms; β_1 is the difference in expected average outcome between audited and controls before the audit; β_2 is the difference in expected average outcome before/after event for the controls. Academics call β_1 the group effect and β_2 the time trend.

However, the DID critical coefficient, for the purpose of this study, is α since it measures the effect of the intervention (tax audit). In other words, this coefficient measures the effect of a tax audit on the future behaviour of an audited firm. The coefficient α is the difference in expected average outcome for the audited group compared to the control group, and can be calculated using the following formula:

$$\hat{\alpha} = \left(\overline{y}_{1,1} - \overline{y}_{1,0} \right) - \left(\overline{y}_{0,1} - \overline{y}_{0,0} \right) \quad (2)$$

where $\overline{y}$ is average sales growth rate or ETR, and the first subscript refers to the difference over time in expected average outcome for the treatment group, and the second subscript refers to the difference over time in the expected average outcome for control group.

Using the sales growth rate as the dependent variable, rather than the level, we aim to remove the potential correlation between the treatment group and unobserved time-constant mechanisms (i.e., firm-specific fixed effects) such as the firm's tendency to tax evade.

Besides, to ensure consistent estimation of the tax audit impact, we seek to guarantee that the two groups (treatment and control) have had a parallel behavior in the periods before the tax audit has taken place (i.e. the parallel trend assumption). The graphical analysis made suggests that we have a valid control group.

In the next section, we explain the data collection procedures needed to execute the DID strategy, which was one of the most challenging steps in our research.

4.5 Data collection procedures

The data used in our study came from two sources that combine secondary data with primary data. First, we selected firms on the Sabi database (phase I) and we sent an email with an online confidential questionnaire (phase II).

After obtaining the taxpayer number through the survey and other details about the tax audit, we used the Sabi again to describe the firms' tax behavior after a tax audit (phase III). Next, we present these phases of the data collection procedure in more detail.

4.5.1 Phase I – Initial sample

In the first phase, we proceeded to collect information about the firms in the Sabi database[8]. Given the large number of firms available, we established minimum requirements for inclusion in the sample. For instance, all firms included had to be in the legal form and had to be in business for at least 5 years. We aimed to study firms already established in the market and not firms with only a few years of activity.

In addition, we excluded firms with more than 200,000,000 euros of turnover, as they are monitored by a special unit of the tax authority and may behave differently. The next table summarizes the search strategy used.

Table 5. Initial data collection procedures

	Description (Sabi Firm Search strategy)	Step result	Search result
1.	Country: Portugal	658,794	658,794
2.	Portuguese status: Active	351,258	351,258
3.	Legal form: Limited liability company; One-person company with limited liability	616,863	325,630
4.	Data of incorporation in business: up to and including 31/12/2004	305,940	129,764
5.	Sales (EUR): max =199,000,000	351,933	122,695
6.	All firms with e-mail address	194,202	58,193
	Total		**58,193**

As we imposed strict requirements in the data collection process, only 58,193 firms made up the initial sample. Earlier on, only firms from Lisbon and Porto composed the sample but due to a low response rate, we decided to extend the survey to the rest of country. After this selection process, we sent emails to the selected firms (58,193) requesting the completion of a short online questionnaire that we describe next.

4.5.2 Phase II – Survey

Our survey, under the title "*Experience with tax audit in Portugal*", was designed with the purpose of obtaining information about the existence or non-existence of a full tax audit in the field. Appendix 8.1 displays a sample of the email sent with the invitation to complete the survey and appendix 8.2 shows the entire survey.

The questionnaire began with a brief description of the full tax audit procedure and an example of the advance notice that the tax authority usually sends to firms that will be

[8] Sabi is a subset of the Amadeus database that contains comprehensive information on firms in Spain and Portugal. We used it to research firms with specific profiles and for analysis. FEP subscription contains only firms of Portugal.

audited within a 5-day deadline. We found it important to send an example of this letter in order to help the firm identify the tax audit type, as it is only sent in case of a full tax audit. As stated previously, this type of tax audit is key for our study.

We aimed to develop short and simple answers since we were aware that the survey response rate may have been low. The key objective was to get the firm's taxpayer number and identify the start date of the tax audit, which is sensitive information. In summary, we intended to obtain the following information directly from firms (primary source):

- Firm ID (taxpayer number - obligatory answer);
- Location of the firm;
- Tax audit performed and operational information about full tax audit;
- Tax authority's assessment;
- Tax auditor's assessment;
- Tax audit feedback (comments).

Obtaining this data was a challenge since we requested delicate information through a survey, in particular the firm ID, which was fundamental information to proceed with our study. The next table summarizes the data that we got through the online questionnaire.

Table 6. Survey statistics

Description	N
Firms registered in Sabi database	658,794
E-mails sent to firms selected in Sabi database.	58,193
E-mail delivery successfully (exclude e-mail failure notice)	43,264
Replies received	3,829
Response Rate	7%

As we anticipated, the response rate was low (7%), although we sent emails to more than 58,000 firms. To mitigate this situation, we used the university's e-mail to give credibility to the questionnaire, and we provided a telephone helpline to answer questions. Nevertheless, some firms thought the tax authority had sent the survey. The novelty and the language used in the survey may have led taxpayers to this conclusion.

Curiously, some firms expressly stated that they did not wish to participate in the survey. As we said above, we suspect that this attitude may be related to the fact that they thought the survey was sent by the tax authority[9].

Also, many e-mail addresses were not correct which resulted in a large number of delivery failures. Additionally, this issue was tricky to manage since we were only able to send 5,000 daily emails over 10 days[10].

In sum, this type of approach is not common in Portugal. We received numerous calls and requests for information by email, but the overall result at this stage was positive (3,829 replies). Furthermore, this interaction with firms was a fascinating experience.

4.5.3 Phase III – Final sample

At the final phase, after obtaining the taxpayer number in the earlier phases, we used the Sabi database again to describe the firm's tax behavior after a tax audit through financial statements. The next table summarizes the final data collection.

Table 7. Final data collection procedures

Description	Treatment Group	Control Group	Total
Replies received	1,393	2,436	3,829
Less:			
Firms with missing data	852	1673	
Firms with sales variations over 220%[11]	41	124	
Number of Firms per year (2007-2017)	500	639	1,139
Number of observations	5,500	7,029	12,529

The final sample consists of 500 firms from the treatment group and 639 from the control group. In sum, in this chapter we provided insight about the policy context, empirical approach and the data collections procedures. Next, we present the results obtained.

[9] These taxpayers did not respond to the survey but sent an email with the word REMOVE in the subject. For issues related to the new General Data Protection Regulation (GDPR), we suggested this option if the firm did not want to participate in the survey (see appendix 8.3).

Another curious fact is that some firms found that the only mandatory question in the survey, the firm's tax number, could be overcome by placing 9 random digits, for example: 000000000 or 999999999.

[10] Indeed, this phase was time consuming. First, the university email does not allow more than 500 daily emails to be sent, so higher authorization was required. Then questions were raised about the legitimacy of using Sabi data in light of the GDPR. We had to make another authorization request (see appendix 8.4).

[11] The sample has three firms with variations greater than 200%, that we chose not to exclude from the sample, so we raised the exclusion limit to 220%.

5. Data Analysis

In this chapter, we describe the results obtained in this research. First, we begin to present some descriptive statistics. Then, we make an assessment of the tax audits, which is a novelty in the literature. In the final part, we present the main results.

5.1 Descriptive statistics

In this section, the tables present summary statistics for some firms' characteristics. We started with the firms' location in Portugal.

Table 8. Firms by Region (District)

Region	Treatment Group		Control Group	
	N	**%**	**N**	**%**
Angra do Heroísmo	0	0.00%	1	0.16%
Aveiro	77	15.40%	58	9.08%
Beja	0	0.00%	8	1.25%
Braga	62	12.40%	62	9.70%
Bragança	2	0.40%	3	0.47%
Castelo Branco	5	1.00%	5	0.78%
Coimbra	30	6.00%	14	2.19%
Évora	5	1.00%	5	0.78%
Faro	81	16.20%	37	5.79%
Funchal	6	1.20%	15	2.35%
Guarda	7	1.40%	7	1.10%
Leiria	54	10.80%	54	8.45%
Lisboa	41	8.20%	146	22.85%
Ponta Delgada	3	0.60%	7	1.10%
Portalegre	2	0.40%	2	0.31%
Porto	85	17.00%	126	19.72%
Santarém	9	1.80%	29	4.54%
Setúbal	3	0.60%	29	4.54%
Viana do Castelo	9	1.80%	14	2,19%
Vila Real	6	1.20%	6	0.94%
Viseu	13	2.60%	11	1.72%
Total	**500**	**100.00%**	**639**	**100.00%**

The table above shows that Porto and Lisbon are the most representative districts in terms of location of the selected firms. We designed the initial sample to cover only these two districts, which are also the largest in terms of population, but later, the study was extended to the entire country.

We were forced to make this extension since a low response rate was obtained in the first phase. However, we later came up with a larger sample spread throughout the national territory.

Also, we are aware that the sample contains firms that belong to business sectors more sensitive to economic cycles, such as construction or real estate activities. Others operate in very specific sectors such as agriculture, farming, hunting and forestry. Despite these and other specifics specificities, we chose not to remove any firms from the treatment

group and we developed a matching process to find similar firms to include in the control group

The next table shows the sectors of activity in which the selected firms operate. *Wholesale and retail trad*e were the most represented sector in the treatment group. The second most represented sector was *human health and social work activities*, with firms connected to dental practice activities and general/specialist medical practice activities.

Table 9. Firms by Industry

Industry	Treatment Group		Control Group	
	N	**%**	**N**	**%**
Agriculture, farming of animals, hunting and forestry	13	2.60%	16	2.50%
Mining and quarrying	2	0.40%	4	0.63%
Manufacturing	81	16.20%	93	14.55%
Water collection, treatment and distr.; sewerage, waste manag. and remediation activities	3	0.60%	4	0.63%
Construction	36	7.20%	42	6.57%
Wholesale and retail trade; repair of motor vehicles and motorcycles	121	24.20%	233	36.46%
Maintenance and repair of motor vehicles (3 firms in treatment group vs 9 in control group)				
Transportation and storage	28	5.60%	46	7.20%
Accommodation and food service activities	56	11.20%	51	7.98%
Information and communication activities	3	0.60%	4	0.63%
Financial and insurance activities	2	0.40%	2	0.31%
Real estate activities	4	0.80%	4	0.63%
Consultancy, scientific and technical activities	24	4.80%	32	5.01%
Administrative and support service activities	14	2.80%	19	2.97%
Education	3	0.60%	5	0.78%
Human health and social work activities	98	19.60%	69	10.80%
Dental practice activities (34 firms in treatment group vs 14 in control group)				
General /Specialist medical p. activit. (42 firms in treatment group vs 28 in control group)				
Arts, entertainment, sports and recreation activities	5	1.00%	8	1.5%
Other service activities	7	1.40%	7	1.10%
Beauty parlours (1 firm in treatment group vs 1 in control group)				
Funeral /related activities (6 firms in treatment group vs 6 in control group 6)				
Total	**500**	**100.00%**	**639**	**100.00%**

Indeed, finding a suitable control group was another challenge to our research. In order to mitigate this situation, we selected firms with predetermined characteristics to include in the survey. For instance, one requirement in the selection process was the number of years in business. As stated previously, we aimed to study firms already established in the market.

The consequence of this requirement was the elimination of firms with potentially outlier behaviors, which could have easier behaviors to detect by our research model, but on the other hand could create a bias since they might not have representative behaviors of the population of firms. In the next table, we present the results obtained given these pre-established requirements.

Table 10. Firms' characteristics

Indicator	Treatment Group	Control Group	Total
Sales in Euros (mean)	1,395,050.00	1,291,667.00	
Sales growth rate (mean)	3.9%	2.7%	
Effective tax rate (mean)	18.48%	19.33%	
Corporate taxe rate (mean)	23.6%	23.6%	
Years in business in 2012 (mean)	20	21	
The most recent activity start date	2004-12-31	2004-12-31	
The earliest activity start date	1923-01-01	1935-09-21	
Number of firms per year (2007-2017)	500	639	**1,139**
Number of observations	5,500	7,029	**12,529**

As we expected, the table above shows that the average sales value of treatment and control groups is relatively close. The same happens with the growth rate of sales. As we have imposed requirements, the most recent start of activity was December 31, 2004.

Also, we find that ETR signals that the treatment group firms are more tax-aggressive. The next table shows in detail the evolution of the Sales Growth Rate and ETR in all periods, which are also our dependent variables.

