U.PORTO

MASTER DEGREE
FINANCE AND TAXATION

Tax rate uncertainty on profit shifting identification

Miguel Augusto Pereira Santos

M

2021

U.PORTO

FEP FACULDADE DE ECONOMIA UNIVERSIDADE DO PORTO

Tax rate uncertainty on profit shifting identification

Miguel Augusto Pereira Santos

Dissertation

Master in Finance and Taxation

Supervised by

Samuel Cruz Alves Pereira, PhD

2021

Acknowledgments

Thank you so much to all of those who, in one way or another, helped me to carry out this dissertation and this master's degree… like for instance: the professors of the Master in Finance and Taxation, especially to Prof. Samuel Pereira for his availability and attention given throughout this final journey; all of my family, who have always supported me on this academic path, especially my parents, my sister and my uncle Nélio; to my many friends from the Jayme Rios de Souza residency and from the Masters, who were with me during this learning period in Porto, especially to Ricardo Martins and Pedro Lopes (for great insights given to develop this dissertation); to former FEP student José Miguel Martins for his attention and valuable insights on the topic under study; and to my great friend Pedro Amendoeira for his knowledge and different perspectives, which helped in my personal development as well as in the realization of this master's and dissertation.

Abstract

We consider the ongoing development of the literature about tax-motivated firm profit shifting (PS) behaviours, firstly with the empirical identification methods, and then with their driving forces, to argue that one should consider these driving forces when looking for PS behaviours, in this case, tax rate uncertainty (TU), so that we have a different but better perspective on this matter. As a result, by following the work of Dharmapala and Riedel (2013) and Delis, Hasan, and Karavitis (2020), and using firm level data of 22 579 subsidiaries and its 9 792 parent firms located throughout Europe, we find (1) stronger evidence of PS under TU than if we don't consider it (although the relation between high and low TU is different than what's expected and found in previous studies) and (2) the inexistence of the adjustment to low-cost strategies of PS under TU (in line with recent efforts to counter various firm illegal tax planning practices).

Resumo

Ao considerar a contínua literatura a ser desenvolvida sobre o desvio de lucros das empresas causado pelos impostos, primeiramente com os modelos empíricos criados, e depois com as determinantes de comportamentos de desvio de lucros, argumentamos que no âmbito da identificação destes comportamentos devemos considerar estas determinantes, aqui em causa a incerteza da taxa de imposto, de modo a que tenhamos uma perspetiva diferente mas mais correta sobre a matéria. Em função da nossa investigação, que segue o trabalho de Dharmapala and Riedel (2013) e Delis et al. (2020), e usando informação ao nível das empresas de 22 579 subsidiárias e suas 9 792 empresas-mãe localizadas ao longo da Europa, encontramos (1) evidência mais forte de desvio de lucros se considerarmos a incerteza da taxa de imposto do que se não o fizermos (apesar de a relação entre incerteza alta e baixa ser diferente do esperado e encontrado em estudos anteriores) e (2) a inexistência do ajustamento para estratégias de desvio de lucros de menor custo apesar desta incerteza (em linha com os esforços atuais de combater diversas práticas ilegais de planeamento fiscal).

Keywords: Debt-shifting, International taxation, Profit shifting, Multinational firms, Taxation uncertainty

Index

Table index

1. Introduction

Maximizing value creation is one of the key objectives of businesses in general, and there are a lot of strategies that companies can pursue for that: many are legitimate, and some are not. About the last, there is one that has been largely attributed to multinationals, which is tax evasion[1]. The OECD, a supervisor in this matter, states that, by exploiting gaps and mismatches on international tax rules to avoid paying tax, countries lose about 100 to 240 billion USD revenue each year[2]. As a consequence, less developed countries that also depend on corporate tax revenue as a source of income are highly affected by this. In the last decade, however, there's been a growing effort by the international community (OECD and G20) to tackle this problem, where they created the project BEPS (Base erosion and profit shifting), where such institutions work together on the implementation of measures to improve the coherence of international tax rules and to reach a more transparent tax environment.

In part, this quest for tax minimization happens because of the nature of the international tax framework. Throughout the world there's several domestic legislations, bilateral and multilateral tax treaties, and companies are usually taxed at the individual level. In the case of multinational enterprises (MNE), subsidiaries are subject to the tax legislation of its host country. It also depends on the type of income that is generated: it could be active (due to the selling of products and services) or passive (which usually derives from investment). Today, source countries (the location of investment and production) usually retain primary taxing rights over those active profits, whilst residence countries have the right to tax passive income. But we have to consider two alternative tax systems: territorial or worldwide. Under the former, found in Europe or Japan, foreign earnings of MNEs are only taxed at the source country, therefore exempted by residence countries. The last, found in the US before that Tax Cuts and Jobs Act of 2017 (nowadays closer to the other regime) and in the BRICS, the residence country has the right to tax income from all of a company's source countries. At last, there are several ways companies can take to optimally shift their profits: transfer mispricing (the strategic stipulation of internal prices between related firms) (Davies, Martin, Parenti, & Toubal, 2018), debt shifting (intercompany loans, where, overall,

[1] To this day, there is still no consensus for tax evasion and tax avoidance, over to which refers to legal or illegal practices of tax minimization (Beer, de Mooij, & Liu, 2020). In our work, we refer to the legal practices as tax avoidance, otherwise tax evasion.
[2] https://www.oecd.org/tax/beps/

borrowing is favoured in high-tax countries and lending in low-tax countries) (Harry Huizinga, Laeven, & Nicodeme, 2008), the strategic allocation of intellectual property (locating the ownership of those assets to countries where its income are going to be taxed at a lower rate) (Dudar & Voget, 2016), tax deferral (Hasegawa & Kiyota, 2017), and many more. With such a diverse environment, companies will seek the paths that better leads them towards maximization of value, in this case thanks to tax minimization.[3]

On the academic side, one part of the debate has tried to develop models who can identify for profit shifting (PS) behaviour of MNE. A pioneering study is Hines and Rice (1994) where they identify PS on the implication of tax rates variation on subsidiaries earnings. Eventually, more models have been developed, and others even refined. One that has received relevant attention and departs from other approaches belongs to Dharmapala and Riedel (2013), where they identify PS by observing how exogenous variations in parent firms' earnings can be propagated to affiliates earnings. Since then, it has also helped the literature to identify PS flows.

Sometime later, some concern have been raised about the capacity of this model. Schimanski (2017) and Martins (2018) try to replicate the model with an approximate data set, but in a more recent time period. As a result they came to find no significant evidence of PS, arguing that Dharmapala and Riedel (2013)'s approach isn't very effective because of the limitations of the model, of the sample, the type of information that its used, and on the other hand because of an existing tendency to the decrease of magnitudes of PS.

We should, however, consider another strand of literature that has been receiving increased attention: about the determinants of profit shifting behaviour. Many studies in this dimension argue that the consideration of these driving forces help to identify PS more effectively because we must account for the differentiation between firms and countries characteristics. As an example, Dyreng and Markle (2016) find that financially constrained firms shift less income than their unconstrained peers. Building in this reasoning, comes Delis et al. (2020), where, in fact, by applying the Dharmapala and Riedel (2013)'s approach in a relatively recent data set, they find that in countries with stable corporate tax rates there's strong evidence of PS. As a result, they show that we need a more focused empirical estimation of PS behaviour, so we can have a different but better perspective on the problem.

[3] In fact, Kenneth J. Klassen, Lisowsky, and Mescall (2017) show that some of these elements (like transfer pricing) are used for other purposes besides tax minimization, like to attain for tax compliance.

Given all of this, we build on the work of Delis et al. (2020) and Dharmapala and Riedel (2013), and explore the importance of considering certain determinants when we empirically estimate for tax-motivated profit shifting, in this case the tax rate uncertainty, in a more recent data set. Right up next, we observe how this influences the PS behaviour of companies, more specifically if and how they adjust their strategies.

We use a panel dataset with a maximum of 22 579 subsidiaries and its 9 792 parent firms, located in the EU-27, plus Norway, Turkey, UK, Switzerland, and Russia, for the period of 2015 to 2018. To assess tax rate uncertainty, we consider the frequency or volatility of changes on corporate tax rates in the company's country.

The main empirical identification method is Dharmapala and Riedel (2013)'s DID (*difference-in-differences*) model, which observes for the propagation of exogenous shocks on parent's earnings to foreign subsidiaries within the same multinational group. The idea is that an exogenous increase in a parent's earnings will positively affect PS to affiliates in low-tax rate countries. To construct such a variable, we use pretax profits of other companies in the same industry and company based on Bertrand, Mehta, and Mullainathan (2002).

We split the sample between (1) not yet considering TU, (2) countries that changed the corporate tax rate during 2015-2018 (regarded as those of high-tax rate uncertainty) and (3) those who didn't (of low TU). Contrary to Martins (2018) and Schimanski (2017) and in a more recent sample, we find significant evidence of PS although a bit lower than what was found by Dharmapala and Riedel (2013). The results for TU, however, are quite mixed: there's significant PS towards subsidiaries in low TU countries in some specifications, but not usually for those that account for affiliate fixed effects (which contribute a lot to the model estimation). In fact, these can become stronger in the high TU sample, contrary to what was found by Delis et al. (2020). In robustness tests – either considering intangible property or volatility (instead of uncertainty) - the results are quite similar. In a 4-year period (instead of 3, the baseline sample) or when considering the Hines and Rice (1994)'s approach, however, we observe that if parent companies experience an earnings shock of 10%, their low-taxed affiliates will have an increase of 0,88% of pretax profits (in line of what was found by Delis et al., 2020). As such, the results appoint that tax rate uncertainty is a relevant variable which affects PS behaviours and provides a different perspective (i.e. stronger magnitudes), although its relationship isn't as clear as was seen in previous literature.

On the other hand, we don't observe an adjustment of PS strategies. Under the argument that companies make a trade-off about costs/benefits on tax planning, which would influence the strategies used in PS, we didn't find significant evidence that TU causes a switch from more costly strategies (as transfer pricing is thought of) to debt shifting (which comparatively and theoretically has less associated costs). Actually, some results may even appoint to a decrease of such strategy, which is in line with recent efforts and implementation of countermeasures of PS (eg. Marques & Pinho, 2016).

Our results contribute to the literature by extending the evidence about the driving forces of tax-motivated profit shifting, in this case tax rate uncertainty. With a more recent dataset, we find that irrespective of being a low or high TU sample, the evidence of PS behaviour is stronger in these samples (compared to when we don't consider TU). As such, it definitely shows that one should consider TU as a driving force of PS, so it can help us to have a different perspective on the magnitudes of these behaviours, detecting in which conditions these are predominant and thus indicating where countermeasures should be prioritized.

The reminder of this investigation is as follows: Section 2 engages on the existing literature, providing a baseline to this research; Section 3 provides the rationale and hypothesis development; Section 4 explains the empirical strategy and the dataset that is used; Section 5 discusses the empirical findings; and Section 6 provides our conclusions.

2. Literature review

1. Profit shifting identification and the empirical models

When we look at the literature on the BEPS issue, the empirical estimation of tax-motivated profit shifting has gone a long way, starting, not only, but with the important contribution of Hines and Rice (1994). In their study, its analysed for the US multinational enterprise use of tax havens as low-tax jurisdictions to shift their reported income and real business activities from high-tax countries (for tax minimization purposes). For that matter, it was developed a pioneering methodology which proposes that a subsidiary's total pretax income is composed of two distinct parts: by a "true" income that comes from the company's production activities (as a result of labour and capital inputs), and by a "shifted" income that is determined by the tax incentive (here the tax difference between the parent and its affiliates) to allocate profits in or out of the affiliate. As such, unexplained income that is shifted towards low-tax subsidiaries is not attributable to its own resources, but rather to PS activities. The model in question could be represented as:

$$\log \pi_i = \alpha + \beta_1 \tau_i + \beta_2 log K_i + \beta_3 log L_i + \beta_4 X_i + \varepsilon_i \qquad (2.1)$$

where π is the profit of subsidiary *i* (proxied by earnings before taxes - EBT); the company's resources are represented by *K* as capital inputs (proxied by total assets) and L as its labour inputs (proxied by costs of employees); *X* is a vector that controls for subsidiary characteristics; and τ is the variable of interest, representing the tax incentive to shift income to or from subsidiary *i* (Dharmapala, 2014). With their novel approach, they find that subsidiary's reported profits are sensitive to the tax rate of its host country, and that low-tax jurisdictions help companies to achieve their revenue-maximizing objectives, which (contrary to what we might think) may even contribute a lot to the US tax collections.

Usually, it's the statutory tax rate (STR) that represents the tax incentive of PS (τ). It is true that the STR does not comprehend the actual tax rates that companies face, in which case we recall to the effective tax rates (ETRs). However, in theory, the tax incentive variable should represent the net tax savings related to the relocation of one dollar across the MNE group (Beer et al., 2020). According to Dharmapala (2014), ETRs relate to endogenous choices made by companies (for example, should it use debt?), whereas STRs are exogenous to the firm's choices, in which case are usually determined by the country's government.

ETRs are the result of previously made choices (for instance PS behaviour). In this logic, we see it as a backward looking measure, and in such case, we would be drawing conclusions by reverse causality (Beer et al., 2020). So, and as Devereux (2007) appoints, when concerning the decision of the location of taxable income, the marginal benefit of transferring a dollar from a high to low-tax country should be captured by the differences in STRs (not ETRs).