Table 11. Dependent variables

Description	Sales Growth Rate	Effective tax rate
Mean	3.22 %	19.17%
Median	1.13%	17.91%
Minimum	-99.14 %	0%
Maximum	217.67%	100%
Std. Dev	0.235992	0.190664
Skewness	1.360746	1.891170
Kurtosis	10.34373	8.182536
Jarque – Bera	32020.38	21489.73
Probability	0.000000	0.000000
Number of firms per year (2007-2017)	1,139	1,139
Number of observations (2007-2017)	12,529	12,529

As described earlier, firms with large variations in sales growth rate were excluded because we recognized that these type of firms may have outlier behaviors. The maximum allowable value was less than 220% and the minimum value was greater than -100%, both belonging to firms in the treatment group.

Furthermore, to mitigate the limitations of ETR, namely the presence of negative values, we have established a minimum limit of "0" and a maximum limit of 100% (Gupta & Newberry, 1997). For instance, 18% of firms in the control group and 27% of firms in the treatment group had negative results in 2012.

Globally, there is a reasonable level of consistency between the mean and the median. However, the jarque-bera test that uses the kurtosis and skewness coefficients as parameters reveal that data has no normal distribution (Gujarati, 2003). Next, we present some particularities of the Portuguese tax system.

5.2 Tax audit feedback (Primary Source)

In some countries, there is a tradition of tax audit feedback for measuring taxpayers' satisfaction with the services provided by tax authorities with the purpose of seeking and identifying opportunities for improvement. For example, tax authorities in Canada[12] or the United States[13] carry out this type of survey. The tax authority in Portugal does not take this type of specific approach to tax auditing although it uses others[14].

5.2.1 Tax audit assessment

Inspired by the experience of the Canadian tax authority, our survey contained two questions with three possible answers related to the assessment of the tax authority and the tax auditor after a tax audit. The results found show a positive evaluation of the performance as we can see in the next figure.

Tax authority's assessment	**%**	**Tax auditor's assessment[15]**	**%**
Very efficient	30.2%	Very professional	37.3%
Efficient	**51.2%**	Professional	**50.6%**
Inefficient	18.6%	Unprofessional	12.1%

Figure 7. Tax audit assessment

As the answers were not mandatory, we only had answers from 86 firms. The rest chose not to express their opinion. Anyway, more than 80% of the respondents considered the tax authority's performance efficient or very efficient. The assessment of the tax auditor was quite similar. We received a small yet reliable amount of information straight from firms, which is hard to get with quantitative approaches (Hanlon, 2003).

With these questions, we wanted to know what firms thought after the tax audit. In practice, we tried to associate the perception of firms' risk, which is a parameter of the deterrence model (Slemrod, 2019), with the perception that remained after the tax audit. For example, if a firm found the tax authority's performance to be efficient, its perception of tax risk may increase and this could consequently affect its future tax compliance.

[12] https://cra-arc-survey-sondage.ca/Engine/s.aspx?surveyID=CB383C43-750F-4A5C-A2A2-026EB145F274&lang=EN

[13] https://dor.wa.gov/doing-business/audits/audit-survey

[14] https://info.portaldasfinancas.gov.pt/pt/apoio_contribuinte/SIAT/Documents/Relatorio_SIAT_2018.pdf

[15] According to the tax law, in the course of the tax audit procedure, the tax auditor must act with special prudence, courtesy, serenity and discretion, and should maintain confidentiality about the firms' situation.

5.2.2 Comments collected directly from the firms

To further explore the qualitative approach of our survey, given the limitations of the standard economic model of tax compliance in assessing firms' behavior beyond economic factors (Slemrod, 2019), we ended the online questionnaire with the following invitation:

> *If you would like to provide more information about your experience with tax inspection, including positiv**e** comments, please use the text box below or send us an email.*

Due to the low response rate, we did not require mandatory comments. The next figure summarizes the comments made by firm managers, which were originally written in Portuguese. To put them into context, we also added the answers given in the questions about the tax audit assessment, the tax audit outcome and the firms' location.

We also took advantage of these comments, which are rare information obtained directly from firms, to improve our investigation. The first group of comments collected in the survey is listed in the following figure and was relevant to confirm some details of the research design.

N.º	Comments	Tax authority	Tax auditor	Tax audit outcome	Location
1.	*There was no experience.*	No answer	No answer	No tax audit	--
2.	*The investigation should be terminated immediately after the first question for companies **not subject to an external** audit procedure. Good work!*	No answer	No answer	No tax audit	--
3.	*Having **never been** subject to tax inspections, I have no answer to the 2 questions regarding the efficiency and courtesy of the Tax Inspector, as you would expect.*	No answer	No answer	No tax audit	--
4.	*Corrections to the tax base **were voluntary**, upon further taxpayer declarations.*	Efficient	Professional	With adjustments	Porto
5.	*The inspection carried out is under **judicial review.***	Efficient	Professional	With adjustments	Porto
6.	*The technique visit took place one year after the scheduled visit date, with a high degree of professionalism. We continue to be guided by the fulfillment of all obligations, before the official entities.*	Efficient	Very professional	With adjustments	Coimbra
7.	*We have not yet been informed of the amount to be paid.*	Very efficient	Very professional	With adjustments	Coimbra

Figure 8. Comments relevant to the research design

For instance, the first three comments together with answers to the first survey question[16] helped us to select firms for the control group because these firms were not audited.

[16] *Has the firm been subjected to a full tax audit procedure between 2004 and 2018*? *Yes or No.*

Comments similar to #4 are also important because they signal a non-hostile reaction to the tax audit outcome (adjustments), as they have voluntarily paid the taxes due[17]. For example, this firm made an involuntary error with no real intention to evade taxes[18]. In comments similar to #5, we have the opposite situation with firms resorting to lawsuits.

Comments similar to #6 confirm our concern about the tax audit dates. In this situation, the firm received a warning letter, but the tax audit only started a year later when it should have started in 5 days. Comments similar to #7 confirm another concern. It does not seem plausible that in 2018 there were taxes to be paid from an audit carried out in 2012. The firm may have misinterpreted the type of tax audit.

In sum, these kind of comments were useful to guide the data collection process during the survey. We figure that the perception about the tax authority after a tax audit, despite the adjustments, seems to be positive. The next set of comments signal differences between the audited firms and the tax authority, which is linked to the principle of legality even though tax law can be complex (#8).

N.º	Comments	Tax authority	Tax auditor	Tax audit outcome	Location
8.	***I do not agree*** *to indirect methods. They don't analyze everything about the company and then we have to pay for a margin that is not always the right one.*	Efficient	Professional	With adjustments	Porto
9.	*The* ***fine*** *was imposed on the basis of research on the internet, regarding the consumption of neutral shampoo in a hairdresser, showing no seriousness because the professional dosers are larger than the private ones, and each time the doser is loaded.*	Inefficient	Unprofessional	With adjustments	Porto

Figure 9. Technical differences and fines

In comment #9, the firm mentioned the fine imposed. Indeed, fines are important in tax behavior. The severity of punishment for non-tax compliance is critical to the standard economic model of tax compliance, but this is still an area to explore in the literature (Slemrod, 2019).

[17] In total, the tax authority carried out more than 80.000 audits, but we are interested in less than 50% of these, which include full tax audits. In these situations, one third of taxpayers voluntarily paid the taxes due according the tax report FISCAIS (2012).

[18] For instance, in the United Kingdom the tax gap by behaviour is composed by non-payment, use of avoidance schemes, error, evasion, the hidden economy and criminal attacks on the tax system. But "Failure to take reasonable care' and 'Legal interpretation' account for the largest proportions of the tax gap (HMRC, 2019). Portugal does not publish these types of study.

The next set of comments is negative. For instance, in comment #10, the overall opinion was negative even with no adjustments. In other situations, the assessment of the tax authority was negative but positive for the tax auditor (#13). The opposite also happened (#14).

N.º	Comments	Tax authority	Tax auditor	Tax audit outcome	Location
10.	*Good Morning, The inspector who visited us deduced that because we do not owe suppliers, banks or the state, we would necessarily have to flee in terms of taxes, not wanting to know or know how the company is run.*	Inefficient	Unprofessional	No adjustments	Braga
11.	*It was a tax audit that became a **personal revenge** and in no way corresponds to the corrected value. The notification of liquidation was made outside the expirationy period. The corrected amount has nothing to do with the company's invoicing and the allegations were made against legally documented facts with contracts in existing contracts. An authentic scam. An overbearing Tax Authority that still continues to wreak havoc following this process.*	Inefficient	Unprofessional	No adjustments	Lisboa
12.	*One gets the idea that they have the knife and cheese in hand and make money out of it, because they know it's hard to get lawyers to defend us from the mistakes they make. It is a mobster situation that is difficult to denounce without suffering the consequences and difficult to prove because there are always various interpretations ...*	Inefficient	Unprofessional	With adjustments	Braga
13.	*At the end of the inspection **the company closed its doors**, it was like a witch hunt.*	Inefficient	Professional	With adjustments	Lisboa
14.	*In a meeting with the inspector and the head of inspection, it was found that the purpose of the inspection, rather than correcting the tax base, had a greater need to ensure the effective payment of the correction(…). One of the agreed conditions would be that in the near future we would not have inspections, which was agreed. However, in the following 2 years new corrections were quoteds. **The company has lost business** and has been almost inoperative since 2015.*	Efficient	Unprofessional	With adjustments	Lisboa
15.	***Unfair tax inspection** (why do you only inspect those who haves activity and do something?) Extemporaneous (when you does a project that has already been properly inspected) and unpleasant (trying to get into personal aspects of management).*	Efficient	Professional	No adjustments	Porto
16.	Excessive zeal and unwillingness to listen to the taxpayer.	Very efficient	Professional	With adjustments	Faro

Figure 10. Negative comments

The last group of comments collected from the survey is in favor of tax auditing. In these situations, there are no differences of assessment between tax authority and tax auditor.

N.º	Comments	Tax authority	Tax auditor	Tax audit outcome	Location
17.	*The tax inspection was important for consolidating the transparency and fairness of our organization's tax behavior.*	Efficient	Very professional	No adjustments	Porto
18.	*Inspection / correction by the Tax Inspector allowed us to learn how to work better so that we can comply with all legal procedures.*	Very efficient	Very professional	Not available	
19.	*Let us underline the competence and fine handling of the inspection.*	Very efficient	Very professional	With adjustments	Porto
20.	*The inspection was positive, as it allowed the correction of some less correct procedures and the general improvement of the knowledge of both parties. The only thing to improve is the timeliness of the interventio, as it would behave been more positive if 2017 were being analyzed*	Efficient	Professional	With adjustments	Lisboa
21.	*I had little idea of the exact procedures of the inspection process. The whole process was mainly handled with the accounting service. I know they asked for copies of some invoices and I just had to provide clarification on two points: Identifying the beneficiaries of some training paid by the company to its employees and clarification of the provision of services at VAT 0%, as it is a pharmacy Some of the services provided are exempt from VAT.*	Very efficient	Very professional	No adjustments	Setubal
22.	*We have Roc and Toc in this company with organized accounting. And all up to date*	Very efficient	Professional	Not available	Lisboa

Figure 11. Positive comments

In sum, all comments reflect real situations, but we must be careful with their interpretation because we have no way to confirm the information provided by firms. As stated previously, the only mandatory response in the survey was the firm's identification so although confidential, the questionnaire was not anonymous.

Regarding the information collected regarding the adjustment, it makes sense that the outcome will influence future tax compliance since adjustments have a direct impact on firms and their effects are expected to continue over a period of time. These findings have been suggested in studies that had access to tax data with adjustments (Gemmell & Ratto, 2012; Mazzolini et al., 2017; Perez-Truglia et al., 2019). Next, we check the future tax compliance after tax audit through a quantitative approach.

5.3 Difference-in-differences (DID) results

In the previous section, we presented some descriptive statistics and the feedback on the tax audit's performance. This section presents the main results obtained. As stated previously, to assess the tax audit's effect on tax compliance we followed a DID strategy.

Based on equation (1), we tested whether the behavior of the treatment group (audited firms) differs from the control group with the purpose of assessing the impact of a tax audit on firms' behavior. If the coefficient α is positive and statistically significant, then we might conclude that firms increased compliance after a tax audit.

We present the results for 4 versions of the model based on equation (1). In models 1 and 2, we excluded from the sample the year in which the tax audit was held, similarly to the study conducted in the United Kingdom (Gemmell & Ratto, 2012). The first period includes years 2007 to 2011 (before the event), and the second period includes years 2013 to 2017 (after the event). With this option, we lost 1139 observations from the year 2012.

In models 3 and 4, we included the year of the tax audit performed in the period before the event. The first period includes the years 2007 to 2012 (before the event), and the second period includes the years 2013 to 2017 (after the event). With this option, we did not lose the 1139 observations from the year 2012.