Several years later, H. Huizinga and Laeven (2008) came to improve the previous approach. On the attempt to identify profit shifting from multinationals in the European territory (with its large number of countries and different tax systems), reported profits would be influenced by the weighted average of international tax differences between all of its affiliates. The previous approach only considered parent to affiliate shifting, and now they capture for PS between all affiliates (thus a more complete setting). As a result, they find significant evidence of PS in Europe (more specifically that PS to a country is negatively associated with the weighted average of international tax rate differences between the countries in which the MNE operates) and conclude that the huge variety of tax systems in this territory contributes for these firm behaviours.

Following Hines and Rice (1994), several studies sought for the identification of profit shifting through variations in corporate tax rates. Many did it in an indirect way (like the studies we talked previously) by considering the impact of those variations on the profitability of multinational affiliates, and others took a more direct path by observing its effect on specific PS channels (Dharmapala & Riedel, 2013). According to Dharmapala and Riedel (2013), basing the analysis on these variations presents some challenges: that they have a broad impact on all firms of a given country, which may be correlated to unobserved variables that also determine MNE's behaviour (profitability, transfer prices or financing choices); or that these events tend to happen only now and then, which may not comprehend many other situations that favour PS. In that respect, their study is presented to us as a complement to the literature with a different empirical model for the identification of PS.

Having set a specific theoretical baseline (that MNEs act under territorial systems and engage in PS thanks to transfer pricing and debt shifting), the model's reasoning to find PS is: considering an exogenous shock on the parent firm's pretax earnings, how would it influence the earnings of its subsidiaries? So, it is developed a DID model which analyses the extent to which this external shock on the parent's pretax and shifting profit is reflected on the pretax income of its low-tax affiliates (the treatment group) relative to the case of high-

tax affiliates (the control group), therefore tax-motivated profit shifting. To create a measure of the parent's exogenous income before taxes and PS activities, the authors follow and adapt an approach taken in a different context by Bertrand et al. (2002) with an expected earnings shock variable, based on the earnings of comparable companies (those that are present in the same country and industry as the parent firm). As a result, they came to find significant evidence of PS within European MNE for sample period of 1995-2005.

We can say that Dharmapala and Riedel (2013) had relative success: they confirm the hypothesis of significant PS in Europe and enrich the literature with new sources of evidence. However, it's on a smaller scale than those found in previous studies. It is argued that this could be due to existing economic and political forces in our days (eg. the effort international communities have put on the BEPS matter, and consequently putting in practice transfer pricing regulations or thin-capitalization rules, something we'll cover later). On the other hand, Dharmapala (2014) appoints to the constrain of the sample, where they only consider affiliates that are not in the same industry as the parent. This occurs because we don't want the exogenous shock to directly affect the subsidiary, and thus raising endogeneity problems. However, this comes at the cost of limiting the scope of the study, for example, of cases where its used strategic transfer pricing (or others) between those affiliates and the parent (which frequently occur inside the same industries or countries). In fact, robustness tests of Dharmapala and Riedel (2013) show that, by separately using EBIT and EBT as dependent variables (accounting for the use of transfer pricing strategies and debt shifting, respectively, as the first represents the operating results, and the second comprehends financial arrangements), the results for the former are insignificant, indicating that much of the captured PS may be attributed to the use of debt shifting. Also, the model builds on parent-to-affiliate transfers to identify for PS behaviour, and we aren't considering subsidiary-to-subsidiary relations, which account for a great part of within MNE transactions. Despite all of this, this strategy uses a broader source of variation compared to tax rate differences (used in previous works), as it's something that in reality happens more frequently and continually. Also, Dharmapala and Riedel (2013) allow for the possibility to control for unobserved country-pair-year fixed effects, which accounts for time-invariant characteristics of parent and subsidiary countries over time. This was something not possible to do in previous works due to perfect collinearity of these effects with the tax rate differentials. In summary, and as Dharmapala (2014) conclude, the model can be good to capture for the existence of BEPS, but there are limitations to assess all forms of income shifting.

On the other hand, there's another approach with a completely different manner of looking for PS. We are talking about Collins, Kemsley, and Lang (1998), who look for the extent to which US multinationals engage in tax-motivated income shifting between the US (as a whole) and foreign countries. Their approach is based on the ratio of foreign pretax income to foreign sales (the dependent variable) against the foreign tax rate (the variable of interest and the incentive to engage in PS). That tax rate is weighted by the distribution of its activities in the different economies the MNE is situated. In short, the profitability between the US and foreign countries should equalize when PS does not exist. As a result, they find income shifting from high-tax foreign jurisdictions into the US (cases where the american tax rate is lower than the average foreign tax rate faced by certain subsidiaries), but not out of it (from the US to low-tax jurisdictions).

Some years later, some came to further develop this approach, like K. J. Klassen and Laplante (2012) or Dyreng and Markle (2016). The last, assuming that the location of company's sales aren't manipulable (for example as a strategy for profit shifting), are able to directly estimate the direction of PS (inbound, to the US, or outbound, out of the US) and its extent, by analysing differences between the location of sales and reported earnings.

There are, however, some limitations to these approaches. In Collins et al. (1998), the amount of shifted income and mix of operations that represent the tax incentive variable are endogenous choices of the firm. This means that the results for foreign profitability may be misattributed to the foreign tax rate, when something in fact may drive both variables (Dharmapala, 2014). On the other hand, in Dyreng and Markle (2016), although not inferring PS when profitability rates are different between US and foreign operations, they largely assume that companies (in the sample) register their sales based on the geographical location of the customer. In reality, this depends on the criterion chosen by each company, where for example, it could be determined by the location of the selling subsidiary, and so it may provide misleading conclusions (although robustness tests showed that this didn't affect them).

2. Magnitudes of profit shifting

As we just saw, several empirical models were built to determine PS flows, and consequently many studies have been built on them. With lots of estimated magnitudes of PS in the literature, which one is correct? Well, there is no agreeing on that, but some researchers have

been looking for a "consensus" estimate - one that is based on these major empirical studies and represents the overall landscape. Heckemeyer and Overesch (2017), who synthesize evidence from 203 primary estimates of 27 studies with a meta-analysis (datasets from 1980 up to 2008), predict a tax semi-elasticity of pretax profits of about 0.8, which means that if international tax rate differences (between countries) increase by 1 percentage point, reported profits decrease by about 0.8%. Beer et al. (2020), on the other hand, augmenting the study for 402 semi-elasticities from 37 papers (datasets from 1982 up to 2012), find a consensus semi elasticity of 0.98. According to them, what is sure though is the downward trend of PS magnitudes that have been found over the years.

Much of it is due to a shift from using aggregate data (at the country level) to more firm-level data, but each has its own concerns. For instance, the former is able to capture for a wider range of profit shifting channels than the last (who in turn can only capture for PS that is reflected on the observed profits, like transfer pricing or debt shifting, but not, for example, avoidance of permanent establishment status in which case there are no reported profits) (Beer et al., 2020). However, if we resort to the last, by employing panel data techniques (longitudinal data) we can control for observable and unobservable (affiliate, country, year, industry fixed) effects on the income that is reported in different countries, which in return gives us more credible results (Dharmapala, 2014). One example of this is H. Huizinga and Laeven (2008) who, by using affiliate data from Amadeus (now Orbis Europe) and thus controlling for country and industry specific effects, find substantially smaller magnitudes of PS than earlier studies who use aggregate level data, like Hines and Rice (1994).

On the other hand, recent international efforts against tax avoidance and evasion (eg. the BEPS program, from OECD-G20) also have a contribution to this decrease of PS (Alexander, De Vito, & Jacob, 2020). For example, against debt shifting its usual to talk about thin capitalization rules, in which case there's been implemented limits of interest deductibility above a pre-determined threshold of either net interest payment or net debt (Beer et al., 2020). And in fact, Blouin, Huizinga, Laeven, and Nicodème (2014) show us that when these instruments are in place, there's a reduction of US affiliates indebtedness, thus inter-affiliate debt shifting. Another great example is related to transfer pricing, where stricter legislation, either by a reduction of the methods that can be used to calculate the value of

intra-group firm transactions or stricter documentation requirements, are associated with reduced reported profits by MNEs (Saunders-Scott, 2015).

3. The driving forces of profit shifting

As we saw previously, there are several studies around the techniques used to identify profit shifting. However, there has been a growing focus around what affects MNE's decisions to shift taxable income abroad. In other words, what are the driving forces of PS behaviour?

One relevant study in this matter is K. J. Klassen and Laplante (2012), which examines the role of regulatory costs of income shifting. By examining the case of US MNEs, they find that, ceteris paribus the tax rate differential between countries, these firms shifted more income during 2005-2009 than during the 1998-2002 period, thanks to a decreasing on IRS (US Internal Revenue Service) audit intensity and an increase in non-US transfer pricing enforcement activities. Sugathan and George (2015), on the other hand, examine how the quality of country-level governance and corporate governance influence this behaviour, whereby using data from foreign-owned firms in India for 2001-2010, they find that both negatively affect PS. Markle (2016), for instance, try to understand the role of tax regimes, and conclude that MNEs facing territorial tax regimes shift more income than those facing worldwide systems. And then there's Dyreng and Markle (2016), which by contributing with new empirical models on the identification of PS, examines the association between the need of funds, financial constraints, and PS behaviour of US multinationals. According to them, for the period of 1998-2011, the worldwide tax system of the US incentivized its MNEs to defer repatriation of foreign income, which could mean that US enterprises had to rely on external sources of income (where costs of funding increase with financial constraints). As a result, they find that financially constrained enterprises, needing the cash situated overseas, shift less income than their unconstrained peers (i.e., financial constrains are related to less PS).

Eventually, another study has come to build on the concerns about these determinants, Delis et al. (2020), which focus on the tax rate uncertainty that exists on MNEs host countries, and how that affects their PS behaviour. They argue that under TU, companies will have more trouble to reap the tax benefits given the unpredictability of the environment. Companies would prefer predictability even if the outcome was an unexpected tax reduction, because, if they already knew what could happen, they could prepare

themselves to shift even more income and receive higher profits, or, in the opposite situation, postpone the shifting to the next period until it changes downwardly (Delis et al., 2020). So, they come to predict that companies will engage in more PS if they are located in countries with stable corporate tax rates (low TU) in comparison to those located in more unstable settings (high TU). Additionally, considering that firms consider the benefits/costs when engaging in certain tax-planning strategies, they argue that under TU the costs of using certain strategies (like transfer pricing) would increase, which in return would make firms to switch to others of lower cost (like debt shifting). As a result, by defining TU as the frequency of changes on the STR, and using Dharmapala and Riedel (2013)'s approach, they find consistent evidence of PS in low TU countries, and infer the use of debt shifting when TU is higher (the cost-adjustment of PS strategies).

The success of these studies of finding strong evidence of PS greatly depends on the empirical model that is used. Some have been using the Hines and Rice (1994)'s approach later developed by H. Huizinga and Laeven (2008), some use the Dharmapala and Riedel (2013) one, etc. And each one of them has its own assumptions and limitations. Nevertheless, given that PS is not homogenous across regions or companies (Dyreng & Markle, 2016), they show that if we consider these driving forces when looking for relevant PS, we can have a better perspective on the location and magnitudes of it. This may explain why global samples without this type of differentiation present weaker levels of PS.

3. Hypothesis development

This study has the major objectives of exploring the importance of considering certain determinants when we empirically estimate for tax-motivated profit shifting, in this case the tax rate uncertainty, and how this influences the PS behaviour of companies, more specifically if and how they adjust their strategies.

For that, we build on the work of Dharmapala and Riedel (2013), who developed a unique model to identify MNE profit shifting behaviour. Despite some limitations about the data and the model used, the last is acceptably able to identify PS flows, in which case they found statistically significant ones, although quite weaker than previously found by other studies.

Eventually, there have been some studies which put this approach to the test. For example, Schimanski (2017) tested the extent of the results obtained by Dharmapala and Riedel (2013) geographically and over time. Applying the exact same methodology of the last to see if the results would maintain, but in a sample period of 2006-2015, they found statistically insignificant evidence of PS. As a complement, they suggest the use of the average effective tax rates instead of the statutory tax rates to determine subsidiaries in high / low-tax countries, and also an expanded version of the initial sample (EU-22) to a worldwide one. The author argues that average ETRs are more realistic measures and are more suited to analyse for profit shifting. Additionally, considering only EU-22 countries are too restricting, not allowing to look for other potentially more attractive destinations of PS. In the end, only with this new setup was found relevant levels of PS. Another example is Martins (2018), who also tested the validity of this model. Considering EU-28 countries, also distinguishing for STR and ETR, and analysing the 2007-2016 period, it was found no significant evidence of PS behaviour. In general, both appoint to the limitations of this empirical approach to identify PS (like we discussed before) and to the existing tendency of the decline of its magnitudes (for example due to the international efforts to tackle BEPS (like the tightening of regulations on transfer pricing and the enforcement of thin capitalization rules), or because of the recent access to more insightful data from information providers, which may allow to have a different but better perspective on the reality).

However, more recently, Delis et al. (2020) shows that things may not be that simple. They propose, alongside Dyreng and Markle (2016), that when we are employing these

empirical models to look for PS, we should set a relatively level playing field. By considering certain determinants which affect the tax planning behaviour of companies, like the tax rate uncertainty, we can have a better perspective on the strategic location of these profits across companies or countries, and thus finding stronger evidence. In fact, with a relatively similar methodology, but now considering TU, they came to identify strong evidence of PS, specifically on the low TU sample. As such, we build on this concern to consider the driving forces of tax-motivated PS, and state:

H1: To consider tax rate uncertainty when trying to identify tax-motivated PS, helps to identify these MNE behaviours, thus finding stronger evidence of PS.

Companies weigh the benefits and costs of their tax planning activities (Dyreng & Markle, 2016). As such, by facing this "uncertainty", or fiscal risk, it is expected that they adjust their PS strategies (Delis et al., 2020). Recently, there has been some studies who look for the substitutability of PS strategies (e.g. Dudar, Nicolay, and Nusser (2016); or Hopland, Lisowsky, Mardan, and Schindler (2018)). According to them, when there is a cost increase of using certain tax-planning strategies, for example the enforcement of transfer pricing regulations, a replacement for other strategies occurs, in which case it was found a replacement to use more intracompany debt shifting. Also, the use of transfer pricing implies, for instance, the need for tax experts (McGuire, Omer, & Wang, 2012) or compliance costs (Masulis, Wang, & Xie, 2012), that may not exist under the use of debt shifting (Delis et al., 2020). Hence, we build on this reasoning to argue that:

H2: Those who face higher tax rate uncertainty adjust their PS strategies to lower cost ones, like intra-firm debt shifting.

4. Methodology

1. The role of tax rate uncertainty on profit shifting

Delis et al. (2020) were the pioneers to study the role of tax rate uncertainty as a determinant to identify PS behaviours, so, we build on their approach and use Dharmapala and Riedel (2013)'s empirical model. As previously showed, this model is based on the propagation of exogenous shocks on parent's earnings to its foreign subsidiaries as the source of identification. Being a DID approach, we distinguish between low-tax countries as the treatment group and high-tax countries as the control group, and conceive the following equation (Model 1):

$$log(EBT_{it}) = \alpha_{0i} + \alpha_1 log(Assets_{it}) + \alpha_2 log\left(EBTPS_{pt}\right) + \alpha_3\left(Dummy_{it} * logEBTPS_{pt}\right) + \alpha_4 Dummy_{it} + \alpha_5 X_{it} + \rho_t + \varepsilon_{it} \quad (4.1)$$

Where the dependent variable (EBT_{it}) is the pretax profit of subsidiary *i*, in year *t,* and the variable of interest is the interaction term between the dummy variable ($Dummy_{it}$, the DID identifier, which returns 1 if the affiliate faces a corporate tax rate lower than the parent firm and 0 if it doesn't), and the exogenous earnings shock variable ($EBTPS_{pt}$), measure of parent *p* pretax and pre-shifting profits. We control for subsidiary *i*'s size with $Assets_{it}$, for time-varying affiliate and country characteristics with vector X_{it}, and fixed effects in many dimensions (like subsidiary, year, industry-year and country-year) with ρ_t. In table 1, we display all of these variables (with their meaning and construction).

To develop $EBTPS_{pt}$, we also build on the reasoning of Bertrand et al. (2002), and use the following set of equations:

$$EBTPS_{pt} = \hat{p}_{jt} * A_{pt} \quad (4.2)$$

$$\hat{p}_j = \sum_j \frac{A_j}{\sum_j A_j} * p_j \,,\ p \neq j \text{ and } p_j = \frac{\pi_j}{A_j} \quad (4.3)$$

Where A_{pt} represents the total assets of the parent *p* of subsidiary *i,* A_j represents the total assets of comparable firms *j* during *t*, π_j its pretax profit, and p_j their return on assets. We call comparable firms to those who pertain to the same industry (i.e., in the same 4-digit

TABLE 1	Variable definitions and sources			
Model	**Variable Name**	**Equation variable**	**Description**	**Data source**
	Dependent variables:			
1 and 2	Earnings before taxes	EBT_{it}	Subsidiary i's pretax profits (in logarithm)	Orbis Europe
3	Parent leverage	PL_{pt}	Parent p's total debt/total assets	Orbis Europe
	Explanatory variables:			
1 and 2	Total assets	$logAssets_{it}$	Subsidiary's total assets (in logarithm)	Orbis Europe
1 and 3	Parent earnings before taxes and profit-shifting	$log(EBTPS_{pt})$	$\hat{\pi}_{pt} = \hat{p}_{jt} * A_{pt}$. More specifically, it's the product of the asset weighted average profitability of all firms j in the same four-digit NACE Rev. 2 industry code in the same country and the parent's total assets. $\hat{p}_j = \sum_j \frac{A_j}{\sum_j A_j} * p_j, i \neq j$ and $p_j = \frac{\pi_j}{A_j}$	Orbis Europe, own calculations
1	Low-tax subsidiary	$Dummy_{it}$	Equals 1 if the corporate STR in the subsidiary's country is lower than the one in the parent's country, and zero otherwise.	OECD, KPMG, own calculations
1 and 2	Financial leverage	In vector X_{it}	Subsidiary's total debt to total assets	Orbis Europe
1	Population	In vector X_{it}	Subsidiary country's permanent residents (in logs)	World Bank
1	GDP per capita	In vector X_{it}	Subsidiary country's gross domestic product per capita (in logs).	World Bank
1	Intangible fixed assets		Subsidiary's intangible fixed assets (in logs)	Orbis Europe
3	Fraction of low-tax subsidiaries	$Fraction_{pt}$	The fraction of the parent's subsidiaries that are in a country with a lower STR than the parent's country in year t.	OECD, KPMG, own calculations
3	Parent total assets	$logAssets_{pt}$	Parent's total assets (in logs).	Orbis Europe
3	Parent population	In vector X_{pt}	Parent country's permanent residents (in logs).	World Bank
3	Parent GDP per capita	In vector X_{pt}	Parent country's gross domestic product per capita (in logs).	World Bank
2	High-tax rate uncertainty		Equals 1 if the STR in the subsidiary's country changed at least once during the last three years, and zero otherwise.	OECD, KPMG, own calculations
2	High-tax rate volatility		Equals 1 if the STR volatility in the subsidiary's country is lower than the sample average, and zero otherwise.	OECD, KPMG, own calculations
2	Labor cost	$logLabor_{it}$	Subsidiary's total labor cost (in logs)	Orbis Europe
2	Unweighted tax difference	UTD_{it}	Calculated as $utd_{it} = \sum_j \frac{(\tau_{it} - \tau_{jt})}{N}, i \neq j, \forall t \in \{1, \dots, T\}$, where N is the total number of affiliates (including the parent) in the corporate group at time t and τ is the subsidiary country's STR.	Orbis Europe, OECD, KPMG, own calculations

NACE Rev. 2 code) and country as parent *p*. Then, the sample is restricted to those cases that have at least 10 comparable firms (as a way to have enough information about each industry) and to subsidiaries that operate in different industries than their parent firms (preventing industry shocks from affecting the profits of its subsidiaries) (Delis et al., 2020).

Since we want to understand the importance of considering certain determinants when to identify for profit shifting, in this case tax rate uncertainty, we will estimate the model with and without it, and look for differences. I.e., we split the sample and estimate 3 times: for the normal sample (without considering TU), secondly for high TU, and third for low TU.

α_3 is the coefficient of interest, and when positive, we infer profit shifting. We assume that an increase on the pretax and pre-shifting earnings of the parent firm, $\Delta\hat{\pi}_{pt}$, propagates asymmetrically to affiliates in low-taxed countries in comparison to those in high-taxed countries, d_{it}. When considering TU, we expect that in the low TU sample we find higher values of α_3 in comparison to when we don't differentiate for TU. In other words, those who face lower uncertainty engage in more PS, thus helping us to better identify PS behaviour.

To assess the robustness of this approach, we make several tests in line with Delis et al. (2020). First, given that there are different empirical methods to identify for PS (as we discussed previously), we will also use the tax differential approach improved by H. Huizinga and Laeven (2008) with a later contribution of Karkinsky and Riedel (2012) (Model 2):

$$\log(\pi_{it}) = \gamma_{0i} + \gamma_1 \log(L_{it}) + \gamma_2 \log(K_{it}) + \gamma_3 utd_{it} + \gamma_4 Fl + \rho_t + \varepsilon_{it} \qquad (4.4)$$

Quite similar to the initial version of Hines and Rice (1994), the big difference lies in the variable of interest (utd_{it}), which represents the unweighted tax difference between affiliate countries, constructed as:

$$utd_{it} = \sum_j \frac{(\tau_{it} - \tau_{jt})}{N},\ i \neq j,\ \forall t \in \{1, \ \ldots, T\} \qquad (4.5)$$

Where *N* is the total number of firms in the multinational group at *t*, and τ is the subsidiary's country STR. We call this the benefit for PS that a subsidiary faces between its multinational peers (including its parents). We also control for labor costs (*L*), capital (*K*), and for subsidiaries economic conditions with *Fl* (based on the financial leverage). If γ_3 becomes

negative we infer that the multinational group optimally shifts profits to country *i* at year *t*, and vice-versa. Second, and accounting for different types of uncertainty, we define TU by the stability of tax rates in a 4-year period (instead of just three), and by the tax rate volatility (TV, as the standard deviation of corporate tax rates in 3 years). Lastly, and considering the evolution of intangible assets in the world economy and its possible relocation to achieve tax minimization (Dudar & Voget, 2016), we will also consider these as an additional variable.

2. Tax rate uncertainty and the adjustment of strategies

To investigate for the cost-adjustment of profit shifting strategies by MNE, we will also follow Delis et al. (2020) and look for the use of intra-firm debt shifting, where such approach is also developed by Dharmapala and Riedel (2013). Since we don't have access to this kind of information, we use an indirect approach and infer debt shifting by the proportion of parents leverage that is attributable to low-tax subsidiaries (Model 3):

$$Parent\ leverage_{pt} = \beta_{0i} + \beta_1 \log(Assets_{pt}) + \beta_2 log(EBTPS_{pt}) + \beta_3(f_{pt} * logEBTPS_{pt}) + \beta_4 f_{pt} + \beta_5 X_{pt} + \rho_t + \varepsilon_{pt} \quad (4.6)$$

Where the dependent variable is the fraction between the total debt and the total assets of the parent *p*, and the variable of interest is the interaction term between f_{pt} (the fraction of *p*'s affiliates that face lower taxes rates than itself) and, once again, the exogenous shock variable. The rest of the variables are as described as before. Then, we account for the role of tax rate uncertainty, split the sample, and also estimate this equation 3 times, for the normal sample, high TU and low TU.

The coefficient of interest is β_3. When positive and significant, we can read it as: upon an exogenous shock on the parent's earnings, those multinational groups with higher portions of low-tax subsidiaries tend to have a parent with a higher debt to-asset ratio (thus relevant debt shifting). In other words, by having many low-taxed subsidiaries, that can greatly affect the parents leverage, which is attributable to the internal use of debt. And here we expect that to happen especially when TU is high – by facing a rising of tax planning costs, firms will adjust their PS strategies to lower-cost ones, like debt shifting.

Once again, to assess the robustness of our results, we make additional analysis with (1) a 4-year period, (2) the volatility in the rax-rates to define TU, and (3) the consideration of intangible property.

3. Data

Since we look for profit shifting on MNE, the analysis is based on firm-level financial data, where we resort to the database Orbis Europe. This source provides consolidated and unconsolidated financial statement information about European companies and, as equally important, data about MNE ownership structure and their connections between parents and subsidiaries. In our case, we'll look for MNEs located in the UE-27, plus those located in Norway, United Kingdom, Russia, Switzerland, and in Turkey. We require that parent firms have at least one subsidiary in another country and to own them for at least 50% of the shares as ultimate owners. In line with previous studies, we restrict the sample to firms with positive pretax earnings (where PS incentives can be more significant) and at least 5 employees.

To build the variable of interest, we use the parent's assets (A_{pt}). According to Tørsløv, Wier, and Zucman (2018), many databases (including Orbis Europe) have limited data about unconsolidated parent assets. As such, we follow Delis et al. (2020) and, in the case where parents have consolidated data, we subtract the assets of all subsidiaries (in the sample) from their assets. With this, we expect to get closer to the true value of these assets. The same does not hold to the profits of consolidated firms, because that could mean a loss of important information on profit shifting. However, since we restrict to comparable firms, we will only exclude the profits of subsidiary *i* (for the construction of the weighted average industry profitability index, $\hat{p}_j$, of equations 4.2 and 4.3).

After several restrictions on missing observations, the major sample includes 22 579 subsidiaries and 9 792 parent firms from 32 countries for 2015 through 2018. In table A1 of the Appendix, we disclose summary statistics of parent and subsidiary firms by country.

About the variables, we measure firms profits with earnings before taxes (EBT), which includes the financial income and payments (necessary to consider the total profit shifting). We use, however, the logarithms because of the high skewness of EBT (Markle, 2016). Despite causing us to consider only firms with positive earnings, Dharmapala and Riedel (2013) argue that in these cases PS incentives have a good probability of being more relevant. As for the firm's size, we look for its total assets, once again using the logarithm. To control for other firm and economic characteristics, we consider its leverage level and the country's population and PIB per capita. Concerning the DID variables, d_{it} and f_{pt}, we follow the Devereux (2007) justification and use statutory tax rates. At last, we consider

different sets of fixed effects, including firm, year, industry-year, and country-year fixed effects, as way to control for other observed and unobserved effects (as we discussed in the literature).

To consider TU, we make the question: During the sample period, did this country make changes in its corporate tax rate? If yes, we consider companies established in this country on the sample of high TU, otherwise it goes to the low TU sample. Table A2 reports summary statistics for each of these groups, table A3 reports correlations between the main variables of the empirical study, and table A4 displays the sample countries STRs and given tax rate uncertainty.

By looking at table 2, the average subsidiary in our primary sample (of Model 1) has USD 10,2 million of pretax earnings and total assets of USD 133 million, whereas (in Model 3) the average parent firm has USD 224 million of pretax profits and USD 4,3 billion of total assets. On the other hand, we can see that there's a small range of companies that drive the mean level of profits very high, since the median parent profit is only of USD 9 million. Additionally, 45% of the subsidiaries in this sample face lower corporate tax rates than their parents.