Next, we explore the long, medium and short-term impacts of the tax audit on tax compliance. Then, we explored the well-known average and dynamic effect of tax audit on tax compliance.

5.3.1 Long-term impact of the tax audit on tax compliance

In the first approach, we explored the long-term impact (five years) of the tax audit on tax compliance using as dependent variables sales growth rate and ETR. In the next table, we present the results for the 4 versions of the model based on equation (1).

Table 12. Long-term impact of the tax audit on tax compliance (five years)

Equation (1) : $Y_{it} = \beta_0 + \beta_1 D_G + \beta_2 D_T + \alpha D_G D_T + \varepsilon_{it}$, where Y_{it} is the sales growth rate or ETR, our proxy for tax compliance, of firm i in year t (audit year=2012). D_G is a dummy for firms being in a group (1= treatment group; 0= control group). D_T is a dummy equal to "1" for all periods from 2013 to 2017 and "0" before 2012 (2007 to 2011).

Description	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Dependent Variable	Sales growth rate	Sales growth rate	ETR	ETR
Sample (tax years included)	2007-2017	2007-2017	2007-2017	2007-2017
Sample included tax audit performed (2012)	No	Yes (2012)	No	Yes (2012)
Years included before tax audit	**5**	**6**	**5**	**6**
Years included after tax audit	**5**	**5**	**5**	**5**
Coefficient β_0 (Absence of treatment)	0.040781	0.024208	0.190504	0.194990
	(0.003655)	(0.003325)	(0.003184)	(0.002952)
Coefficient β_1 (Group effect)	**0.009784***	0.008141	**-0.014347*****	**-0.014330*****
	(0.005517)	(0.005019)	(0.004806)	(0.004454)
Coefficient β_2 (Time trend effect)	**-0.014147*****	0.001827	0.002156	-0.002262
	(0.005170)	(0.004932)	(0.004503)	(0.004378)
Coefficient α (Effect of tax audit)	0.002622	0.004194	0.010498	0.010524
	(0.007803)	(0.007444)	(0.006797)	(0.006607)
R-squared	0.001707	0.000690	0.001191	0.000915
F-statistic	6.488706	2.883379	4.524754	3.825404
Prob(F-statistic)	0.000221	0.034364	0.003558	0.009432
Durbin-Watson statistic	1.899789	1.878505	1.114516	1.089169
Fixed effects and Firms control	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes
Number of treatment firms per year	500	500	500	500
Number of control firms per year	639	639	639	639
Entry and exit of firms in the sample	No	No	No	No
Cross-sections included (number of firms)	1139	1139	1139	1139
Total panel (balanced) observations	11390	12529	11390	12529

The dependent variable was winsorized at the 2st and 98th percentile. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. Standard errors are in parentheses. Difference-in-Differences Parameters; Method: Panel Least Squares; Software: EViews.

First of all, the results found that the coefficient β_1,also known as group effect, had a significant and positive value in model 1 (0.009784*), that used the sales growth rate as dependent variable, but negative in model 3 (-0.014347***) and model 4 (-0.014330***), which used ETR as dependent variable.

This suggests that the treatment group firms, on average, performed better in terms of sales growth than control group before the tax audit, but there were also more tax aggressive firms measured by ETR.

This result is also in line with the average ETR calculated earlier (see Table 10). Indeed, the treatment group has an average ETR over the entire period of 18.48%, which is lower than the average ETR of the control group which is 19.33%. Therefore, the latter has a

less aggressive behavior measured by ETR, which is also used in the literature as a measure of tax compliance (Lennox et al., 2013). If we consider only the period before the tax audit, the conclusion appears to be similar- the treatment group firms are more tax aggressive (see Figure 2).

Second, the coefficient β_2, also known as time trend effect, has a significant but negative value (-0.014147***) in model 1.This suggests that the performance of both groups was worse in the second period (after tax audit). In the remaining models, this coefficient is not significant.

Finally, the coefficient α, that is the most important for measuring the effect of a tax audit, is positive but not significant in all models.This suggests that tax audits had no effect after 5 years on the tax behavior of audited firms.

In sum, it is expected that the effect of an audit will be limited in time. With these results, we can conclude that this effect is less than 5 years. After testing the long-term impact of a tax audit on tax compliance (five years after tax audit), in the next approach, we will go deeper into this path by testing the medium-term impact (two years after tax audit). With this strategy, we seek to identify over time the effect of a tax audit, namely the maximum and minimum scope[19].

[19] We are aware that there are other ways to explore the long-term impact of a tax audit on compliance. For instance, Beer et al. (2015) used the change of the reported taxable income between two different tax years (2007 and 2010) as the variable dependent.

5.3.2 The medium-term impact of the tax audit on tax compliance

In this set, we explore the medium-term impact of tax audits on tax compliance (two years). The following table presents the results of the 4 versions of the model in equation (1).

Table 13. Medium-term impact of a tax audit on tax compliance (two years)

Equation (1) : $Y_{it} = \beta_0 + \beta_1 D_G + \beta_2 D_T + \alpha D_G D_T + \varepsilon_{it}$, where Y_{it} is the sales growth rate or ETR, our proxy for tax compliance, of firm i in year t (audit year=2012). D_G is a dummy for firms being in a group (1= treatment group; 0= control group). D_T is a dummy equal to "1" for all periods from 2013 to 2017 and "0" before 2012 (2007 to 2011).

Description	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Dependent Variable	Sales growth rate	Sales growth rate	ETR	ETR
Sample (tax years included)	2010-2014	2010-2014	2010-2014	2010-2014
Sample included tax audit performed (2012)	No	Yes (2012)	No	Yes (2012)
Years included before tax audit	**2**	**3**	**2**	**3**
Years included after tax audit	**2**	**2**	**2**	**2**
Coefficient β_0 (Absence of treatment)	0.023180	-0.001321	0.167692	0.175083
	(0.004089)	(0.003340)	(0.003585)	(0.003002)
Coefficient β_1 (Group effect)	-0.009294	-0.004828	**-0.014724*** **	**-0.016361*** **
	(0.006172)	(0.005042)	(0.005410)	(0.004529)
Coefficient β_2 (Time trend effect)	**-0.010544***	**0.012076** **	**0.013423*** **	0.006887
	(0.005783)	(0.005282)	(0.005069)	(0.004746)
Coefficient α (Effect of tax audit)	**0.020297** **	**0.015532***	-0.003617	-0.001939
	(0.008729)	(0.007972)	(0.007651)	(0.007162)
R-squared	0.001226	0.004676	0.006247	0.004690
F-statistic	1.862499	8.911576	9.538222	8.939050
Prob(F-statistic)	0.133660	0.000007	0.000003	0.000007
Durbin-Watson statistic	1.930267	1.882335	0.899610	0.879628
Fixed effects and Firms control	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes
Number of treatment firms per year	500	500	500	500
Number of control firms per year	639	639	639	639
Entry and exit of firms in the sample	No	No	No	No
Cross-sections included (Number of firms)	1139	1139	1139	1139
Total panel (balanced) observations	4556	5695	4556	5695

The dependent variable was winsorized at the 10th and 90th percentile. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. Standard errors are in parentheses. Difference-in-Differences Parameters; Method: Panel Least Squares; Software: EViews. Note: In model 1, the F statistic is not significant. In models 3 and 4, the Durbin-Watson test detected the presence of positive serial correlation in the residuals.

First of all, the coefficient β_1 is negative and therefore significant in models 3 and 4. Similarly to the previous approach, this result suggests that firms from the treatment group are more tax aggressive before a tax audit.

Second, the coefficient β_2 has a significant and negative value in model 1, but positive in model 2, which is inconsistent despite the fact that the models used the same dependent variable.

Finally, the coefficient α (effect of tax audit) is positive and significant in models 1 and 2 which used the sales growth rate as dependent variable. This suggests that the impact of a tax audit on tax compliance persists in the medium term, at least two years.

5.3.3 The short-term impact of the tax audit on tax compliance

In this approach, we explore short-term impact of tax audits on tax compliance (one year). The next table, presents the results for 4 versions of the model based on equation (1).

Table 14. Short-term impact of tax audit on tax compliance (one year)

Equation (1) : $Y_{it} = \beta_0 + \beta_1 D_G + \beta_2 D_T + \alpha D_G D_T + \varepsilon_{it}$, where Y_{it} is the sales growth rate or ETR, our proxy for tax compliance, of firm i in year t (audit year=2012). D_G is a dummy for firms being in a group (1= treatment group; 0= control group). D_T is a dummy equal to "1" for all periods from 2013 to 2017 and "0" before 2012 (2007 to 2011).

Description	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Dependent Variable	Sales growth rate	Sales growth rate	ETR	ETR
Sample (tax years included)	2011-2013	2012-2013	2011-2013	2012-2013
Sample included tax audit performed (2012)	No	Yes (2012)	No	Yes (2012)
Years included before tax audit	**1**	**1**	**1**	**1**
Years included after tax audit	**1**	**1**	**1**	**1**
Coefficient β_0 (Absence of treatment)	-0.002931	-0.053195	0.177921	0.203203
	(0.006949)	(0.006779)	(0.006214)	(0.006555)
Coefficient β_1 (Group effect)	-0.008241	0.002565	-0.013537	**-0.016566***
	(0.010488)	(0.010232)	0.009379	(0.009884)
Coefficient β_2 (Time trend effect)	0.003104	**0.052197*****	**0.025949*****	0.001381
	(0.009827)	(0.009587)	(0.008788)	(0.009267)
Coefficient α (Effect of tax audit)	**0.029383****	0.018137	-0.005596	-0.002374
	(0.014832)	(0.014470)	(0.013264)	(0.013979)
R-squared	0.004120	0.031655	0.008278	0.002843
F-statistic	3.135990	24.77903	6.326953	2.160803
Prob(F-statistic)	0.024524	0.000000	0.000286	0.090669
Durbin-Watson statistic	1.978861	2.004774	1.035848	0.844792
Fixed effects and Firms control	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes
Number of treatment firms per year	500	500	500	500
Number of control firms per year	639	639	639	639
Entry and exit of firms in the sample	No	No	No	No
Cross-sections included (Number of firms)	1139	1139	1139	1139
Total panel (balanced) observations	2278	2278	2278	2278

The dependent variable was winsorized at the 5th and 95th percentile. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. Standard errors are in parentheses. Difference-in-Differences Parameters; Method: Panel Least Squares; Software: EViews. Note: In models 3 and 4, the Durbin-Watson test detected the presence of positive serial correlation in the residuals.

The coefficient β_1 is only significant in model 4 and the coefficient β_2 has a significant value in models 2 and 3. The coefficient α is positive and significant only in model 1. This suggests that tax audits have effect up to 1 year on the tax behavior of audited firms.

5.3.4 Impact of tax audit on tax compliance (overall summary)

The results in the previous points seem to suggest that tax auditing has a positive impact on tax behavior of audited firms in the short (one year) and medium-term (two years). No evidence was found in the long-term, that is, 5 years after the tax audit it appears that its effect has disappeared. In the next table, we present a summary of the scale of the impact of a tax audit.

Table 15. Tax audit effect on tax compliance

Model\Years after the tax audit	One years after the tax audit (2013)	Two years after the tax audit (2013-2014)	Five years after the tax audit (2013-2017)
Model 1 Dependent Variable: Sales Growth Rate (percentage points)	**2.94****	**2.03****	0.26
Model 3 Dependent Variable: ETR (percentage points)	-0.56	-0.36	1.05

On the one hand, the results of model 1 show that the impact in the first year after a tax audit is 2.94 percentage points on the growth rate of sales at the treatment group relative to the control group. This higher average performance of audited firms, compared to non-audited firms, continues for the following 2 years (2.03 p.p.), even though the difference fades over time.

After five years, we no longer find differences between the groups, which suggests that the effect of a tax audit has become insignificant in the long-term. This is an interesting result and may represent a maximum scope of the tax audit in tax compliance. The results of model 2 are similar.

On the other hand, the results of model 3 suggest a higher level of tax aggressiveness in the first year after the tax audit, and this also decreases over time. Yet, we found no statistically significant difference on the results of this model for coefficient α (effect of the tax audit). The results of model 4 are similar. These models used ETR, the second dependent variable used in our study.

In the next two sections, we will explore two common approaches in the literature to study the effect of tax audits (DeBacker et al., 2015b): The average and dynamic effect of tax audit on tax compliance.

5.3.5 The average effect of the tax audit on tax compliance (four years)

In this set, we explore the average effect of a tax audit on tax compliance. As usual, the next table presents the results for the 4 versions of the model based on equation (1).

Table 16. Average impact of the tax audit on tax compliance

Equation (1) : $Y_{it} = \beta_0 + \beta_1 D_G + \beta_2 D_T + \alpha D_G D_T + \varepsilon_{it}$, where Y_{it} is the sales growth rate or ETR, our proxy for tax compliance, of firm i in year t (audit year=2012). D_G is a dummy for firms being in a group (1= treatment group; 0= control group). D_T is a dummy equal to "1" for all periods from 2013 to 2017 and "0" before 2012 (2007 to 2011).

Description	Model 1	Model 2	Model 3	Model 4
Dependent Variable	Sales growth rate	Sales growth rate	ETR	ETR
Sample (tax years included)	2008-2016	2008-2016	2008-2016	2008-2016
Sample included tax audit performed (2012)	No	Yes (2012)	No	Yes (2012)
Periods included before tax audit	**4**	**5**	**4**	**5**
Periods included after tax audit	**4**	**4**	**4**	**4**
Coefficient β_0 (Absence of treatment)	0.020469	0.005532	0.165474	0.170627
	(0.002899)	(0.002598)	(0.002467)	(0.002256)
Coefficient β_1 (Group effect)	0.002404	0.002550	**-0.014839*** **	**-0.015806*** **
	(0.004376)	(0.003922)	(0.003723)	(0.003404)
Coefficient β_2 (Time trend effect)	-0.004625	0.008408	**0.008703** **	0.004240
	(0.004100)	(0.003898)	0.003489	(0.003383)
Coefficient α (Effect of tax audit)	**0.011020***	**0.010797***	0.004030	0.005052
	(0.006189)	(0.005883)	(0.005266)	(0.005106)
R-squared	0.001066	0.002916	0.004413	0.003506
F-statistic	3.238853	9.990638	13.45651	12.01778
Prob(F-statistic)	0.021181	0.000001	0.000000	0.000000
Durbin-Watson statistic	1.908934	1.883827	0.859895	0.855247
Fixed effects and Firms control	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes
Number of treatment firms per year	500	500	500	500
Number of control firms per year	639	639	639	639
Entry and exit of firms in the sample	No	No	No	No
Cross-sections included (Number of firms)	1139	1139	1139	1139
Total panel (balanced) observations	9112	10251	9112	10251

The dependent variable was winsorized at the 10th and 90th percentile. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. Difference-in-Differences Parameters; Method: Panel Least Squares; Software: EViews.
Note: In models 3 and 4, the Durbin-Watson test (DW) detected the presence of positive serial correlation in the residuals. In both models, the DW statistic is less than 1, which is a concern when using the least squares method. There are no indications of correlation if the DW statistic is around 2.

First of all, the coefficient β_1 is positive but not significant in models 1 and 2. In models 3 and 4 which used the ETR as a dependent variable, the group effect is negative and statistically significant. As in previous models (medium and long-term impact of the tax audit on tax compliance, see Table 12 and 13), this suggests that the treatment group firms on average were more tax aggressive before the tax audit.

Second, the coefficient β_2 has a significant and positive value in model 3. This result suggests that firms were more tax compliant in the post-tax audit period.

Finally, our coefficient α is positive and significant in models 1 and 2 .This suggests that tax audits have an effect of up to 4 years after on the tax behavior of the audited firm. Next we explore how the impact of a tax audit changes over time.

5.3.6 The dynamic effect of tax audit on tax compliance

In the previous models, we estimated the average effect of a tax audit. In this set, we explore the dynamic effect of a tax audit on tax compliance. To achieve this purpose, a vector α_T in equation (1) represents the dynamic tax audit effect by the interactions between the treatment dummy and variables dummy for the number of years (2013 to 2017) since the tax audit (2012). As usual, in the next table we present the results of the 4 versions of the model based on equation (1).

Table 17. Dynamic tax audit effect

Equation (1) : $Y_{it} = \beta_0 + \beta_1 D_G + \beta_2 D_T + \alpha D_G D_T + \varepsilon_{it}$, where Y_{it} is the sales growth rate or ETR, our proxy for tax compliance, of firm i in year t (audit year=2012). D_G is a dummy for firms being in a group (1= treatment group; 0= control group). D_T is a dummy equal to "1" for all periods from 2013 to 2017 and "0" before 2012 (2007 to 2011).

Description	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Dependent Variable	Sales growth rate	Sales growth rate	ETR	ETR
Sample (tax years included)	2007-2017	2007-2017	2007-2017	2007-2017
Sample included tax audit performed (2012)	No	Yes (2012)	No	Yes (2012)
Periods included before tax audit	**5**	**6**	**5**	**6**
Periods included after tax audit	**5**	**5**	**5**	**5**
Coefficient β_0 (Absence of treatment)	0.037056	0.028208	0.167419	0.169155
	(0.002391)	(0.002226)	(0.001367)	(0.001312)
Year 1 (Treatment Group=1)*(Year 2013=1)	**0.028126****	**0.027890****	**-0.021169*****	**-0.021095*****
	(0.012915)	(0.012779)	(0.007386)	(0.007532)
Year 2 (Treatment Group=1)*(Year 2014=1)	-0.003359	-0.003280	**-0.015514****	**-0.015505****
	(0.012915)	(0.012779)	(0.007386)	(0.007532)
Year 3 (Treatment Group=1)*(Year 2015=1)	0.012810	0.012905	-0.008285	-0.008230
	(0.012915)	(0.012779)	(0.007386)	(0.007532)
Year 4 (Treatment Group=1)*(Year 2016=1)	**0.029939****	**0.029944****	0.001730	0.001814
	(0.012915)	(0.012779)	(0.007386)	(0.007532)
Year 5 (Treatment Group=1)*(Year 2017=1)	-0.002946	-0.003040	-0.005084	-0.005017
	(0.012915)	(0.012779)	(0.007386)	(0.007532)
R-squared	0.026618	0.040746	0.005623	0.005983
F-statistic	22.21820	35.43435	0.004399	5.021271
Prob(F-statistic)	0.000000	0.000000	0.000000	0.000000
Durbin-Watson statistic	1.919480	1.920452	0.847881	0.845993
Year fixed effects	Yes	Yes	Yes	Yes
Firms control	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes
Number of treatment firms per year	500	500	500	500
Number of control firms per year	639	639	639	639
Entry and exit of firms in the sample	No	No	No	No
Cross-sections included (Number of firms)	1139	1139	1139	1139
Total panel (balanced) observations	11390	12529	11390	12529

The dependent variable sales growth rate was winsorized at the 1st and 99th percentile. The dependent variable ETR was winsorized at the 10th and 90th percentile. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. Standard errors are in parentheses. Difference-in-Differences Parameters; Method: Panel Least Squares; Software: EViews. Note: In models 3 and 4, the Durbin-Watson test detected the presence of positive serial correlation in the residuals.

With regard to models 1 and 2, the results from the first year (2013) after the tax audit suggest that the treatment group firms experienced a higher sales growth rate than firms that were not audited. In model 1, audited firms reported a sales growth rate of 2.81 percentage points (p.p.) higher than non-audit firms. The results obtained using model 2 are similar.

For the second year (2014) and third year (2015), the values found are not significant, but in the fourth year (2016) the values are again positive and significant (**0.029939****). Indeed, four years after the tax audit, we found that audited firms still reported more than unaudited firms. From the fifth year (2017) onwards, the results found are not significant.

With regard to models 3 and 4 that use ETR as a dependent variable, the results from the first year (2013) and second year (2014) after the tax audit suggest that the treatment group firms experienced higher levels of tax aggressiveness than firms that were not audited which is consistent with the results of the previous models[20]. From the third year (2015) onwards, the results found are not significant.

In sum, in this chapter the research hypothesis were was confronted with data and a theoretical framework. The main findings confirmed the first hypotheses formulated during these investigation (*H0*: *The level of tax compliance of firms increases after a tax audit*). In the next chapter, we will proceed to a more detailed discussion of the results obtained.

[20] In the previous analysis of the long-term impact of the tax audit on tax compliance (five years after a tax audit), the coefficient β_1 is (group effect) is, also negative and significant in Model 3 and 4 (see Table 12); This result suggests that firms from the treatment group were more tax aggressive before the tax audit.

In the previous analysis of the Medium-term impact of the tax audit on tax compliance (two years after tax audit), the coefficient β_1 (group effect) is, also negative and significant in Model 3 and 4 (see Table 13);

In the previous analysis of the average impact of the tax audit on tax compliance, the coefficient β_1 (group effect) is, also negative and significant in Model 3 and 4 (see Table 16).

6. Discussion

The well-known benchmark standard economic model of tax compliance or simply the deterrence model, which is widely used by tax authorities, predicts that tax compliance will increase after a tax audit.

This model has been tested several times in the past few decades (Slemrod, 2019), but recent empirical studies have indicated some inconsistencies in the fundamental assumptions that may compromise the full understanding of high tax compliance in present times (Perez-Truglia et al., 2019; Slemrod, 2007).

The purpose of our study is to assess if the effect of tax audits is consistent with this model and aims to give a contribution to this specific and growing literature that studies the effect of tax audits on tax compliance done in some cases in close collaboration with tax authorities. We did not address the general deterrence that follows the impact of threat of a tax audit usually associated with tax experiments, in which sometimes participants may have prior knowledge that they are part of a study.

Indeed, we investigated the impact of tax enforcement on real economic activity, the specific deterrence and our research was based on financial statements with an innovative approach based on surveys, which made it possible to obtain perceptions directly from firms (primary sources). To the best of our knowledge, our study is unique in Portugal. Despite the increase of literature, this topic remains to be further explored (Pomeranz & Vila-Belda, 2019).

With this background, in the next sections we attempt to discuss the results found more in depth and how they can be integrated into the current literature. We started by analysing the long and short-term impacts of a tax audit on tax compliance. The idea is to start with a longer term and then reduce it in order to identify the effect of a tax audit over time. Then, we explored the dynamic and average effects that are another way of assessing the impact of a tax audit on tax compliance.

The final part of this study addresses some specific issues related to target and random tax audits, tax audit feedback and parameters of the standard economic model of tax compliance.

6.1 The long-term impact of tax audit on tax compliance (five years)

As we have seen in the previous chapter, the first set of difference-in-differences (DID) estimations explores the long-term impact of tax audit on tax compliance. We used the sales growth rate and ETR as dependent variables, over the tax years 2007 to 2017. The target tax audit was carried out in 2012 and estimates of average tax audit effects based on equation (1) that were presented in the previous table 12.

In line with recent studies, we did not find a long-term impact of tax audit on tax compliance. Indeed, 5 years after the tax audit it appears that its effect has practically disappeared. This is an interesting finding, as it can represent a maximum limit of the effect of tax auditing on tax compliance.

Our result is not unexpected due to the fact that some studies published in the last decade have found similar conclusions. For instance, the positive effect seems to have disappeared from the fourth year in Italy, in a study based on taxpayers exposed to target audits using DID methodology (Mazzolini et al., 2017).

Findings from another investigation, this time based on random tax audits from UK, indicates a similar conclusion. Also with DID approach, the effect of the tax audit from the fifth year onward tends to be insignificant (Advani et al., 2015). In the same stream, although with target audits, a study from US suggests the equivalent effect (Niu, 2011).

However, we are aware that there are studies that point in a different direction from our results, diverging from common expectations. For instance, in a major project in US also using random audits and DID approach it was found that firms decrease tax compliance few years after tax audit and then increase it sharply, with the so-called crater effect or U shape impact (DeBacker et al., 2015b).

Another interesting investigation found that tax compliance increases until a certain tax audit level and decreases after that level, using country-level data including Portugal (Mendoza et al., 2017). These authors point out another interesting point, they emphasize the importance of distinguishing the different types of tax audits, for example desk tax audit or full tax audit, random audit vs. target audit or firms vs. individuals. Concerning this, our investigation tried to mitigate this type of situation by focusing only on target full tax audit and only on firms, not on individuals.

As stated previously, the evidence found that the tax audit effect will fade over time is not an unexpected result. There are some possible reasons for this finding. For instance, several processes like audit-risk, penalty updating or learning experience could lead to this result.

In addition, there may be other reasons for the changes in the audited firms, as a whole, after the tax audit were not significant larger or smaller than those reported in the non-audited firms. For instance, there may be several subgroups in the sample that may react differently to a tax audit (Gemmell & Ratto, 2012). In order to obtain a similar response and avoid subgroups, our selection process was designed to include similar firms.

Overall, our findings about the long-term impact of a tax audit suggest that, like other countries, this consequence is limited in time. Five years later, it seems that there is no effect. This conclusion, related to the indirect effects of target tax audits, can be particularly useful for tax authorities when deciding on optimal enforcement strategy.

Indeed, understanding the long-term impact of conducting tax audits, besides the direct effect like revenue collections or penalties for the year the inquiry, could be critical to tax compliance. For firms, this result may also be relevant, since raises awareness to the importance of tax risk management on reporting frameworks.