TABLE 2	Summary statistics of the main variables, by Model					
MODEL 1 **2015 -2018**	**No. Observations**	**Mean**	**Median**	**Std. Dev.**	**Minimum**	**Maximum**
Dependent variable						
Earnings before taxes	19 020	10 255,4	1 268,5	72 644,5	1,0	4 023 075,0
Explanatory variables						
Total assets	19 020	133 165,2	13 180,5	927 988,7	37,0	33 348 493,0
Parent earnings before taxes and profit shifting	19 020	672 787,7	66 526,8	2 183 013,5	0,1	55 630 726,5
Low-tax subsidiary	19 020	0,45	0,00	0,50	0,00	1,00
Financial leverage	19 020	0,09	0,00	0,21	-0,01	14,06
Population	19 020	35 537,1	19 815,6	28 254,4	1 315,4	144 496,7
GDP per capita	19 020	35,239	34,616	16,072	7,056	82,818
Intangible fixed assets	19 020	8 081,6	13,0	111 945,8	-181 281,0	5 633 783,0
MODEL 2 **2015 -2018**	**No. Observations**	**Mean**	**Median**	**Std. Dev.**	**Minimum**	**Maximum**
Dependent variables						
Earnings before taxes	67 737	8 905,4	1 065,0	64 586,2	1,0	5 057 157,0
Explanatory variables						
Labor cost	67 737	14 442,8	2 722,0	106 688,8	1,0	11 727 096,0
Total assets (Capital)	67 737	121 361,1	11 513,0	1 040 563,1	7,0	70 935 076,0
Unweighted tax difference	67 737	0,00	0,00	0,06	-0,28	0,26
Financial leverage	67 737	0,10	0,00	0,19	-0,05	14,06
High-tax rate uncertainty	67 737	0,61	1,00	0,49	0,00	1,00
High-tax rate volatility	67 737	0,36	0,00	0,48	0,00	1,00
MODEL 3 **2015 -2018**	**No. Observations**	**Mean**	**Median**	**Std. Dev.**	**Minimum**	**Maximum**
Dependent variables						
Parent leverage	4 984	0,26	0,23	0,29	0,00	12,20
Explanatory variables						
Parent total assets	4 984	4 366 359,4	233 479,0	31 250 658,7	372,0	1 069 004 879,0
Parent earnings before taxes and profit shifting	4 984	224 317,8	9 436,4	1 500 359,2	0,2	55 630 726,5
Fraction of low-tax subsid	4 984	0,45	0,33	0,46	0,00	1,00
Parent population	4 984	45 588,1	60 421,8	29 891,7	1 315,4	144 496,7
Parent GDP per capita	4 984	40,534	41,631	11,349	7,056	82,818
Parent Intangible FA	4 952	1 051 250,9	7 166,0	6 503 299,6	-22 075,0	186 814 000,0

Notes: The variables are defined in Table 1. The monetary units are thousands of US dollars, and population is in thousands of individuals.

5. Empirical results

1. The role of tax-uncertainty on profit shifting

The baseline results are presented in Table 3, using a set of specifications on Model 1 for the period of 2016 to 2018. Columns 1 to 5 report estimations without considering TU (normal sample), columns 6 to 10 report estimations by considering high TU, and columns 11 to 15 consider low TU. In each one, different sets of fixed effects are controlled[4].

In the first columns (normal) we can see some evidence of PS: The relevant variable (*EBTPS*Dummy)* has positive coefficient estimates, significant only at the 10% level. We can read this as: if the parent company experiences an earnings shock (increase in EBTPS) of 10%, its low-tax subsidiaries will have its profits enhanced by 0,1 to 0,2%. These results contrast to what was found by Martins (2018) and Schimanski (2017) (i.e. no evidence of PS), although these are lower than those found in earlier studies like Dharmapala and Riedel (2013) (in line with the literature for the decrease of magnitudes of PS in the last decades). Importantly, we can observe that specifications with subsidiary fixed effects have a greater Adjusted R-squared (from 0,7 in specification one to 0,9 in specification two), thereby showing that firms characteristics are very important when we try to find PS (with these models). So, we'll pay more attention to these specifications.

Concerning TU, the results are somewhat in line of what we expected: that PS magnitudes would be greater under Low-tax uncertainty than High TU, and it is, if we consider only year, industry, country, or no fixed effects, but leaving those who contribute the most to the model estimation, the affiliate effects. In this last case, however, the results are somewhat significant in the high TU sample.

The picture is the same in other specifications, table 4 (which considers intangible fixed assets) and table 5 (considering tax rate volatility). Without measuring for TU, there's relevant evidence of PS, at the 10% level, especially for the subsidiary effects sets specifications. On the TU side, the affiliate effect specification is relevant in the high TU sample, and the others strongly significant in the low TU sample. Additionally, we begin to

[4] The literature uses this model with heteroscedasticity robust standard errors. But since there exists a conflict by estimating simultaneously with fixed effects and this methodology, we only estimate with the last in specifications 1, 6 and 11 (i.e., without considering fixed effects), whereas in the rest we use the normal OLS.

TABLE 3 | Baseline results: 3-year period, 2016 - 2018.

	Normal					High TU					Low TU				
Dependent variable: EBT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,885*** **	**0,673*** **	**0,621*** **	**0,888*** **	**0,877*** **	**0,874*** **	**0,653*** **	**0,607*** **	**0,875*** **	**0,867*** **	**0,891*** **	**0,704*** **	**0,654*** **	**0,897*** **	**0,894*** **
	(87,433)	(20,74)	(18,266)	(145,198)	(152,79)	(67,993)	(15,893)	(14,078)	(113,804)	(120,156)	(63,319)	(13,255)	(11,762)	(86,529)	(94,585)
EBTPS	**0,021*** **	**0,015**	**0,004**	**0,024*** **	**0,021*** **	**0,028*** **	**0,049** **	**0,031**	**0,030*** **	**0,031*** **	**-0,001**	**-0,016**	**-0,018**	**0,005**	**-0,003**
	(2,881)	(0,997)	(0,234)	(5,048)	(4,593)	(3,281)	(2,34)	(1,452)	(5,403)	(5,57)	(-0,087)	(-0,767)	(-0,848)	(0,509)	(-0,382)
EBTPS*Dummy	**0,015***	**0,024***	**0,021***	**0,015** **	**0,009**	**0,010**	**0,031***	**0,030***	**0,014***	**0,005**	**0,031** **	**0,005**	**0,001**	**0,027** **	**0,026** **
	(1,664)	(1,884)	(1,673)	(2,441)	(1,48)	(0,869)	(1,751)	(1,727)	(1,699)	(0,585)	(2,041)	(0,274)	(0,07)	(2,557)	(2,5)
Dummy	**-0,092**	**-0,177**	**-0,156**	**-0,074**	**-0,161** **	**-0,114**	**-0,197**	**-0,224**	**-0,122**	**-0,115**	**-0,234**	**-0,099**	**-0,029**	**-0,212***	**-0,343*** **
	(-0,884)	(-1,26)	(-1,11)	(-1,069)	(-2,325)	(-0,843)	(-0,983)	(-1,116)	(-1,361)	(-1,298)	(-1,346)	(-0,494)	(-0,141)	(-1,706)	(-2,787)
Fin. Leverage	**-0,853*** **	**-0,197*** **	**-0,192*** **	**-0,811*** **	**-0,898*** **	**-0,624** **	**-0,174*** **	**-0,166*** **	**-0,572*** **	**-0,708*** **	**-1,378*** **	**-0,316*** **	**-0,327*** **	**-1,381*** **	**-1,384*** **
	(-3,026)	(-4,226)	(-4,123)	(-18,459)	(-20,479)	(-2,129)	(-3,43)	(-3,266)	(-10,869)	(-13,617)	(-10)	(-2,621)	(-2,711)	(-16,691)	(-16,927)
Population	**0,010**	**-6,761*** **	**-7,271*** **	**-0,001**		**0,005**	**-9,067*** **	**-8,802*** **	**-0,012**		**0,010**	**-4,437** **	**-6,836** **	**0,007**	
	(0,775)	(-4,69)	(-4,127)	(-0,106)		(0,283)	(-4,503)	(-3,66)	(-1,108)		(0,5)	(-2,15)	(-2,392)	(0,475)	
GDPpc	**0,173*** **	**0,084**	**0,103**	**0,190*** **		**0,220*** **	**0,021**	**0,453**	**0,256*** **		**0,183*** **	**0,051**	**-0,452**	**0,169*** **	
	(6,287)	(0,865)	(0,371)	(9,97)		(5,305)	(0,141)	(1,031)	(8,768)		(4,929)	(0,381)	(-0,982)	(6,361)	
Observations	14 268	14 268	14 268	14 268	14 268	8 586	8 586	8 586	8 586	8 586	5 682	5 682	5 682	5 682	5 682
No Subsidiaries	4 756	4 756	4 756	4 756	4 756	2 862	2 862	2 862	2 862	2 862	1 894	1 894	1 894	1 894	1 894
Adjusted R-squared	0,701	0,895	0,895	0,706	0,706	0,707	0,896	0,896	0,714	0,713	0,686	0,889	0,890	0,692	0,690
Subsidiary effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 1, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational subsidiaries with a foreign parent firm. The dependent variable is the logarithm of EBT and logarithm of EBTPS*Dummy is the earnings shock variable; all variables are defined in table 1. Tax-rate uncertainty is defined by a three-year period of corporate tax rate stability. In columns (1) to (5) we include the normal sample (without considering TU); in columns (6) to (10) we include countries with high TU, and in columns (11) to (15) we include countries with low TU. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TABLE 4 | Additional tests: intangible property.

	Normal					High TU					Low TU				
Dependent variable: EBT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,887*** **	**0,708*** **	**0,646*** **	**0,894*** **	**0,887*** **	**0,864*** **	**0,643*** **	**0,591*** **	**0,871*** **	**0,873*** **	**0,906*** **	**0,819*** **	**0,761*** **	**0,923*** **	**0,910*** **
	(59,771)	(15,102)	(12,936)	(93,038)	(97,324)	(45,043)	(10,779)	(9,337)	(70,347)	(73,876)	(41,626)	(10,753)	(9,338)	(58,536)	(63,777)
EBTPS	**0,021****	**0,010**	**-0,002**	**0,027*** **	**0,021*** **	**0,033*** **	**0,024**	**0,008**	**0,035*** **	**0,033*** **	**-0,008**	**-0,004**	**-0,006**	**0,001**	**-0,011**
	(2,173)	(0,507)	(-0,098)	(4,241)	(3,335)	(2,866)	(0,892)	(0,274)	(4,58)	(4,58)	(-0,457)	(-0,131)	(-0,219)	(0,081)	(-0,917)
EBTPS*Dummy	**0,018**	**0,029***	**0,028***	**0,012**	**0,013**	**0,011**	**0,059****	**0,057****	**0,009**	**0,006**	**0,035***	**-0,006**	**-0,009**	**0,028****	**0,033****
	(1,484)	(1,795)	(1,691)	(1,445)	(1,626)	(0,685)	(2,556)	(2,461)	(0,803)	(0,552)	(1,801)	(-0,271)	(-0,397)	(2,026)	(2,501)
Dummy	**-0,113**	**-0,234**	**-0,223**	**-0,042**	**-0,199****	**-0,179**	**-0,557****	**-0,566****	**-0,156**	**-0,166**	**-0,226**	**0,068**	**0,126**	**-0,164**	**-0,349****
	(-0,81)	(-1,261)	(-1,201)	(-0,452)	(-2,125)	(-0,955)	(-2,034)	(-2,068)	(-1,248)	(-1,352)	(-0,996)	(0,265)	(0,487)	(-1,007)	(-2,202)
Fin. Leverage	**-0,699****	**-0,153*** **	**-0,146*** **	**-0,691*** **	**-0,689*** **	**-0,441**	**-0,111****	**-0,105****	**-0,435*** **	**-0,477*** **	**-1,555*** **	**-0,588*** **	**-0,569*** **	**-1,621*** **	**-1,474*** **
	(-2,093)	(-3,125)	(-2,98)	(-13,151)	(-13,268)	(-1,608)	(-2,173)	(-2,057)	(-7,297)	(-8,187)	(-9,643)	(-3,458)	(-3,348)	(-14,259)	(-13,179)
Population	**-0,009**	**-7,545*** **	**-8,691*** **	**-0,016**		**-0,039***	**-10,725*** **	**-10,202*** **	**-0,051*** **		**0,034**	**-4,610**	**-9,638****	**0,049****	
	(-0,571)	(-3,827)	(-3,731)	(-1,385)		(-1,829)	(-3,91)	(-3,395)	(-3,525)		(1,262)	(-1,621)	(-2,278)	(2,56)	
GDPpc	**0,153*** **	**-0,081**	**-0,256**	**0,175*** **		**0,138*** **	**0,100**	**0,828**	**0,174*** **		**0,147*** **	**-0,328***	**-1,278****	**0,117*** **	
	(4,373)	(-0,638)	(-0,707)	(6,926)		(2,631)	(0,519)	(1,406)	(4,401)		(2,843)	(-1,883)	(-2,021)	(3,225)	
Intangibles	**0,001**	**-0,022****	**-0,023****	**-0,005**	**-0,003**	**0,010**	**-0,019**	**-0,020**	**0,003**	**-0,003**	**0,003**	**-0,021**	**-0,021**	**-0,005**	**0,003**
	(0,075)	(-1,972)	(-2,09)	(-0,91)	(-0,485)	(0,937)	(-1,268)	(-1,38)	(0,436)	(-0,485)	(0,209)	(-1,272)	(-1,253)	(-0,581)	(0,311)
Observations	8 379	8 379	8 379	8 379	8 379	4 848	4 848	4 848	4 848	4 848	3 531	3 531	3 531	3 531	3 531
No Subsidiaries	2 793	2 793	2 793	2 793	2 793	1 616	1 616	1 616	1 616	1 616	1 177	1 177	1 177	1 177	1 177
Adjusted R-squared	0,687	0,894	0,894	0,692	0,694	0,699	0,896	0,896	0,704	0,706	0,675	0,888	0,889	0,679	0,677
Subsidiary effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 1, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational subsidiaries with a foreign parent firm. The dependent variable is the logarithm of EBT and logarithm of EBTPS*Dummy is the earnings shock variable; all variables are defined in table 1. Tax-rate uncertainty is defined by a three-year period of corporate tax rate stability. In columns (1) to (5) we include the normal sample (without considering TU); in columns (6) to (10) we include countries with high TU, and in columns (11) to (15) we include countries with low TU. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TABLE 5 | Additional tests: tax rate volatility.