In sum, after finding a maximum scope for the long-term impact of the tax audit on tax compliance (five years after the tax audit), in the next section we will discuss a minimum limit (one years after the tax audit). As we said before, with this strategy we seek to identify over time the effect of a tax audit, namely the maximum and minimum scope.

6.2 The short-term impact of tax audit on tax compliance (one year)

The next set of DID estimations explores the short-term impact of tax audit on tax compliance. Following our strategy, we used the same dependent variables, but only over tax years 2011 to 2013. In others words, we reduced the sample to the minimum possible, the tax year before and after the target tax audit. Estimates of average tax audit effects based on equation (1) were presented in table 14.

As we expected, we found a positive short-term impact of tax audit on tax compliance, using sales growth rate as a dependent variable. For instance, model 1 suggests an impact on the first year after a tax audit of 2.94 percentage points on the growth rate of sales of

treatment firms relative to control firms, similar to other studies (D'Agosto et al., 2018). In general, the results of this set are in line with the literature (Advani et al., 2015). Furthermore, a study that used similar dependent variables shows an impact of 2.63 pp in the first year after tax audit (Niu, 2011). With regard to models 3 and 4 that use ETR as a dependent variable, the results suggest a higher level of tax aggressiveness but they are not statistically significant.

In sum, we have found a positive impact of the tax audit in the short term (one or two[21] years after a tax audit), but not in the long term (five years after a tax audit). In the next two sections, we go further down this path with an analysis of the average and dynamic effects of tax audits on tax compliance, a common approach in this specific area of the literature.

6.3 The average effect of the tax audit on tax compliance (four years)

This set of DID estimations explores the average effect of tax audits on tax compliance. We used the same dependent variables, but over tax years 2008 to 2016[22]. In others words, we took one year from the sample used in the earlier long-term (five years) approach, where no tax audit effect was found. Estimates of average tax audit effects based on equation (1) were presented in table 16.

As we said before, we tested whether the behavior of the targeted tax audited firms, as a whole, differ from the non-audited firms. Our evidence indicates, as predicted, a positive impact of tax audit on tax compliance using sales growth rate as a dependent variable (models 1 and 2). This finding supports the commonly held belief that tax audit influence firms to be more compliant in the future (Slemrod, 2019).

Indeed, the positive average effect of a tax audit, with adjustments, on tax compliance found in our investigation is in line with recent studies on this specific literature (Advani et al., 2015; DeBacker et al., 2015b; Gemmell & Ratto, 2012; Mazzolini et al., 2017).

Another interesting finding is related to the final outcome of the tax audit. This hypothesis earlier discussed suggests that taxpayers with adjustments in tax audits tend to comply

[21] For two years after the tax audit the result is similar (see Table 13).

[22] Over tax years 2007 to 2017 the results found were not significant.

more (Gemmell & Ratto, 2012). This UK study found the response to a tax audit depends on the results of the audit. In particular, those who were found to be compliant reduced their subsequent compliance while those found to be noncompliant increased their subsequent compliance.

Concerning this, in our sample there are only firms that were tax audited resulting in adjustments, although the situation was solved voluntarily. Thus, our findings point in the same direction as Gemmell and Ratto (2012). Our study only focused on this particular group, which reacted as expected, being more tax compliant in the future.

Furthermore, Gemmell and Ratto (2012) found that in general the effect of a tax audit on small and medium businesses was greater than that for personal taxpayers, which is consistent with the argument that tax compliance depends on tax evasion opportunities. Our results support this finding, since we only addressed small and medium firms, and they reacted as expected, being more tax compliant in the future.

Indeed, in the selection process we tried to include only similar firms so that the reaction to the tax audit would be as similar as possible. The key idea is to have firms with the same tax evasion opportunities and incentives in the sample. In other words, we can say that we only addressed one type of taxpayers (small and medium firms), and thus mitigated the different reactions to tax audits. Large firms may have different opportunities to evade taxes.

Also, our results are in line with the conclusions of others studies that found that tax audits led to an increase of the income report (Kleven et al., 2011), or that found a positive relationship between tax compliance and tax auditing (Niu, 2011).

Overall, our findings are in line with what we anticipated in our first formulated research hypothesis and emphasizes the relevance of the indirect effect of tax audits on tax compliance. This suggests the importance of designing tax compliance strategies based on compliance risk management in order to balance cost and effectiveness (improving targeting). Tax authorities should be aware of how tax audits have an impact on future compliance behavior

Finally, there are noted differences between our study and most of the above-mentioned studies. First, our study does not address the effect of random audits on tax compliance,

but the effect of target audits, which is a less explored area (Advani et al., 2017). We will explore this issue later.

Second, our study does not address the behavior of individuals, but of small and medium-sized firms, which is also an area with few published studies. For example, a study from Italy used target tax audits to study the effect on individuals (Mazzolini et al., 2017). A study from the US uses random tax audits to study the effect on firms (DeBacker et al., 2015b). We used target tax audits to study the effect on real firms.

6.4 The dynamic tax audit effect

After exploring the average effect of tax audits in the previous section, the the following set of DID estimations explores the dynamic effect of tax audit on tax compliance. We are aware that firms' behavior may change over time, and it is likely that they will review the likelihood of a tax audit based on their most recent experience. Through a dynamic analysis, it is possible to assess the duration of the effect of a tax audit on tax compliance.

However, given the specifics of tax audits, namely the start and end dates or the final result of the procedure which may occur in different years, some caution is needed in the short-term analysis of the effect of a tax audit on tax compliance. As usual, we used the sales growth rate (models 1 and 2) and ETR (models 3 and 4) as dependent variables, over tax years 2007 to 2017. The target tax audit was carried out in 2012 and the results on equation (1) are presented in table 17 (see above).

With regard to models 1 and 2, we found a positive impact of tax auditing on tax compliance one year after the tax audit. In others words, the results from the first year (2013) after the tax audit suggest that the treatment group firms experienced a higher sales growth rate than firms that were not audited. A study that used equivalent dependent variables shows a similar impact (2.63 p.p.) in the first year after tax audit (Niu, 2011).

For the second and third year after the tax audit, the values found are not significant. In the fourth year the values are again positive and significant. Indeed, four years after the tax audit, we found that audited firms still report more than unaudited firms. From the fifth year onwards, the results found became insignificant. In general, the results of this set are as expected and are in line with the literature (Advani et al., 2015).

With regard to models 3 and 4 that use ETR as a dependent variable, the results from the first (2013) and second years after the tax audit suggest that the treatment group firms experienced a higher level of tax aggressiveness than firms that were not audited. From the third year onwards, the results found are not significant.

Next, we will read the models together, since the dependent variables are different. One tries to measure tax compliance, while the other tries to assess the level of tax aggressiveness (ETR). The growth rate of sales is an advanced indicator that measures the change in the behavior of firms, which can originate from the conditions imposed by the markets or reflect the result of a business strategy of the firm itself. ETR is a more comprehensive measure which may not capture the immediate behavior of firms. In the next table, we resume the scale of the impact of a tax audit over time, using the results of models 1 and 3.

Table 18. Dynamic effect of tax audit effect on tax compliance

Model/Years after the tax audit	1 Year (2013)	2 years (2013-2014)	3 years (2013-2015)	4 years (2013-2016)	5 years (2013-2017)
Model 1 - Dependent Variable: Sales Growth Rate (percentage points)	**2.81****	-0.34	1.28	**2.99****	-0.29
Model 3 - Dependent Variable: ETR (percentage points)	**-2.12*****	**-1.55****	-0.83	0.17	-0.51

If we look closely at the data presented in the last table, the combined results of models 1 and 3 suggest that, at least in the first year after the tax audit (2013), the treatment group firms experienced a higher sales growth rate (2.81**) than firms that were not audited which is an expected result, but also experienced higher level of tax aggressiveness (-2.12***), which is an unexpected result according to the standard economic model of tax compliance. In other words, it appears that the audited firms report more revenue in the year after the audit but, at the same time, report proportionally more spending. This is an interesting finding that results from the joint reading of the two measures.

In the second year after the tax audit, the audited firms continue to be more aggressive (-1.55 **), which is a trend that carried over from the period before the audit, but this time they experienced a lower sales growth rate than firms that were not audited, although the results are not significant (-0.34).

Finally, in the fourth year the values are again positive and significant (2.99**). This result supports the maximum reach of the effect of a tax audit found in the previous

approach (average effect of tax audit on tax compliance, see Table 16). In others words, four years after the tax audit, we found that audited firms still report more than unaudited firms. From the fifth year onwards, the results found became insignificant on all models.

In sum, so far we have addressed the various effects of a tax audit on tax compliance studied in the literature such as long and short term effect, or the average and dynamic effect. In the next section, we tackle an equally interesting subject, which is the type of tax audit that tax authorities use to have these effects.

6.5 Risk based tax audit vs random tax audit

We used operational data from tax audits (target audits), a distinctive feature of our study, but we are aware that this may not be the most appropriate way to assess tax compliance for the entire population since tax audits are designed to detect suspicious taxpayers (Advani et al., 2015).

Therefore, the magnitude of tax evasion could be exaggerated. In this way, random audits could provide a more accurate picture of the phenomenon of tax evasion. Studies based on random tax audits have a methodological advantage over those using operational data from tax audits, which results from the randomness of treatments.

An interesting study that addresses this topic was carried out by Gemmell and Ratto (2012). Already mentioned a few times given its relevance in literature, this UK study explores if target tax audits may have stronger tax compliance effects than random tax audits. The latter seem to have a negative effect on tax compliance, as they increase the share of tax audits without adjustments. This UK investigation also suggests that the indirect effect of a tax audit may be higher with tax random audits than with target audits. Thus, it is not clear which of these two opposing effects may be stronger in tax compliance.

Indeed, if the investigation intends to assess the impact of a tax audit on future behavior of audited taxpayers, as is our case, the use of random audits can have two major limitations (Slemrod, 2018).

First, taxpayers may know that they were randomly selected to be audited for study purposes. In the real world, taxpayers' reactions depend on the probability of detection of their evasion and penalty, according to the standard economic model of tax compliance.

If the taxpayer already knows one of these parameters, his reaction may be different from the reaction he might have had without this knowledge. Random tax audits may not have the same effect as target tax audits on the perceived chance of a future tax audit.

Second, as mentioned before, taxpayers who are selected at random may not be representative of taxpayers who are normally the subject of tax audits, which by principle seek out the most non-compliant taxpayers. Therefore, the future behavior of these taxpayers can be very different and estimates of future impact on tax compliance may, in this way, be compromised. This may also lead to an incorrect assessment of the performance of the tax authority.

However, if the investigation intends to assess the impact of a tax audit on the future behavior of audited taxpayers, we find that the use of target tax audits may be more appropriate than the use of random tax audits.

Thus, our investigation focuses on target tax audits conducted by the tax authority during their customary auditing activity and it is not based on random tax audits, which is an important difference compared to other studies on the effect of tax audits (Slemrod, 2019).

However, there are already published studies that are supported by real-world operational audits, not random tax audits, and that also took into account the results of tax audits (Beer et al., 2020). In this recent and interesting study, the importance of including the results of tax audits (adjustments) in the general assessment is emphasized, which our investigation also tried to do.

6.6 Tax audit feedback

In some countries there is a tradition of tax audit feedback, which measures taxpayers' satisfaction with the services provided and seeks to identify opportunities for improvement. Portugal does not have this kind of specific approach. Therefore, inspired by the experience of others tax authorities, with sophisticated tax systems, our survey contained specific questions to assess the tax authority and the tax auditor after a tax audit.

With these questions, we wanted to know what firms thought after the tax audit. In practice, we tried to associate the perception of firms' risk, which is a parameter of the standard economic model of tax compliance (Slemrod, 2019), with the perception that remained after the tax audit. For example, if a firm found the tax authority's performance

to be very efficient, its perception of tax risk may increase. In other words, the firm may think it will be more likely to be caught in the act of tax evasion.

In our survey, the results found show a positive evaluation of the performance, both of the tax authority and the tax auditor. In more than 80% of tax audits, the audited firms assessed the performance of the tax authority as efficient or very efficient. Negative responses, classified as inefficient, represented less than 20%. In case of tax auditors, the result was similar. Firms responded that in almost 90% of the situations the assessment was professional or very professional.

These results may suggest that the audited firms updated the probability of tax evasion being detected. In this way, firms may increase tax compliance in the future, which supports the deterrence model and our first research hypothesis (H0).

In other words, the belief that remains after a tax audit is fundamental to the perception of firms' tax risk. This perception is a key factor to assess the chance of detection in the event of tax evasion, this being one of the assumptions of the deterrence model, which predicts that tax compliance depends on evasion detection probability and fines.

These results are quite remarkable given that the survey is confidential but not anonymous. Note that these are reactions of firms resulting from the operating activity of the tax authority.