	Normal					High TU					Low TU				
Dependent variable: EBT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,885*** **	**0,673*** **	**0,621*** **	**0,888*** **	**0,877*** **	**0,844*** **	**0,562*** **	**0,499*** **	**0,851*** **	**0,843*** **	**0,903*** **	**0,759*** **	**0,716*** **	**0,904*** **	**0,902*** **
	(87,433)	(20,74)	(18,266)	(145,198)	(152,79)	(57,294)	(10,387)	(8,831)	(83,427)	(89,196)	(84,348)	(18,562)	(16,743)	(117,308)	(125,502)
EBTPS	**0,021*** **	**0,015**	**0,004**	**0,024*** **	**0,021*** **	**0,036*** **	**0,048***	**0,032**	**0,032*** **	**0,037*** **	**0,006**	**-0,001**	**-0,009**	**0,011***	**0,005**
	(2,881)	(0,997)	(0,234)	(5,048)	(4,593)	(3,315)	(1,747)	(1,129)	(4,462)	(5,215)	(0,722)	(-0,08)	(-0,53)	(1,678)	(0,863)
EBTPS*Dummy	**0,015***	**0,024***	**0,021***	**0,015** **	**0,009**	**-0,015**	**0,045***	**0,041***	**-0,011**	**-0,018**	**0,029*** **	**0,012**	**0,010**	**0,029*** **	**0,024*** **
	(1,664)	(1,884)	(1,673)	(2,441)	(1,48)	(-0,916)	(1,865)	(1,68)	(-1,002)	(-1,608)	(2,659)	(0,79)	(0,664)	(3,862)	(3,139)
Dummy	**-0,092**	**-0,177**	**-0,156**	**-0,074**	**-0,161** **	**0,050**	**-0,350**	**-0,357**	**0,026**	**0,081**	**-0,265** **	**-0,099**	**-0,074**	**-0,271*** **	**-0,210*** **
	(-0,884)	(-1,26)	(-1,11)	(-1,069)	(-2,325)	(0,276)	(-1,239)	(-1,261)	(0,212)	(0,652)	(-2,092)	(-0,604)	(-0,453)	(-3,15)	(-3,485)
Fin. Leverage	**-0,853*** **	**-0,197*** **	**-0,192*** **	**-0,811*** **	**-0,898*** **	**-0,445**	**-0,089***	**-0,082**	**-0,434*** **	**-0,446*** **	**-1,359*** **	**-0,634*** **	**-0,632*** **	**-1,341*** **	**-1,436*** **
	(-3,026)	(-4,226)	(-4,123)	(-18,459)	(-20,479)	(-1,529)	(-1,676)	(-1,549)	(-6,932)	(-7,321)	(-13,213)	(-6,159)	(-6,131)	(-21,226)	(-22,582)
Population	**0,010**	**-6,761*** **	**-7,271*** **	**-0,001**		**0,022**	**-7,848***	**-8,803** **	**0,002**		**0,042*** **	**-6,864*** **	**-7,447*** **	**0,036*** **	
	(0,775)	(-4,69)	(-4,127)	(-0,106)		(0,772)	(-1,832)	(-2,022)	(0,117)		(2,718)	(-4,511)	(-3,549)	(3,351)	
GDPpc	**0,173*** **	**0,084**	**0,103**	**0,190*** **		**-0,045**	**0,208**	**1,123**	**-0,002**		**0,218*** **	**-0,024**	**-0,062**	**0,223*** **	
	(6,287)	(0,865)	(0,371)	(9,97)		(-0,506)	(0,984)	(1,253)	(-0,037)		(7,666)	(-0,219)	(-0,19)	(11,063)	
Observations	14 268	14 268	14 268	14 268	14 268	4 956	4 956	4 956	4 956	4 956	9 312	9 312	9 312	9 312	9 312
No Subsidiaries	4 756	4 756	4 756	4 756	4 756	1 652	1 652	1 652	1 652	1 652	3 104	3 104	3 104	3 104	3 104
Adjusted R-squared	0,701	0,895	0,895	0,706	0,706	0,669	0,882	0,883	0,675	0,669	0,724	0,901	0,901	0,730	0,728
Subsidiary effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 1, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational subsidiaries with a foreign parent firm. The dependent variable is the logarithm of EBT and logarithm of EBTPS*Dummy is the earnings shock variable; all variables are defined in table 1. Tax-rate uncertainty is defined by a three-year period of corporate tax rate volatility. In columns (1) to (5) we include the normal sample (without considering TV); in columns (6) to (10) we include countries with high TV, and in columns (11) to (15) we include countries with low TV. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

see (in table 4, low TU sample) that the variable of interest can become negative, contrary to our understanding and expectations.

The same doesn't hold for the 4-year period of TU (table 6). In the Normal sample, the relevant coefficients range from 0.01 to 0.03 (according to what we saw previously and with the literature), but in the low TU sample coefficients go up to 0.088 (much near to the 0.093 that Delis et al. (2020) found for the 2010-2013 period), many of them with statistical significance at the 5% level or below. As a consequence, this shows stronger flows of PS in the set of countries of stable corporate tax rates, compared to the unstable ones as well as if we didn't make such a distinction.

As an additional test, we use the refined model of H. Huizinga and Laeven (2008), with an adaptation from Karkinsky and Riedel (2012). In table 7, the first 15 columns are as specified before, but columns 16 to 20 additionally consider an interaction between the variable of interest (UTD) and the variable high TU (a dummy variable of 1 in countries of high TU, and 0 otherwise).

The results are in line to those found by Delis et al. (2020). In the normal category, we see evidence of PS: UTD is negative and significant (at least at the 5% level), which shows that corporate tax differences between company's firms are influential to PS behaviour. On the other hand, by comparing high TU and low TU, we can observe "stronger" negative coefficients for the variable of interest in the last sample (excluding the year effects specification), especially in the case for subsidiary fixed effects, meaning that the semi-elasticity of pretax profits with respect to the difference in average tax rates is 2,115. The same logic holds on the interaction specifications (columns 16 to 20), where UTD* High TU is positive and significant (most at the 1% level), thus indicating that PS is lower among subsidiaries in countries with High TU. We obtain similar results when using tax rate volatility instead of uncertainty, in table 8.

In general, this points to the belief that PS is still relevant between MNE firms. On one hand, and as we see in table 7, the tax differential seems to hold as an important variable to look for these behaviours, and in table 3 to 6 (considering parent exogenous shocks), despite being less relevant, it still appoints for some evidence of PS. But on the other hand, the magnitudes are lower than those found in previous studies, which is in line with previous

TABLE 6 | Additional tests: 4-year period, 2015 - 2018.

	Normal					High TU					Low TU				
Dependent variable: EBT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,884*** **	**0,714*** **	**0,676*** **	**0,887*** **	**0,875*** **	**0,881*** **	**0,728*** **	**0,685*** **	**0,885*** **	**0,874*** **	**0,872*** **	**0,671*** **	**0,647*** **	**0,879*** **	**0,877*** **
	(94,51)	(28,589)	(26,284)	(166,928)	(175,972)	(78,776)	(25,985)	(22,699)	(145,089)	(151,994)	(53,129)	(13,975)	(13,152)	(79,897)	(88,355)
EBTPS	**0,021*** **	**0,024***	**0,007**	**0,024*** **	**0,022*** **	**0,025*** **	**0,031** **	**0,013**	**0,026*** **	**0,027*** **	**-0,020**	**-0,034**	**-0,043**	**-0,006**	**-0,020**
	(3,069)	(1,931)	(0,587)	(5,831)	(5,51)	(3,384)	(2,56)	(1,077)	(5,96)	(6,306)	(-1,041)	(-1,078)	(-1,36)	(-0,515)	(-1,618)
EBTPS*Dummy	**0,016***	**0,028** **	**0,027** **	**0,016*** **	**0,010***	**0,011**	**0,024** **	**0,023***	**0,013** **	**0,005**	**0,054** **	**0,088** **	**0,084** **	**0,044*** **	**0,050*** **
	(1,838)	(2,469)	(2,429)	(3,036)	(1,828)	(0,918)	(2,148)	(1,897)	(1,864)	(0,79)	(2,522)	(2,516)	(2,399)	(3,332)	(3,768)
Dummy	**-0,107**	**-0,217***	**-0,227***	**-0,091**	**-0,177*** **	**-0,138**	**-0,176**	**-0,185**	**-0,148***	**-0,139** **	**-0,573** **	**-1,042** **	**-0,985** **	**-0,449*** **	**-0,598*** **
	(-1,054)	(-1,751)	(-1,831)	(-1,533)	(-2,965)	(-1,009)	(-1,338)	(-1,335)	(-1,874)	(-2,003)	(-2,294)	(-2,458)	(-2,321)	(-2,828)	(-3,757)
Fin. Leverage	**-0,900*** **	**-0,263*** **	**-0,252*** **	**-0,854*** **	**-0,954*** **	**-0,811*** **	**-0,264*** **	**-0,250*** **	**-0,754*** **	**-0,895*** **	**-1,063*** **	**-0,260** **	**-0,254** **	**-1,039*** **	**-1,206*** **
	(-3,883)	(-6,234)	(-5,993)	(-21,98)	(-24,599)	(-3,1)	(-5,873)	(-5,495)	(-17,12)	(-20,696)	(-7,094)	(-2,445)	(-2,387)	(-11,696)	(-13,661)
Population	**0,004**	**-4,541*** **	**-6,591*** **	**-0,006**		**-0,005***	**-6,445*** **	**-8,409*** **	**-0,019***		**0,059** **	**-2,218***	**-4,416** **	**0,047*** **	
	(0,289)	(-5,106)	(-5,506)	(-0,796)		(1,888)	(-3,741)	(-5,541)	(1,739)		(2,559)	(-1,647)	(-2,124)	(3,055)	
GDPpc	**0,190*** **	**0,276*** **	**0,121**	**0,198*** **		**0,254*** **	**0,412**	**0,411***	**0,275*** **		**0,179*** **	**0,139**	**-0,263**	**0,160*** **	
	(7,325)	(3,56)	(0,683)	(12,127)		(8,031)	(0,905)	(-1,767)	(13,369)		(4,805)	(1,19)	(-0,604)	(6,451)	
Observations	19 020	19 020	19 020	19 020	19 020	13 892	13 892	13 892	13 892	13 892	5 128	5 128	5 128	5 128	5 128
No Subsidiaries	4 755	4 755	4 755	4 755	4 755	3 473	3 473	3 473	3 473	3 473	1 282	1 282	1 282	1 282	1 282
Adjusted R-squared	0,700	0,886	0,887	0,705	0,708	0,704	0,887	0,888	0,709	0,710	0,689	0,881	0,881	0,697	0,691
Subsidiary effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 1, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational subsidiaries with a foreign parent firm. The dependent variable is the logarithm of EBT and logarithm of EBTPS*Dummy is the earnings shock variable; all variables are defined in table 1. Tax-rate uncertainty is defined by a four-year period of corporate tax rate stability. In columns (1) to (5) we include the normal sample (without considering TU); in columns (6) to (10) we include countries with high TU, and in columns (11) to (15) we include countries with low TU. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TABLE 7 | Additional test: H. Huizinga and Laeven (2008) improved approach.