6.7 Perceived tax audit probability

As stated above, the probability of detection is one of the parameters of the standard economic model of tax compliance, but firms, especially small ones, may have difficulty in calculating it and, above all, interpreting its meaning correctly, so they may overreact.

For example, in a study developed in Uruguay it was suggested that individuals have difficulties assessing the probability of detection. One group from this study reported a 31.5% probability of being audited while in reality the probability was only 11.7% (Perez-Truglia et al., 2019).

During our data collection process, there were several interactions, specifically with with small firms, either by replying to emails or by telephone contacts (not fully described here). For example, we received over 400 requests from firms to be excluded. This unexpected behavior may be related to a misperception about the purpose of the study.

Despite this, we made it clear that the study was unrelated to the tax authority; however, the language used on the survey and the novelty effect may have contributed to some confusion. At times, we felt that some taxpayers perceived us as a complaint service[23].

Still, this unexpected behavior may be related to other factors. For instance, tax authorities may be reluctant to disclose data on tax audits. Some even try to maintain some opacity. Indeed, this lack of information can influence the firm's risk perception which become more sensitive to tax audit performance, which is a deterrent similar to the withholding tax mechanism in individuals (Kleven et al., 2011).

Another situation may be the possible fear that firms have of the tax authority. Indeed, some tax authorities already use emotion to influence taxpayer behavior in certain contexts. For example, in the USA an unbalanced number of tax compliance related events are published on dates close to Tax Day (usually April 15), presumably to influence taxpayers (Blank & Levin, 2010; Morse, 2008).

In the same way, the United Kingdom (UK) tax authority, made a mass advertising campaign placing posters, in public places, with suggestive images about tax compliance during 2012[24]. In one of these banner posts, its pair of eyes was displayed peering menacingly through a cut in a newspaper, as shown in the figure[25], with the following text: "If you've declared all your income you have nothing to fear."

Figure 12. Billboard Poster, United Kingdom's Tax Authority, 2012

[23] In 2019, the tax authority implemented a service to deal "more friendly" with taxpayers, after one of the recommendations of the Working Group for the Prevention and Friendly Settlement of Disputes between the Taxpayer and the Tax Authority, designated by the Minister of Finance.

[24] The same year the tax audits studied in our study took place.

[25] Picture no longer available, accessed through http://web.archive.org/

Indeed, the UK tax authority used deterrence to promote compliance. It took steps to publicize operational work in order to influence and stop those who might be tempted to evade taxes. Publicity strategies complements targeted activity against tax evasion, in order to prompt higher levels of tax compliance.

In general, there is some evidence that some tax authorities in certain contexts may be tempted to use an alternative approach to the deterrence model, known as risk-as-feelings, to increase tax compliance, whether to reach a broad or a targeted group of taxpayers. However, it seems there is no direct evidence of success with these policies on tax compliance, and ethical questions can be raised.

In our study, we tested whether the audited firms' reactions are consistent with the standard economic model of tax compliance using a particular data collection technique: The Survey. An advantage of the survey is the ability to get a direct perception about the firms' motivation, which is more challenging to obtain through quantitative studies.

From the original source, we get the perception that the performance of tax authority in Portugal has an impact on firms' behavior and influences their perception of tax risk. These results suggest that, due to the sensitive nature of handling taxes, small and medium firms may overreact to the threat of tax audits. Given all the information collected, including interactions and comments made, it appears that firms tend to exaggerate the threat of a tax audit although in reality the probability of detection is low, which is in line with the results found in others studies (Bérgolo et al., 2017).

In sum, we found evidence that tax audits have a positive effect on tax compliance, which is in line with recent studies on this specific literature field. The audited firms' reactions seem to be consistent with the standard economic model of tax compliance. Additionally, this study aims to contribute to the understanding of the effect of tax audits on subsequent tax compliance by directly asking audited taxpayers.

As one last note, the current covid-19 pandemic may limit the regular activity of tax authorities. For instance, tax auditors may be at home without being able to freely perform tax audits (e.g. lockdown rules or wearing a mask). This may lead to a reduction in the actual probability for detecting non-compliance. If firms anticipate this decline in the audit detection probability, the economic model of tax compliance predicts a decline in the level of tax compliance (Alm et al., 2020).

Governments have responded to the crisis with unprecedented measures by using public debt. This could lead to a tax increase in the future. However, ensuring tax compliance could be an even greater challenge in times of a coronavirus crisis, which tests one of the basic assumptions of the economic model of tax compliance, once again.

7. Conclusions

The final chapter starts with a summary, major conclusions and contributions of the study conducted. We make a brief review about the major limitations and suggestions for further research. The last part is dedicated to some practical implications and recommendations for practice.

7.1 Summary of the study conducted

The present investigation intends to examine the effects of tax audits on subsequent tax compliance by audited taxpayers. We tested if this effect is consistent with the well-known standard economic model of tax compliance which predicts that tax compliance depends on evasion detection probability and penalty.

To evaluate the future behavior of audited firms on tax compliance, we followed a strategy based on the difference-in-differences (DID) comparison, which is one of the most common designs used to evaluate causal effects of policy interventions. We compared firms who experienced a tax audit (treatment group) with firms who were not subject to a tax audit (control group).

We used information from primary sources (survey-based), which is a novelty in the field of taxation, and secondary sources (financial statements). When this project was conceived, we had hoped that the tax authority would provide the data, which did not happen despite all efforts made. This required a re-orientation in terms of data collection, which was a challenge given the nature of the data needed to perform the ongoing research. However, this fact forced us to think outside the box, which has made this project more challenging and rewarding.

7.2 Major conclusions and contributions

The main results of this study are in line with the traditional theory on tax compliance. We found evidence that tax audits have a positive effect on tax compliance. However, this effect could be limited in time. Five years after a tax audit, it seems that there is no further effect on tax compliance.

The results found support for the standard economic model of tax compliance, tested countless times in the past (D'Agosto et al., 2018; Slemrod, 2019). Despite not fully

explaining tax compliance nowadays, which may be due to information reported by third parties or by non-deterrence drives like tax moral and civic duty, this model seems to corroborate that tax audits are key deterrent instruments available to governments.

However, in certain contexts, some alternative approaches to the deterrence model could add behavioural factors, like emotions, conscience or adherence to norms, which influence tax compliance (Perez-Truglia et al., 2019). An interesting model on the role of law enforcement suggests others routes to archive tax compliance (Kirchler et al., 2008). For instance, this approach argued that trust in tax authorities may induce voluntary tax compliance and emphasizes the importance of a tax policy beyond deterrence.

Our findings can be valuable for tax authorities when determining the optimal tax enforcement strategy and raising awareness of the importance of tax risk management on report frameworks. Understanding the long-term effect of tax audits could be critical for tax compliance, both for tax authorities and firms.

Additionally, our study aimed to contribute to the understanding of tax audits' effect on subsequent tax compliance by directly asking tax audited firms (primary sources), and this is a novelty in the field of taxation. Furthermore, by exploring the impact of tax enforcement on real economic activity (target tax audits), to the best of our knowledge, our study is unique in Portugal.

7.3 Limitations and suggestions for further investigation

Our research has some limitations. The first has to do with primary data. We used a data collection technique which had never been used before in the field of tax auditing in Portugal. We tried to mitigate the negative effects of using a survey, but to get honest answers about tax behavior is an enormous challenge and represented an important setback.

Second, our sample focused on firms with stable activity. Thus, it is possible that we do not have firms with aggressive tax behaviours in which the effect of a tax audit could be different. One final limitation refers to not having access to tax data, which made it impossible to obtain some details about the tax audits, such as their results, which is the kind of sensitive information that only the tax authority can confirm.

Suggestions for further investigation are primarily related to the major limitations described above. It would also be interesting to assess the indirect impact of tax auditing, especially target audits, on firms' lives through other measures of tax compliance.

7.4 Implications and recommendations for practice

This study may have some practical implications and recommendations for practice, namely in terms of assessing the effects of tax audits, random tax audit, tax gap or improving collaboration between academia and tax authority.

7.4.1 Measuring the total tax audit effect.

The results found in this study are important for assessing the performance of the tax authority, which may go beyond the outcome of a tax audit (direct effect). Indeed, measuring the indirect effects of a tax audit may show the full effect among audited firms while accounting for variations in future behavior. Our study only focuses on these particular effects also known as the corrective/preventive effect or the direct deterrent effect of tax audit.

Our study aims to show the relevance of the tax authority through its main instrument of persuasion to tax compliance, which is the tax audit. Taking into account only the direct effects of a tax audit, which has a high cost, can minimize the role of the tax authority in tax compliance. Therefore, we recommend that when assessing the long-term performance of tax authority, the indirect effects of tax audits shall be taken into account.

7.4.2 Random tax audits

In general, benefits of random tax audits usually do not appear immediately, as they take time to materialize, but are important in the long term. They can help to measure the tax gap by providing an unbiased picture of the level of tax compliance in the population (Slemrod, 2019).

Indeed, data from target tax audits will not provide an accurate picture of tax compliance since they are designed to detect noncompliance. By definition, they are not representative. In order to get an accurate picture of tax compliance, we may need to use random samples that mirror the population as a whole. This type of sample can provide an unbiased and representative view.

Random audits are used by some tax authorities. For instance, in 1985 the United States (US)[26] started implementing a series of randomized audits through the taxpayer compliance measurement program to provide a snap-shot of tax compliance. The primary objective of this program was to optimize tax audit strategies, but also to estimate the tax gap (Pomeranz & Vila-Belda, 2019).

Governments may be interested in conducting random tax audits for various reasons. For instance, random samples allow every potential firm subject to tax audits to have a similar chance of being audited, since tax authorities are not able to audit the whole population. Furthermore, they can be seen as a measure of tax equality and may boost the tax compliance in the long-term.

Our investigation only addresses target tax audits but it appears that random tax audits could also be useful to increase the general deterrent effect. Since (it seems that) Portugal does not have a random auditing program, perhaps a strategy that combines target and random audits may be the most effective for tax compliance (Alm et al., 2009).

7.4.3 Tax gap

As we mentioned in the previous section, the benefits of random audits are several, but one is particularly interesting for purposes of tax gap estimation. Random tax audits can help to measure the tax gap by providing an unbiased picture of the level of tax compliance in the population.

However, the definition of tax gap is not consensual and there are countries with slightly different approaches, which can make it difficult to compare countries. It is sometimes challenging to know whether the different tax gap estimates are real or due to different methodologies (Slemrod, 2019). For instance, the United Kingdom (UK) tax authority, Her Majesty's Revenue and Customs (HMRC), defines the tax gap as the difference between the amount of tax that should, in theory, be paid and what is actually paid.

[26] The Internal Revenue Service (IRS) in this country builds some of its risk models on only random samples, which from a purely theoretical point of view could be considered a best practice.

Indeed, the UK is a distinguished exception in tax enforcement. They are one of the few countries that calculates and publishes tax gap estimates for many taxes based on random tax audits (HMRC, 2019). This publication recommends this type of tax gap methodology in order to get a valuable tool for understanding the relative size and nature of non-compliance. In addition, the tax gap can help to define strategies to improve tax compliance and can be used as a measure of effectiveness / efficiency of the tax authority.

It should be noted that EU Member States do not have a monetary or exchange policy, which means that fiscal policy, especially since the international financial crisis of 2007-2008, has a critical importance as a governance tool (political evaluation of governments). With the current pandemic, the role of the tax authority may be again up to a big challenge (Alm et al., 2020).

In sum, if we want to know how much tax is not being declared in the country as a whole, or for a specific region or specific tax, we recommend the tax gap estimation using a random sample. Portugal does not seem to have such estimates, yet.

7.4.4 Collaboration between academia and tax authority

Collaborations between the Academy and tax authorities, with different forms and levels of intensity, have seen a progressive increase in recent years across the world. Partnerships can take the form of simple data sharing, policy evaluation or joint implementation of field experiments.

A recent review on collaboration with tax authority listed a number of reasons that may lead tax authorities to be interested in establishing partnerships with the academy (Pomeranz & Vila-Belda, 2019):

(i) Knowledge about more effective ways to increase tax compliance;
(ii) Knowledge about new research methods;
(iii) Leveraging their own data and implementing research projects in its own interest, but which the tax authority does not have time to carry out without external collaboration;
(iv) Getting an independent view on policy issues;
(v) Providing a motivating experience for tax professionals interested in research;
(vi) Gaining the reputation associated with working with academic institutions.

It seems evident that partnerships have advantages for all parties, but it is necessary to bear in mind that this type of collaboration is not a priority for tax authorities. It takes time to build and maintain such a long-term research relationship.

We recommend that the tax authority follows this international trend of empirical research into tax compliance and enforcement. We also recommend that academia tries to understand the point of view of the tax authorities, which is not a "black box" to explore without rules. It takes time to learn from their experiences, perspectives and needs.

One of the purposes of this investigation is to make a positive contribute to establish a future partnership with the tax authority. Additionally, it is also important to establish a relationship of trust between the tax authority and the rest of society. This type of partnership with academics can be of help to good governance/engagement and improve tax compliance.

7.5 Closing Thoughts

As a final comment, in the course of our investigation, which started in 2016, and after numerous contacts with academics and tax officials, including researchers who established a partnership with tax authorities in advanced countries, we consider this relationship complex.

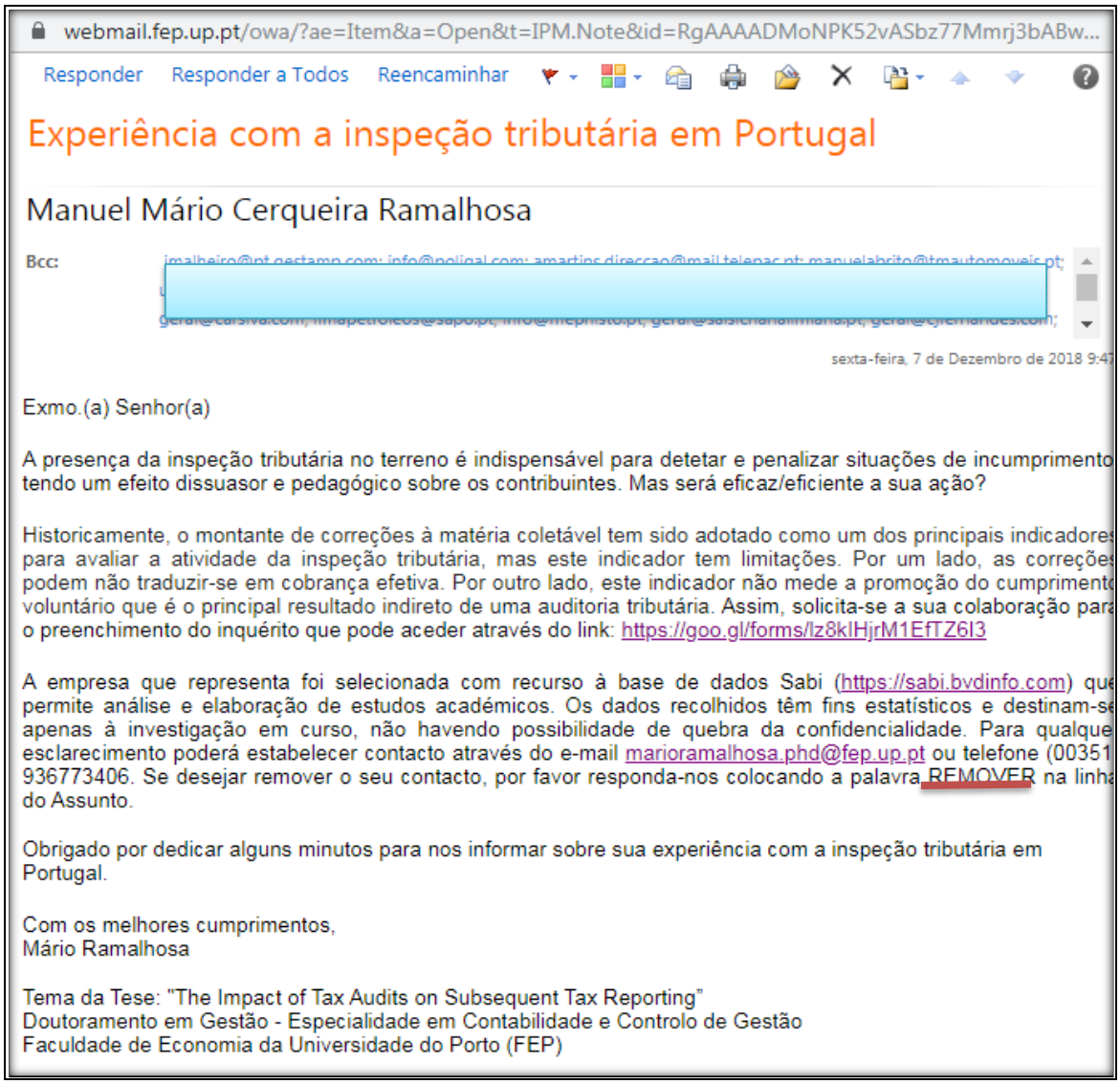
Thus, our view on this topic has evolved over time. Nowadays, we better understand the obstacles of building a relationship of trust between the tax authority and any external entity.

Even though the current situation is challenging at all levels, the covid-19 pandemic still with no end in sight makes taxation an even a greater challenge and it seems to have caught everyone unprepared, but like all crises throughout history, it too will come to an end. The current beginning of vaccination is a light of hope.

8. Appendix

8.1 Sample e-mail: Invitation to the online survey

Note that in the email sent, the possibility to remove was given.



webmail.fep.up.pt/owa/?ae=Item&a=Open&t=IPM.Note&id=RgAAAADMoNPK52vASbz77Mmrj3bABw...

Responder Responder a Todos Reencaminhar

Experiência com a inspeção tributária em Portugal

Manuel Mário Cerqueira Ramalhosa

Bcc: [redacted]

sexta-feira, 7 de Dezembro de 2018 9:47

Exmo.(a) Senhor(a)

A presença da inspeção tributária no terreno é indispensável para detetar e penalizar situações de incumprimento tendo um efeito dissuasor e pedagógico sobre os contribuintes. Mas será eficaz/eficiente a sua ação?

Historicamente, o montante de correções à matéria coletável tem sido adotado como um dos principais indicadores para avaliar a atividade da inspeção tributária, mas este indicador tem limitações. Por um lado, as correções podem não traduzir-se em cobrança efetiva. Por outro lado, este indicador não mede a promoção do cumprimento voluntário que é o principal resultado indireto de uma auditoria tributária. Assim, solicita-se a sua colaboração para o preenchimento do inquérito que pode aceder através do link: https://goo.gl/forms/lz8klHjrM1EfTZ6I3

A empresa que representa foi selecionada com recurso à base de dados Sabi (https://sabi.bvdinfo.com) que permite análise e elaboração de estudos académicos. Os dados recolhidos têm fins estatísticos e destinam-se apenas à investigação em curso, não havendo possibilidade de quebra da confidencialidade. Para qualquer esclarecimento poderá estabelecer contacto através do e-mail marioramalhosa.phd@fep.up.pt ou telefone (00351 936773406. Se desejar remover o seu contacto, por favor responda-nos colocando a palavra REMOVER na linha do Assunto.

Obrigado por dedicar alguns minutos para nos informar sobre sua experiência com a inspeção tributária em Portugal.

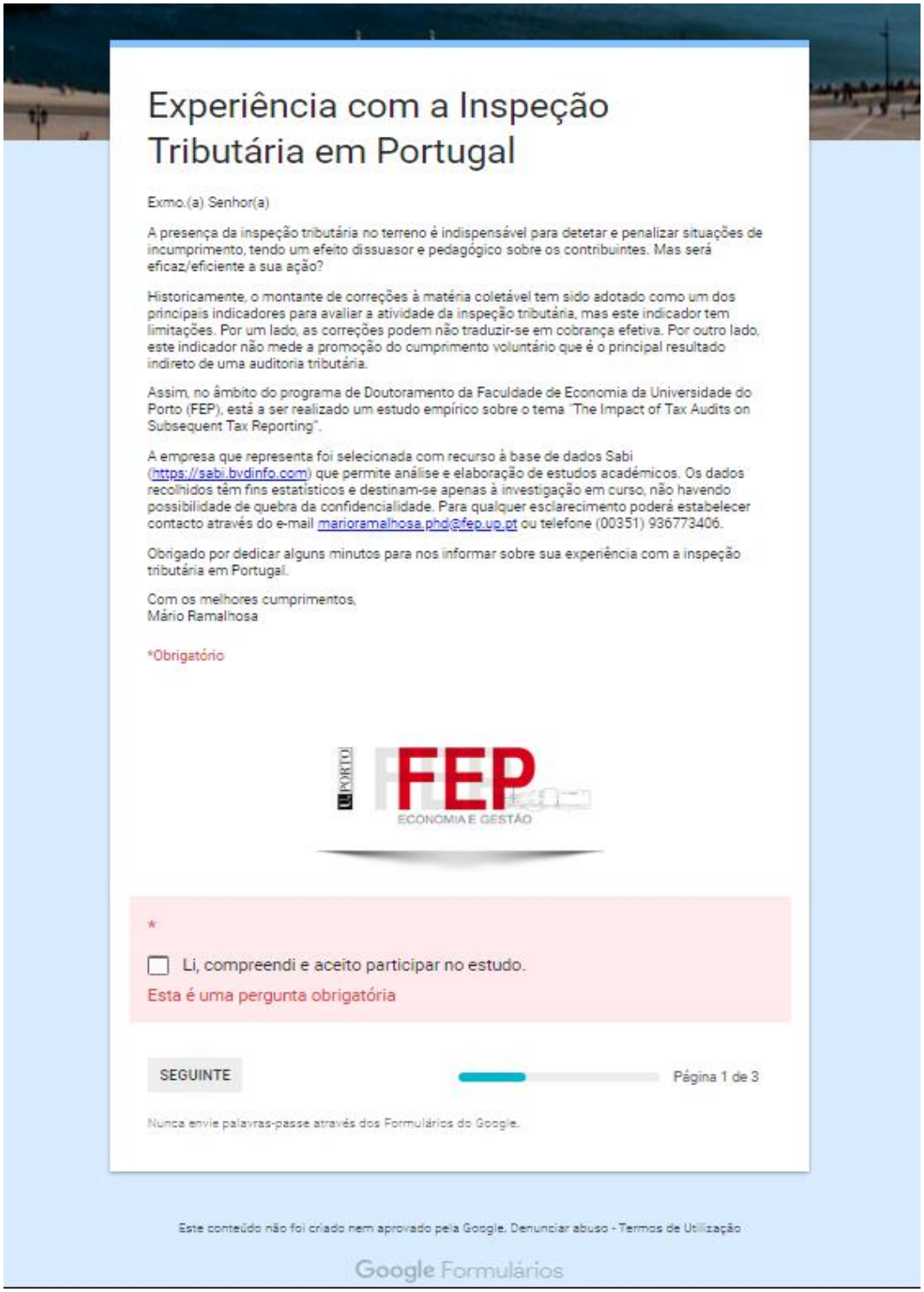
Com os melhores cumprimentos,
Mário Ramalhosa

Tema da Tese: "The Impact of Tax Audits on Subsequent Tax Reporting"
Doutoramento em Gestão - Especialidade em Contabilidade e Controlo de Gestão
Faculdade de Economia da Universidade do Porto (FEP)

8.2 Online survey questionnaire

The questionnaire is available at the following link:

https://goo.gl/forms/Hj3eKYEAU4gQkT293



Experiência com a Inspeção Tributária em Portugal

Exmo.(a) Senhor(a)

A presença da inspeção tributária no terreno é indispensável para detetar e penalizar situações de incumprimento, tendo um efeito dissuasor e pedagógico sobre os contribuintes. Mas será eficaz/eficiente a sua ação?

Historicamente, o montante de correções à matéria coletável tem sido adotado como um dos principais indicadores para avaliar a atividade da inspeção tributária, mas este indicador tem limitações. Por um lado, as correções podem não traduzir-se em cobrança efetiva. Por outro lado, este indicador não mede a promoção do cumprimento voluntário que é o principal resultado indireto de uma auditoria tributária.

Assim, no âmbito do programa de Doutoramento da Faculdade de Economia da Universidade do Porto (FEP), está a ser realizado um estudo empírico sobre o tema "The Impact of Tax Audits on Subsequent Tax Reporting".

A empresa que representa foi selecionada com recurso à base de dados Sabi (https://sabi.bvdinfo.com) que permite análise e elaboração de estudos académicos. Os dados recolhidos têm fins estatísticos e destinam-se apenas à investigação em curso, não havendo possibilidade de quebra da confidencialidade. Para qualquer esclarecimento poderá estabelecer contacto através do e-mail marioramalhosa.phd@fep.up.pt ou telefone (00351) 936773406.

Obrigado por dedicar alguns minutos para nos informar sobre sua experiência com a inspeção tributária em Portugal.

Com os melhores cumprimentos,
Mário Ramalhosa

*Obrigatório

U.PORTO FEP ECONOMIA E GESTÃO

*

Li, compreendi e aceito participar no estudo.