	Normal					High TU				
Dependent variable: EBT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cost of employees	**0,203*** **	**0,214*** **	**0,240*** **	**0,214*** **	**0,183*** **	**0,227*** **	**0,188*** **	**0,200*** **	**0,239*** **	**0,199*** **
	(26,942)	(12,981)	(13,294)	(47,058)	(41,268)	(22,592)	(8,691)	(8,498)	(39,352)	(34,155)
Total assets	**0,785*** **	**0,638*** **	**0,651*** **	**0,776*** **	**0,787*** **	**0,773*** **	**0,654*** **	**0,660*** **	**0,762*** **	**0,780*** **
	(110,528)	(43,471)	(42,131)	(189,562)	(209,653)	(80,21)	(35,638)	(34,237)	(144,808)	(160,023)
UTD	**-1,245*** **	**-0,394** **	**-0,415** **	**-1,283*** **	**-0,629*** **	**-0,941*** **	**-0,213**	**-0,364***	**-0,995*** **	**-0,453*** **
	(-11,736)	(-2,248)	(-2,369)	(-17,653)	(-5,223)	(-6,628)	(-1,157)	(-1,951)	(-10,489)	(-2,987)
UTD * High TU										
Leverage	**-1,059*** **	**-0,504*** **	**-0,516*** **	**-1,029*** **	**-1,139*** **	**-0,975*** **	**-0,441*** **	**-0,446*** **	**-0,939*** **	**-1,089*** **
	(-10,639)	(-15,295)	(-15,638)	(-46,7)	(-50,507)	(-6,695)	(-11,481)	(-11,592)	(-33,261)	(-37,775)
Observations	67 737	67 737	67 737	67 737	67 737	41 340	41 340	41 340	41 340	41 340
No Subsidiaries	22 579	22 579	22 579	22 579	22 579	13 780	13 780	13 780	13 780	13 780
Adjusted R-squared	0,728	0,906	0,906	0,733	0,731	0,731	0,908	0,908	0,736	0,735
	Low TU					**Interação**				
Dependent variable: EBT	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Cost of employees	**0,173*** **	**0,262*** **	**0,300*** **	**0,182*** **	**0,160*** **	**0,203*** **	**0,219*** **	**0,240*** **	**0,214*** **	**0,182*** **
	(15,645)	(10,126)	(10,579)	(26,049)	(23,366)	(26,952)	(13,224)	(13,298)	(46,956)	(41,177)
Total assets	**0,794*** **	**0,615*** **	**0,637*** **	**0,788*** **	**0,794*** **	**0,785*** **	**0,640*** **	**0,651*** **	**0,776*** **	**0,787*** **
	(76,623)	(25,19)	(24,672)	(119,068)	(134,056)	(110,626)	(43,571)	(42,127)	(189,564)	(209,656)
UTD	**-1,356*** **	**-2,115*** **	**-0,254**	**-1,483*** **	**-0,961*** **	**-1,726*** **	**-1,964*** **	**-0,595**	**-1,773*** **	**-0,936*** **
	(-6,007)	(-3,85)	(-0,411)	(-9,686)	(-4,829)	**(-8,35)**	**(-3,675)**	**(-1,068)**	**(-13,022)**	**(-4,79)**
UTD * High TU						**0,721*** **	**1,765*** **	**0,203**	**0,734*** **	**0,496** **
						(2,745)	(3,11)	(0,341)	(4,253)	(1,995)
Leverage	**-1,181*** **	**-0,674*** **	**-0,699*** **	**-1,151*** **	**-1,213*** **	**-1,051*** **	**-0,505*** **	**-0,516*** **	**-1,022*** **	**-1,137*** **
	(-13,331)	(-10,685)	(-11,057)	(-32,24)	(-33,434)	(-10,562)	(-15,349)	(-15,639)	(-46,243)	(-50,382)
Observations	26 397	26 397	26 397	26 397	26 397	67 737	67 737	67 737	67 737	67 737
No Subsidiaries	8 799	8 799	8 799	8 799	8 799	22 579	22 579	22 579	22 579	22 579
Adjusted R-squared	0,716	0,901	0,901	0,723	0,717	0,728	0,906	0,906	0,733	0,731
Subsidiary effects		√	√				√	√		
Year effects			√					√		
Industry-year effects				√					√	
Country-year effects					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 3, which is estimated with robust standard errors in specifications 1, 6, 11 and 16, and with OLS in the rest. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in table 1. Tax-rate uncertainty is defined by a three-year period of corporate tax rate stability. In columns (1) to (5) we include the normal sample (without considering TU); (6) to (10) we include countries with high TU; (11) to (15) we include countries with low TU, and (16) to (20) we consider the interaction with a high TU variable. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

evidence that legislation against these behaviours are indeed affecting its decrease (eg., Alexander et al., 2020). This can also be supported by the fact that we use affiliate level data, allowing to control for certain non-observable characteristics like the subsidiary effects, which we saw that really helps to improve the model's estimation.

We can observe stronger values of profit shifting under the TU samples compared to those of the normal sample, although, often this happens for high TU (and not under low TU, as argued by Delis et al., 2020). Nevertheless, and consistent with H1, it shows that if

TABLE 8 | Additional test: H. Huizinga and Laeven (2008) improved approach (with tax rate volatility).

	Normal					High TU				
Dependent variable: EBT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cost of employees	**0,203*** **	**0,214*** **	**0,240*** **	**0,214*** **	**0,183*** **	**0,219*** **	**0,293*** **	**0,259*** **	**0,236*** **	**0,215*** **
	(26,942)	(12,981)	(13,294)	(47,058)	(41,268)	(15,25)	(10,091)	(8,247)	(28,345)	(27,577)
Total assets	**0,785*** **	**0,638*** **	**0,651*** **	**0,776*** **	**0,787*** **	**0,761*** **	**0,583*** **	**0,562*** **	**0,745*** **	**0,762*** **
	(110,528)	(43,471)	(42,131)	(189,562)	(209,653)	(56,545)	(24,55)	(22,589)	(105,798)	(117,589)
UTD	**-1,245*** **	**-0,394** **	**-0,415** **	**-1,283*** **	**-0,629*** **	**0,028**	**-0,077**	**-0,226**	**0,014**	**-0,421** **
	(-11,736)	(-2,248)	(-2,369)	(-17,653)	(-5,223)	(0,167)	(-0,397)	(-1,115)	(0,114)	(-2,292)
UTD * High TV										
Leverage	**-1,059*** **	**-0,504*** **	**-0,516*** **	**-1,029*** **	**-1,139*** **	**-1,004*** **	**-0,3*** **	**-0,295*** **	**-0,947*** **	**-1,015*** **
	(-10,639)	(-15,295)	(-15,638)	(-46,7)	(-50,507)	(-3,548)	(-6,72)	(-6,608)	(-23,7)	(-25,449)
Observations	67 737	67 737	67 737	67 737	67 737	24 477	24 477	24 477	24 477	24 477
No Subsidiaries	22 579	22 579	22 579	22 579	22 579	8 159	8 159	8 159	8 159	8 159
Adjusted R-squared	0,728	0,906	0,906	0,733	0,731	0,704	0,900	0,900	0,709	0,705
	Low TU					**Interação**				
Dependent variable: EBT	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Cost of employees	**0,189*** **	**0,179*** **	**0,235*** **	**0,194*** **	**0,167*** **	**0,202*** **	**0,218*** **	**0,24*** **	**0,213*** **	**0,182*** **
	(21,846)	(8,902)	(10,65)	(35,38)	(30,989)	(26,84)	(13,194)	(13,291)	(46,761)	(41,205)
Total assets	**0,798*** **	**0,674*** **	**0,709*** **	**0,794*** **	**0,799*** **	**0,784*** **	**0,639*** **	**0,651*** **	**0,776*** **	**0,787*** **
	(99,712)	(36,119)	(35,965)	(157,227)	(172,975)	(110,542)	(43,566)	(42,13)	(189,554)	(209,612)
UTD	**-1,250*** **	**-1,607*** **	**-0,135**	**-1,291*** **	**-0,785*** **	**-1,735*** **	**-1,594*** **	**-0,413**	**-1,786*** **	**-0,789*** **
	(-6,922)	(-3,996)	(-0,309)	(-10,526)	(-4,9)	**(-9,835)**	**(-3,999)**	**(-0,98)**	**(-14,963)**	**(-4,917)**
UTD * High TV						**0,864*** **	**1,492*** **	**-0,002**	**0,886*** **	**0,367**
						(3,523)	(3,352)	(-0,005)	(5,31)	(1,505)
Leverage	**-1,128*** **	**-0,734*** **	**-0,767*** **	**-1,107*** **	**-1,197*** **	**-1,054*** **	**-0,505*** **	**-0,516*** **	**-1,025*** **	**-1,138*** **
	(-17,733)	(-15,207)	(-15,854)	(-41,592)	(-43,75)	(-10,624)	(-15,328)	(-15,638)	(-46,491)	(-50,418)
Observations	43 260	43 260	43 260	43 260	43 260	67 737	67 737	67 737	67 737	67 737
No Subsidiaries	14 420	14 420	14 420	14 420	14 420	22 579	22 579	22 579	22 579	22 579
Adjusted R-squared	0,741	0,909	0,909	0,746	0,743	0,728	0,906	0,906	0,733	0,731
Subsidiary effects		√	√				√	√		
Year effects			√					√		
Industry-year effects				√					√	
Country-year effects					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 3, which is estimated with robust standard errors in specifications 1, 6, 11 and 16, and with OLS in the rest. The observational units are multinational subsidiaries with a foreign parent firm. All variables are defined in table 1. Tax-rate uncertainty is defined by a three-year period of corporate tax rate volatility. In columns (1) to (5) we include the normal sample (without considering TV); (6) to (10) we include countries with high TV; (11) to (15) we include countries with low TV, and (16) to (20) we consider the interaction with a high TV variable. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the

we consider TU on the identification of PS, we can have a better perspective and find stronger evidence of such behaviours.

We could, however, reflect on how this concept is defined. How do we define uncertainty? In our case, by taking an approach based on the past 3-year period, we don't find relevant evidence of PS on countries with stable tax rates (low TU). We do that, however, by considering a 4-year period. The last setup demands more stabilization than in just 3 years, so, comparatively, a 4-year period may better represent if a country has more/less TU. Should therefore be defined a consensus period, i.e., a specific number of years to look

for (3, 4, 5, … years)? Additionally, Delis et al. (2020) used the Economic Policy Uncertainty Index (and we didn't because of data limitations), a forward-looking measure in which case they found even stronger evidence of PS. One could say that uncertainty may be defined based on the past, actual circumstances and what can we expect from the future. As such, maybe TU should be defined under a broader base (not just on the past, not just on future conditions).

Another thing that may affect the relevance of TU for PS behaviour is the existence of other driving forces. As we saw previously, there are many factors out there that affect companies tax planning strategies, and thus a linear interaction between these and PS behaviour may be misleading or incomplete. These other forces may also be in place as such that they affect the relevance of TU as significant driving force of PS. However, it is also true that we make an effort to control for such different, sometimes unobservable, forces with the help of fixed effects. Dharmapala and Riedel (2013) and Delis et al. (2020), in fact, simultaneously controlled for subsidiary, year, industry, or even country-pair-year effects. And this is where we fall apart. In our study, we couldn't simultaneously control for such effects, but just one at a time, which may affect the relevance of our results.

2. Tax-uncertainty and the adjustment of strategies

Table 9 reports the baseline results of estimating Model 3 in the same manner as Table 3 (regarding TU), where we test the second hypothesis for the cost-adjustment to lower cost PS strategies, like debt shifting.

Once again, we can see that those specifications who control for subsidiary effects are more effective, with a higher adjusted R-squared. In fact, those who don't consider them are pretty we weak, with an adjusted R-squared much lower than in previous studies (eg. Delis et al., 2020; Dharmapala & Riedel, 2013), in this case lower than 10% and sometimes even negative (i.e., the model fits worse than a horizontal mean value of the data). As such, we will only consider the subsidiary effect specifications.

The coefficient on the variable of interest (*EBTPS*Fraction)* is positive and significant in specifications 2, 3, 12 and 13 (these last two at the 1% level), but not in the high TU sample (specifications 7 and 8) - appointing to the use of debt shifting between MNE firms under low TU but not under high TU (contrary to what was expected and found by Delis et al., 2020). In additional estimations, on table 10, by considering the role of a parent's intangible fixed assets, the coefficient of interest is statistically significant and negative without considering TU (i.e., a lower level of parent leverage upon an earnings shock when the MNE group has a high number of low-taxed subsidiaries – the opposite of our reasoning) and insignificant when considering it. This irrelevance also holds true when looking for tax rate volatility (table 11). In the 4-year period (table 12), not only the model poorly fits the data (the maximum R-squared going up to 0.68 in specification 13), but evidence is also significant (at the 1% level) and negative on the normal and low TU sample, and not under high TU.

As such, the results are not consistent with our hypothesis, i.e., we don't observe the cost-adjustment to low-cost strategies of PS, in this case debt shifting, caused by higher uncertainty. In part, the negative results could even indicate that the use of this strategy is in decline, maybe being substituted by other strategies that we didn't account for (tax deferrals, etc.). Besides, although Dharmapala and Riedel (2013) argue that this empirical approach has a more emphasis to look for debt shifting between firms (because it limits transactions between companies of the same industry, where transfer pricing transactions are relevant), it is nonetheless an indirect approach (considering the data limitations) to infer for such

TABLE 9 | Baseline results: 3-year period, 2016 - 2018.

	Normal					High TU					Low TU				
Dep. variable: Parent leverage	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,021*** **	**-0,039*** **	**-0,039*** **	**0,014** **	**0,018*** **	**0,024** **	**-0,020**	**-0,011**	**0,019** **	**0,028*** **	**0,005**	**-0,055*** **	**-0,058*** **	**-0,007**	**-0,001**
	(2,802)	(-3,537)	(-3,381)	(2,407)	(3,905)	(2,475)	(-1,182)	(-0,589)	(2,059)	(4,657)	(0,479)	(-3,755)	(-3,893)	(-0,681)	(-0,153)
EBTPS	**-0,017** **	**-0,012** **	**-0,011** **	**-0,011** **	**-0,018*** **	**-0,02** **	**-0,001**	**-0,001**	**-0,019** **	**-0,028*** **	**-0,002**	**-0,013***	**-0,014***	**0,009**	**0,002**
	(-2,244)	(-2,096)	(-2,013)	(-2,078)	(-3,785)	(-1,992)	(-0,117)	(-0,132)	(-2,08)	(-4,607)	(-0,163)	(-1,83)	(-1,882)	(0,897)	(0,303)
EBTPS*Fraction of LT Subs.	**0,008**	**0,009***	**0,009***	**0,007** **	**0,008*** **	**0,007**	**-0,009**	**-0,009**	**0,008***	**0,011*** **	**0,006**	**0,027*** **	**0,027*** **	**0,003**	**0,001**
	(1,388)	(1,952)	(1,951)	(2,361)	(2,657)	(0,832)	(-1,199)	(-1,25)	(1,657)	(2,715)	(0,51)	(4,224)	(4,272)	(0,536)	(0,143)
Fraction of LT Subs.	**-0,040**	**-0,104**	**-0,101** **	**-0,030**	**-0,037**	**-0,063**	**0,058**	**0,057**	**-0,065**	**-0,066***	**0,020**	**-0,255*** **	**-0,261*** **	**0,053**	**0,038**
	(-0,7)	(-2,428)	(-2,36)	(-1,045)	(-1,291)	(-0,841)	(0,878)	(0,859)	(-1,601)	(-1,779)	(0,183)	(-4,431)	(-4,515)	(0,923)	(0,682)
Population	**-0,01***	**0,470**	**0,114**	**-0,011*** **		**0,001**	**1,569** **	**1,655***	**0,001**		**-0,015** **	**0,092**	**-0,714**	**-0,016*** **	
	(-1,824)	(1,334)	(0,25)	(-2,932)		(0,094)	(2,254)	(1,867)	(0,107)		(-2,006)	(0,23)	(-1,078)	(-3,144)	
GDPpc	**-0,022**	**0,016**	**-0,085**	**-0,024** **		**-0,007**	**0,013**	**-0,016**	**-0,017**		**-0,027**	**0,012**	**-0,146**	**-0,018**	
	(-0,781)	(0,48)	(-1,026)	(-1,992)		(-0,216)	(0,249)	(-0,1)	(-0,727)		(-0,701)	(0,297)	(-1,294)	(-1,159)	
Observations	3 738	3 738	3 738	3 738	3 738	1 827	1 827	1 827	1 827	1 827	1 911	1 911	1 911	1 911	1 911
No Parents	1 246	1 246	1 246	1 246	1 246	609	609	609	609	609	637	637	637	637	637
Adjusted R-squared	0,018	0,844	0,844	0,031	0,051	0,011	0,827	0,827	-0,022	0,046	0,036	0,864	0,864	0,076	0,058
Parent effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 3, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational parent firms. The dependent variable is parent leverage, logarithm of EBTPS*Fraction is the variable of interest; all variables are defined in table 1. In columns (1) to (5) we include the normal sample (without considering TU); in columns (6) to (10) we include countries with high TU, and in columns (11) to (15) we include countries with low TU. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TABLE 10 | Additional tests: intangible property.

	Normal					High TU					Low TU				
Dep. variable: Parent leverage	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,001**	**-0,004**	**0,001**	**-0,010**	**-0,005**	**0,000****	**-0,04****	**-0,031**	**-0,002**	**0,002**	**-0,005**	**0,024***	**0,029****	**-0,019***	**-0,014***
	(0,132)	(-0,356)	(0,106)	(-1,597)	(-0,917)	(0,042)	(-1,83)	(-1,367)	(-0,187)	(0,276)	(-0,44)	(1,696)	(2,056)	(-1,896)	(-1,743)
EBTPS	**-0,015****	**0,000**	**0,001**	**-0,01***	**-0,013*****	**-0,018**	**0,001**	**0,002**	**-0,025****	**-0,019*****	**-0,008**	**-0,002**	**0,000**	**0,000**	**-0,004**
	(-2,031)	(-0,033)	(0,094)	(-1,816)	(-2,64)	(-1,604)	(0,137)	(0,161)	(-2,417)	(-2,718)	(-0,862)	(-0,256)	(0,003)	(-0,041)	(-0,547)
EBTPS*Fraction of LT Subs.	**0,005**	**-0,011****	**-0,011****	**0,005**	**0,006**	**0,005**	**-0,011**	**-0,011**	**0,005**	**0,008**	**0,006**	**-0,005**	**-0,004**	**0,008**	**-0,002**
	(0,719)	(-2,127)	(-2,125)	(1,333)	(1,573)	(0,52)	(-1,309)	(-1,319)	(0,929)	(1,57)	(0,533)	(-0,7)	(-0,658)	(1,14)	(-0,308)
Fraction of LT Subs.	**-0,006**	**0,103****	**0,103****	**-0,006**	**-0,025**	**-0,039**	**0,085**	**0,081**	**-0,043**	**-0,039**	**0,006**	**0,053**	**0,055**	**-0,005**	**0,037**
	(-0,094)	(2,106)	(2,108)	(-0,187)	(-0,738)	(-0,435)	(1,112)	(1,053)	(-0,801)	(-0,81)	(0,052)	(0,827)	(0,85)	(-0,086)	(0,6)
Population	**-0,013****	**0,044**	**0,043**	**-0,015*****		**-0,014**	**1,996****	**2,379****	**-0,019*****		**-0,010**	**-0,766****	**-0,749**	**-0,011****	
	(-2,152)	(0,127)	(0,093)	(-3,959)		(-1,199)	(2,556)	(2,369)	(-2,614)		(-1,349)	(-2,248)	(-1,256)	(-2,107)	
GDPpc	**-0,045**	**0,009**	**-0,009**	**-0,053*****		**-0,037**	**0,049**	**0,116**	**-0,058****		**-0,039**	**-0,012**	**-0,018**	**-0,034****	
	(-1,294)	(0,27)	(-0,105)	(-4,236)		(-0,876)	(0,799)	(0,637)	(-2,295)		(-0,855)	(-0,334)	(-0,178)	(-2,118)	
Intangibles	**0,016*****	**0,009*****	**0,009*****	**0,019*****	**0,016*****	**0,017*****	**0,012****	**0,012****	**0,023*****	**0,015*****	**0,015*****	**0,005**	**0,005**	**0,017*****	**0,016*****
	(5,365)	(2,84)	(2,738)	(10,43)	(8,773)	(4,298)	(2,23)	(2,205)	(7,987)	(5,913)	(2,905)	(1,484)	(1,393)	(6,456)	(6,249)
Observations	3 225	3 225	3 225	3 225	3 225	1 494	1 494	1 494	1 494	1 494	1 731	1 731	1 731	1 731	1 731
No Parents	1 075	1 075	1 075	1 075	1 075	498	498	498	498	498	577	577	577	577	577
Adjusted R-squared	0,046	0,850	0,850	0,084	0,084	0,039	0,798	0,798	0,033	0,069	0,049	0,902	0,902	0,112	0,090
Parent effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 3, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational parent firms. The dependent variable is parent leverage, logarithm of EBTPS*Fraction is the variable of interest; all variables are defined in table 1. In columns (1) to (5) we include the normal sample (without considering TU); in columns (6) to (10) we include countries with high TU, and in columns (11) to (15) we include countries with low TU. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TABLE 11 | Additional tests: tax rate volatility.

	Normal					High TU					Low TU				
Dep. variable: Parent leverage	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,021*** **	**-0,039*** **	**-0,039*** **	**0,014** **	**0,018*** **	**0,025** **	**0,077*** **	**0,098*** **	**0,032*** **	**0,026*** **	**0,024** **	**-0,084*** **	**-0,088*** **	**0,015***	**0,012***
	(2,802)	(-3,537)	(-3,381)	(2,407)	(3,905)	(2,559)	(5,691)	(6,794)	(3,589)	(4,315)	(2,433)	(-5,5)	(-5,642)	(1,761)	(1,669)
EBTPS	**-0,017** **	**-0,012** **	**-0,011** **	**-0,011** **	**-0,018*** **	**-0,025** **	**-0,004**	**-0,004**	**-0,03*** **	**-0,021*** **	**-0,02** **	**-0,012**	**-0,011**	**-0,014***	**-0,011**
	(-2,244)	(-2,096)	(-2,013)	(-2,078)	(-3,785)	(-2,154)	(-0,59)	(-0,639)	(-3,453)	(-3,327)	(-2,125)	(-1,503)	(-1,469)	(-1,647)	(-1,569)
EBTPS*Fraction of LT Subs.	**0,008**	**0,009***	**0,009***	**0,007** **	**0,008*** **	**0,013**	**-0,002**	**-0,002**	**0,01***	**0,01***	**0,004**	**0,011**	**0,012**	**0,000**	**-0,005**
	(1,388)	(1,952)	(1,951)	(2,361)	(2,657)	(1,335)	(-0,326)	(-0,505)	(1,859)	(1,944)	(0,309)	(1,465)	(1,584)	(0,036)	(-0,987)
Fraction of LT Subs.	**-0,040**	**-0,104**	**-0,101** **	**-0,030**	**-0,037**	**-0,090**	**0,013**	**0,014**	**-0,066**	**-0,063**	**0,042**	**-0,122***	**-0,131***	**0,087***	**0,102** **
	(-0,7)	(-2,428)	(-2,36)	(-1,045)	(-1,291)	(-1,024)	(0,305)	(0,321)	(-1,49)	(-1,538)	(0,307)	(-1,774)	(-1,898)	(1,677)	(1,975)
Population	**-0,01***	**0,470**	**0,114**	**-0,011*** **		**-0,023** **	**1,291** **	**1,455** **	**-0,025*** **		**-0,001**	**0,743**	**-0,381**	**-0,002**	
	(-1,824)	(1,334)	(0,25)	(-2,932)		(-1,979)	(2,093)	(2,368)	(-3,801)		(-0,17)	(1,61)	(-0,494)	(-0,326)	
GDPpc	**-0,022**	**0,016**	**-0,085**	**-0,024** **		**-0,093** **	**-0,136*** **	**-0,168**	**-0,109*** **		**0,000**	**0,046**	**-0,122**	**0,005**	
	(-0,781)	(0,48)	(-1,026)	(-1,992)		(-2,162)	(-3,802)	(-0,794)	(-4,358)		(-0,005)	(0,933)	(-1,133)	(0,341)	
Observations	3 738	3 738	3 738	3 738	3 738	1 410	1 410	1 410	1 410	1 410	2 328	2 328	2 328	2 328	2 328
No Parents	1 246	1 246	1 246	1 246	1 246	470	470	470	470	470	776	776	776	776	776
Adjusted R-squared	0,018	0,844	0,844	0,031	0,051	0,030	0,919	0,921	0,022	0,045	0,027	0,815	0,815	0,052	0,058
Parent effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 3, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational parent firms. The dependent variable is parent leverage, logarithm of EBTPS*Fraction is the variable of interest; all variables are defined in table 1. In columns (1) to (5) we include the normal sample (without considering tax rate volatility); in columns (6) to (10) we include countries with high TV, and in columns (11) to (15) we include countries with low TV. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TABLE 12 | Additional tests: 4-year period, 2015 - 2018.

	Normal					High TU					Low TU				
Dep. variable: Parent leverage	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Assets	**0,010**	**-0,275*** **	**-0,283*** **	**0,002**	**0,008**	**0,009**	**-0,306*** **	**-0,316*** **	**0,011**	**0,014** **	**-0,007**	**-0,248*** **	**-0,253*** **	**-0,025***	**-0,016**
	(0,913)	(-15,204)	(-15,323)	(0,259)	(1,394)	(0,675)	(-11,197)	(-11,204)	(1,157)	(2,106)	(-0,537)	(-11,821)	(-12,086)	(-1,928)	(-1,504)
EBTPS	**-0,007**	**0,012**	**0,013**	**-0,002**	**-0,01***	**-0,008**	**0,004**	**0,005**	**-0,011**	**-0,018*** **	**0,010**	**0,021**	**0,021**	**0,026** **	**0,015**
	(-0,694)	(1,204)	(1,251)	(-0,234)	(-1,766)	(-0,607)	(0,296)	(0,353)	(-1,223)	(-2,647)	(0,725)	(1,623)	(1,606)	(2,023)	(1,428)
EBTPS*Fraction of LT Subs.	**0,003**	**-0,03*** **	**-0,029*** **	**0,003**	**0,003**	**0,000**	**-0,016**	**-0,016**	**-0,001**	**0,006**	**0,012**	**-0,052*** **	**-0,054*** **	**0,018** **	**0,004**
	(0,465)	(-3,064)	(-3,036)	(0,849)	(0,898)	(0,011)	(-1,265)	(-1,205)	(-0,11)	(1,233)	(0,798)	(-3,132)	(-3,237)	(1,964)	(0,471)
Fraction of LT Subs.	**0,004**	**0,205** **	**0,202** **	**0,009**	**0,012**	**0,001**	**0,116**	**0,108**	**0,010**	**-0,006**	**-0,021**	**0,365** **	**0,369** **	**-0,071**	**0,000**
	(0,051)	(2,363)	(2,326)	(0,259)	(0,36)	(0,012)	(1,035)	(0,971)	(0,23)	(-0,139)	(-0,156)	(2,137)	(2,167)	(-0,839)	(0,003)
Population	**-0,009**	**1,048** **	**1,134***	**-0,01** **		**0,007**	**1,408**	**2,058**	**0,005**		**-0,016**	**1,63*** **	**1,743***	**-0,017*** **	
	(-1,397)	(2,084)	(1,672)	(-2,128)		(0,601)	(1,464)	(1,483)	(0,71)		(-1,614)	(3,23)	(1,875)	(-2,732)	
GDPpc	**-0,036**	**0,33*** **	**0,315*** **	**-0,03** **		**0,015**	**0,505*** **	**0,617*** **	**0,018**		**-0,063**	**0,076**	**-0,019**	**-0,054*** **	
	(-0,86)	(5,509)	(2,772)	(-2,117)		(0,388)	(5,857)	(3,565)	(0,767)		(-0,814)	(1,021)	(-0,098)	(-2,773)	
Observations	4 984	4 984	4 984	4 984	4 984	3 024	3 024	3 024	3 024	3 024	1 960	1 960	1 960	1 960	1 960
No Parents	1 246	1 246	1 246	1 246	1 246	756	756	756	756	756	490	490	490	490	490
Adjusted R-squared	0,005	0,504	0,505	0,030	0,042	-0,001	0,415	0,415	0,026	0,014	0,030	0,681	0,684	0,110	0,099
Parent effects		√	√				√	√				√	√		
Year effects			√					√					√		
Industry-year effects				√					√					√	
Country-year effects					√					√					√

Notes: The table reports coefficient estimates and t-statistics (in parentheses) from Model 3, which is estimated with robust standard errors in specifications 1, 6 and 11, and with OLS in the rest. The observational units are multinational parent firms. The dependent variable is parent leverage, logarithm of EBTPS*Fraction is the variable of interest; all variables are defined in table 1. In columns (1) to (5) we include the normal sample (without considering TU); in columns (6) to (10) we include countries with high TU, and in columns (11) to (15) we include countries with low TU. The lower part of this table indicates the type of fixed effects used in each specification. Year (industry-year) effects indicate a full set of year fixed effects (industry-year fixed effects at the four-digit Nace Rev. 2 level). Country-year effects represent a full set of country-year fixed effects for the affiliate's country. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

behaviours, and therefore we can't say for sure that intra-firm debt shifting didn't occur in that period. On the other hand, the growing combat against tax-motivated profit shifting at the international level, and by specifically implementing certain measures (like thin capitalization rules), may have a deterring effect on the use of specific PS strategies by MNE firms (Marques & Pinho, 2016).