Esta é uma pergunta obrigatória

SEGUINTE

Página 1 de 3

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Experiência com a Inspeção Tributária em Portugal

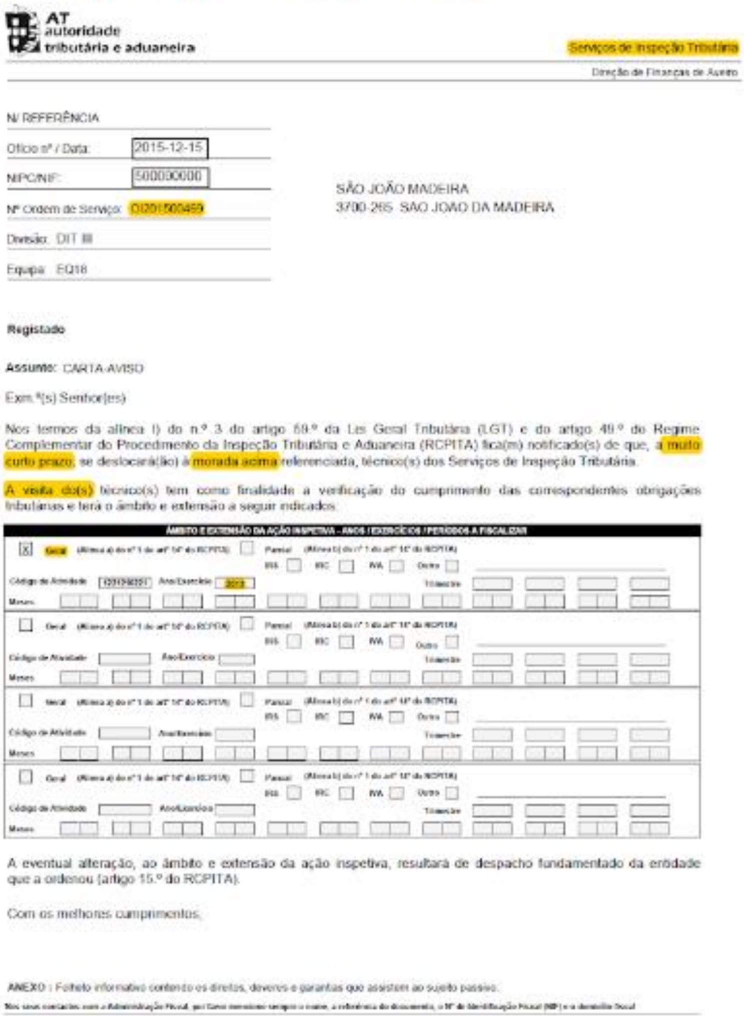
*Obrigatório

Auditoria Tributária EXTERNA

A auditoria tributária através de um procedimento de inspeção EXTERNO é das ações, à disposição dos Serviços de Inspeção Tributária, com mais impacto na atividade do contribuinte.

Em regra, este procedimento é precedido pelo envio de uma carta-aviso e tem início com a entrega de uma cópia da Ordem de Serviço Externa que o contribuinte deve assinar.

Exemplo de Carta-Aviso enviada em dezembro de 2015 para inspecionar o período de tributação de 2013



AT autoridade tributária e aduaneira

Serviços de Inspeção Tributária

Direção de Finanças de Aveiro

N/ REFERÊNCIA

Ofício nº / Data: 2015-12-15

NIPC/NIF: 500000000

Nº Ordem de Serviço: OI201500469

Divisão: DIT III

Equipa: EQ18

SÃO JOÃO MADEIRA
3700-265 SÃO JOÃO DA MADEIRA

Registado

Assunto: CARTA-AVISO

Exm.º(s) Senhor(es)

Nos termos da alínea l) do n.º 3 do artigo 59.º da Lei Geral Tributária (LGT) e do artigo 49.º do Regime Complementar do Procedimento da Inspeção Tributária e Aduaneira (RCPITA) fica(m) notificado(s) de que, a muito curto prazo, se deslocará(ão) à morada acima referenciada, técnico(s) dos Serviços de Inspeção Tributária.

A visita do(s) técnico(s) tem como finalidade a verificação do cumprimento das correspondentes obrigações tributárias e terá o âmbito e extensão a seguir indicados.

ÂMBITO E EXTENSÃO DA AÇÃO INSPETIVA - ANOS / EXERCÍCIOS / PERÍODOS A FISCALIZAR

[X] Geral (Alínea a) do nº 1 do artº 14º do RCPITA) [ ] Parcial (Alínea b) do nº 1 do artº 14º do RCPITA) IRS [ ] IRC [ ] IVA [ ] Outro [ ]

Código de Atividade [illegible] Ano/Exercício 2013 Trimestre

Meses

A eventual alteração, ao âmbito e extensão da ação inspetiva, resultará de despacho fundamentado da entidade que a ordenou (artigo 15.º do RCPITA).

Com os melhores cumprimentos,

ANEXO : Folheto informativo contendo os direitos, deveres e garantias que assistem ao sujeito passivo.

Procedimentos de Inspeção EXTERNOS realizados

Para cada procedimento EXTERNO, que se realiza em parte nas instalações do contribuinte, haverá uma carta-aviso e uma ordem de serviço.

Se foi objeto de duas auditorias externas, por exemplo, uma iniciada em janeiro de 2009 e outra iniciada em dezembro de 2015 preencha por favor 2 formulários.

A empresa foi alvo de procedimento de inspeção EXTERNO entre 2004 e 2018?

- ◯ Sim
- ◯ Não

Indique o ano em que se iniciou o procedimento de inspeção
Ex: 2015

Selecionar

Indique o mês em que se iniciou o procedimento de inspeção
Ex: dezembro

Selecionar

Período de tributação objeto do procedimento de inspeção EXTERNO

Um procedimento de inspeção EXTERNO pode abranger vários períodos de tributação.

Por exemplo, uma auditoria externa que se iniciou em 2015 pode abranger os períodos de tributação de 2013 e 2014. Neste caso indique apenas 2013.

Indique o período de tributação
Ex:2013

Selecionar

Resultado do procedimento de inspeção EXTERNO

Da ação de inspeção podem ou não resultar correções a desfavor do contribuinte. A decisão consta do relatório final que é entregue no fim do procedimento.

Indique o valor global das correções

Selecionar

Sede da empresa

Selecionar

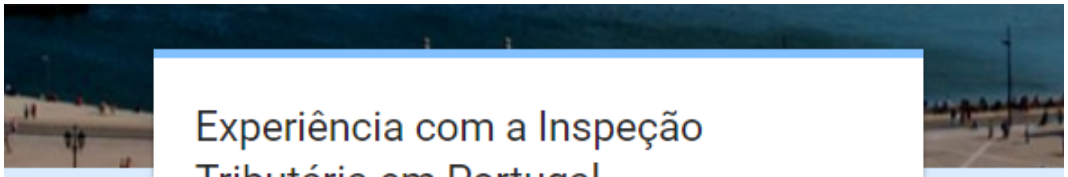
Indique o Número de Identificação Fiscal (NIF) da empresa *
O NIF será utilizado para caracterização na base de dados Sabi (https://sabi.bvdinfo.com).

A sua resposta

Esta é uma pergunta obrigatória

ANTERIOR SEGUINTE Página 2 de 3

Nunca envie palavras-passe através dos Formulários do Google.



Experiência com a Inspeção Tributária em Portugal

A última série de perguntas foi elaborada para avaliar a Inspeção Tributária e o Inspetor Tributário.

Segundo o Plano Estratégico de Combate à Fraude e Evasão Fiscais e Aduaneiras para o triénio 2015-2017, o combate à evasão fiscal foi uma prioridades e passou pelo aumento da eficácia e eficiência da Inspeção Tributária e Aduaneira.

A Inspeção Tributária

Depois da conclusão do procedimento de inspeção tributária externo como avalia a Inspeção Tributária?

- ◯ Pouco eficiente
- ◯ Eficiente
- ◯ Muito eficiente

O Inspetor Tributário

No decurso do procedimento de inspecção, o inspetor tributário deve atuar com especial prudência, cortesia, serenidade e discrição, devendo guardar sigilo sobre a situação do contribuinte.

Como avalia o comportamento do inspetor tributário no decurso do procedimento de inspecção externo?

- ◯ Pouco Profissional
- ◯ Profissional
- ◯ Muito Profissional

Comentário Final

Caso pretenda fornecer mais informações, incluindo comentários positivos, use a caixa de texto abaixo ou envie um e-mail para marioramalhosa.phd@fep.up.pt

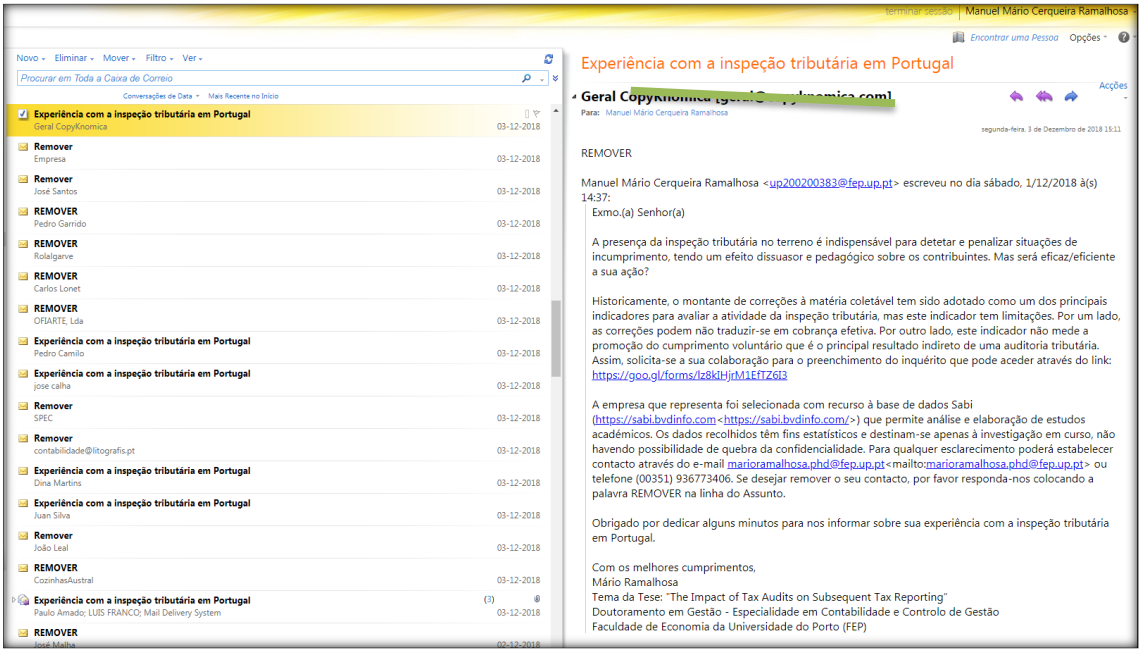
A sua resposta

ANTERIOR SUBMETER Página 3 de 3

Nunca envie palavras-passe através dos Formulários do Google.

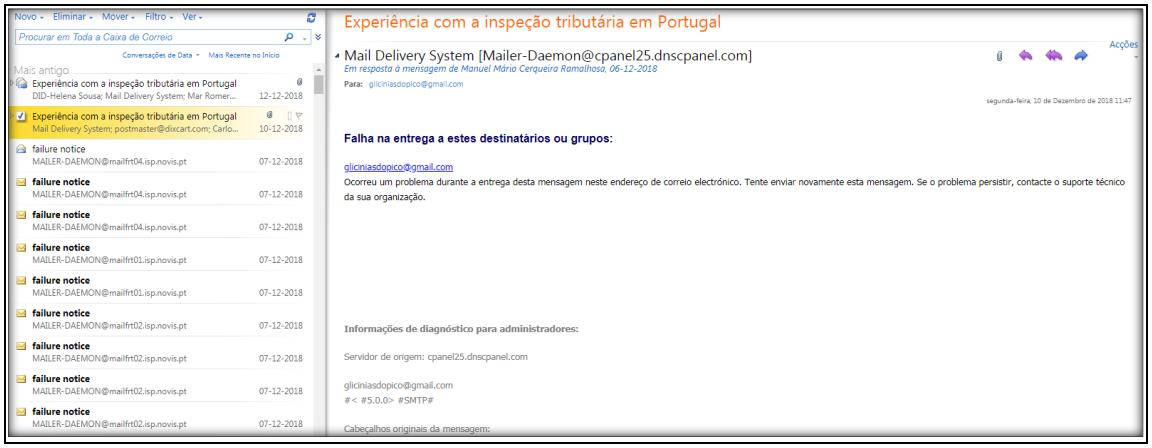
8.3 Sample e-mail: REMOVE

Sample email sent by a firm requesting survey deletion. This possibility was given in the email sent to invite the completion of the survey.



8.4 Sample e-mail: failure notice

Example of failed delivery of emails sent to firms.



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