6. Conclusion

In order to pursue a value maximizing strategy, companies can take several paths, some of which are not legitimate. One of them is called tax evasion, usually where entities explore gaps and mismatches on international tax rules as a way to avoid paying taxes, and this has serious economic consequences. There has been a great effort to tackle this situation, either in practice (with the G20 BEPS program – who's objective is of improving the coherence of international tax rules and to reach a more transparent tax environment), as well as in research. Some of the great pioneers on the last are Hines and Rice (1994), in which they developed a new empirical model to identify tax-motivated profit shifting. Eventually, several models have risen to also contribute in this matter (eg. Dharmapala & Riedel, 2013). However, some studies argue that, in more recent datasets, one doesn't find relevant PS, either because of data or model limitations, or because of the recent tendency of the decline of these behaviours (eg. Schimanski, 2017; Martins, 2018). On the other hand, there has been a growing focus on the driving forces of PS, for example tax rate uncertainty, which was argued to be one of the causes for the heterogeneity of PS found in different countries. If we consider these, one could enhance the identification of these behaviours.

As such, we build on the work of Delis et al. (2020), arguing that when we try to identify for PS behaviour one should consider its driving forces – in our case tax rate uncertainty. For that, we use a large dataset of MNEs located throughout Europe and H. Huizinga and Laeven (2008) and Dharmapala and Riedel (2013)'s approaches, in which the last analyses how an earnings shock on the parent-firm affects its subsidiaries located in different industries and jurisdictions.

Either differentiating for TU or not in subsidiary countries, even nowadays we find significant evidence of PS (unlike certain previous works). More specifically, if we don't consider TU, we observe that a 10% increase in parent profits leads to a 0.1 - 0.3% increase in earnings before taxes for low TU affiliates. But if we consider TU, we observe both in high and low TU samples increases of more than 0.3% in earnings, in which case it goes much higher under more stable tax rates (during a 4-year period) and also in the additional test with H. Huizinga and Laeven (2008)'s approach. Although somewhat contrary to what we expected (between high and low TU), overall, the results appoint to the importance of considering tax rate uncertainty as a driving of PS when we try to identify these behaviours. In contrast, we find that debt shifting related to intragroup loans shows no extended significant evidence under high tax uncertainty, i.e., we don't observe a shift from more costly

strategies towards others that are cheaper (like debt shifting), the cost-adjustment mechanism. Quite the contrary, some results appoint to a decrease of the use of such strategy, which is in fact consistent with the recent effort against PS behaviour and the implementation of countermeasures, like thin capitalization rules.

Some limitations of this investigation should be considered. First, despite our effort to include more countries to our data sample than in previous works (eg. Dharmapala & Riedel, 2013 only accounted for 25 European countries), we could only account for (32) European based firms because of restricted data access. Even though Europe is a very heterogeneous field of tax frameworks and thus suited to observe some tax planning behaviours (like we, Dharmapala and Riedel (2013) and H. Huizinga and Laeven (2008) observed), many of these transactions are not being considered. Ideally, it should be considered the global setting, as we are not taking into account big countries that are home to many MNE (eg. USA, Japan, Brasil, etc.) as well as various tax havens (favourable locations to shift profits) located throughout the world (eg. Bahamas, Panama, etc.). One can observe such consequence in Delis et al. (2020), with an extended sample of 54 countries, and in fact they find stronger magnitudes of PS. Second, the literature appoints to the importance of considering the various fixed effects when estimating PS. Unlike Dharmapala and Riedel (2013) and Delis et al. (2020), we weren't able to simultaneously estimate with all fixed effects because of technical issues, and this may have affected our results. Nevertheless, the results are more conservative than those found in previous studies.

As a result, we can definitely appoint some directions for future research. First, and given the mixed results for tax rate uncertainty, perhaps we should define how to measure this concept, i.e., the length of the period, as well as to consider a broader base (one that accounts for the past, the present, as well as future conditions). Second, since that there are many different empirical models to identify for PS (each with its own assumptions), future research could consider other models that we didn't use (eg. Dyreng and Markle, 2016), as a way to complement the search for PS behaviours. Third, there are many other strategies that MNE firms can use to pay less taxes that we also didn't consider in this test (eg. tax deferrals), and so, future investigations could also seek in this respect. Finally, the literature appoints to the existence of many driving forces of PS. Until now they have been considered separately, and indeed have helped to find relevant evidence of PS behaviours. But there may be some interconnection between them, as firms consider the various tax benefits/costs of engaging in tax planning, and therefore, we propose a broader investigation which considers eventual relationship between the driving forces of profit shifting.

Appendix

TABLE A1	Number of parent and subsidiary firms per country			
Country	**Subsidiary**	**Parent**	**Subsidiary/Parent**	**Total number of firms**
Austria	170	544	0,31	714
Belgium	2 199	334	6,58	2 533
Bulgaria	1 057	33	32,03	1 090
Switzerland	8	719	0,01	727
Cyprus	1	189	0,01	190
Czech Republic	1 672	346	4,83	2 018
Germany	1 714	1 545	1,11	3 259
Denmark	331	219	1,51	550
Estonia	155	12	12,92	167
Spain	1 972	371	5,32	2 343
Finland	214	139	1,54	353
France	1 819	734	2,48	2 553
United Kingdom	1 781	795	2,24	2 576
Greece	1	111	0,01	112
Croatia	577	27	21,37	604
Hungary	482	84	5,74	566
Ireland	188	189	0,99	377
Italy	3 608	829	4,35	4 437
Lithuania	3	28	0,11	31
Luxembourg	16	609	0,03	625
Latvia	35	15	2,33	50
Malta	1	36	0,03	37
Netherlands	8	706	0,01	714
Norway	938	147	6,38	1 085
Poland	83	102	0,81	185
Portugal	704	90	7,82	794
Romania	823	90	9,14	913
Russia	3	60	0,05	63
Sweden	395	395	1,00	790
Slovenia	158	84	1,88	242
Slovak Republic	1 462	110	13,29	1 572
Turkey	1	100	0,01	101
Total	**22 579**	**9 792**	**2,31**	**32 371**

TABLE A2	Summary statistics of the main variables between high and low TU countries					
High TU Countries Period: 2015 -2018	**No. Observations**	**Mean**	**Median**	**Std. Dev.**	**Minimum**	**Maximum**
Dependent variable						
Earnings before taxes	13 892	9 864,8	1 102,0	67 939,2	1,0	4 023 075,0
Explanatory variables						
Total assets	13 892	142 604,0	12 079,0	1 029 956,7	46,0	33 348 493,0
Parent earnings before taxes and profit shifting	13 892	654 174,6	62 646,5	2 150 298,6	0,1	55 630 726,5
Low-tax subsidiary	13 892	0,34	0,00	0,47	0,00	1,00
Financial leverage	13 892	0,10	0,00	0,22	-0,01	14,06
Population	13 892	36 910,7	46 484,1	26 133,6	1 927,2	66 965,9
GDP per capita	13 892	36,631	34,616	15,267	11,782	81,734
Intangible fixed assets	4 848	15 519,7	154,0	154 979,3	1,0	5 588 369,0
Low TU Countries Period: 2015 -2018	**No. Observations**	**Mean**	**Median**	**Std. Dev.**	**Minimum**	**Maximum**
Dependent variable						
Earnings before taxes	5 128	11 313,5	1 698,0	84 077,0	1,0	3 126 804,0
Explanatory variables						
Total assets	5 128	107 595,0	16 219,0	565 255,3	37,0	12 004 748,0
Parent earnings before taxes and profit shifting	5 128	723 211,3	77 447,0	2 268 719,7	0,2	55 630 726,5
Low-tax subsidiary	5 128	0,76	1,00	0,43	0,00	1,00
Financial leverage	5 128	0,08	0,00	0,17	0,00	1,98
Population	5 128	31 815,9	10 594,4	33 045,6	1 315,4	144 496,7
GDP per capita	5 128	31,471	41,087	17,530	7,056	82,818
Intangible fixed assets	3 531	11 987,1	108,0	149 979,9	1,0	5 633 783,0

Notes: The monetary units are thousands of US dollars, and population is in thousands of individuals.

TABLE A3	**Correlation matrix**														
Period: 2016-2018	***EBT***	***Assets***	***EBTPS***	***Dummy***	***Fin. Leverage***	***Population***	***GDPpc***	***Intangibles***	***PL***	***Parent Assets***	***Fraction***	***Parent Population***	***Parent GDPpc***	***Parent intangibles***	***Labor***	***UTD***
EBT	1															
Assets	0,7585876	1														
EBTPS	0,2779034	0,3118404	1													
Dummy	0,026226	0,0321914	-0,005376	1												
Fin. Leverage	0,0846942	0,1103247	-0,007777	0,0635018	1											
Population	0,0804147	0,0874267	0,0893692	0,0409771	0,0194559	1										
GDPpc	0,0489022	0,0538159	0,0333844	-0,130463	-0,032787	0,098384641	1									
Intangibles	0,5570652	0,5523068	0,3468951	0,0151907	0,052756	0,067210288	0,0379378	1								
PL	0,1281127	0,1694666	0,0295212	0,093486	0,1620456	-0,01684024	0,0229838	0,131158855	1							
Parent Assets	0,2133734	0,2571017	0,5598925	-0,035125	-0,020151	0,076116676	0,017864	0,211899015	0,0037872	1						
Fraction	0,0174248	0,0190888	-0,001906	0,9151855	0,0487537	-0,007380609	-0,149453	0,036587751	0,0852822	-0,03416305	1					
Parent Population	0,0773851	0,0816017	0,0666952	-0,088908	-0,015303	0,109137703	-0,177049	0,046509601	-0,038029	0,08711334	-0,108829	1				
Parent GDPpc	-0,015994	-0,034162	0,0039572	-0,101789	-0,030266	0,007425283	0,3491869	-0,013175929	-0,019666	-0,00281975	-0,102216	-0,2752846	1			
Parent intangibles	0,3412088	0,3345483	0,6387092	0,0114769	0,0133063	0,103394604	0,0397628	0,573128116	0,0745856	0,38297028	0,0191423	0,048043508	0,0153773	1		
Labor	0,4382231	0,4665196	0,2008213	0,0405924	0,007345	0,142368452	0,0914445	0,402840955	0,1058316	0,14790935	0,0228932	0,017524039	0,0423916	0,237091119	1	
UTD	-0,02767	-0,016428	-0,021196	-0,68294	-0,068655	0,069050569	0,1071635	-0,002393023	-0,063813	0,00045192	-0,528914	0,071346856	0,0862423	-0,00830498	-0,026065	1

TABLE A4 | Sample countries, their statutory tax rate and according tax rate uncertainty (4-year period).

País	2015	2016	2017	2018	Tax rate uncertainty
Austria	25,0%	25,0%	25,0%	25,0%	
Bulgaria	10,0%	10,0%	10,0%	10,0%	
Cyprus	12,5%	12,5%	12,5%	12,5%	
Czech Republic	19,0%	19,0%	19,0%	19,0%	
Estonia	20,0%	20,0%	20,0%	20,0%	
Finland	20,0%	20,0%	20,0%	20,0%	
Germany	15,8%	15,8%	15,8%	15,8%	
Greece	29,0%	29,0%	29,0%	29,0%	
Ireland	12,5%	12,5%	12,5%	12,5%	Low
Lithuania	15,0%	15,0%	15,0%	15,0%	
Malta	35,0%	35,0%	35,0%	35,0%	
Netherlands	25,0%	25,0%	25,0%	25,0%	
Poland	19,0%	19,0%	19,0%	19,0%	
Romania	16,0%	16,0%	16,0%	16,0%	
Russia	20,0%	20,0%	20,0%	20,0%	
Sweden	22,0%	22,0%	22,0%	22,0%	
Switzerland	8,5%	8,5%	8,5%	8,5%	
Belgium	33,0%	33,0%	33,0%	29,0%	
Croatia	20,0%	20,0%	18,0%	18,0%	
Denmark	23,5%	22,0%	22,0%	22,0%	
France	38,0%	34,4%	44,4%	34,4%	
Hungary	19,0%	19,0%	9,0%	9,0%	
Italy	27,5%	27,5%	24,0%	24,0%	
Latvia	15,0%	15,0%	15,0%	20,0%	
Luxembourg	22,5%	22,5%	20,3%	19,3%	High
Norway	27,0%	25,0%	24,0%	23,0%	
Portugal	28,0%	28,0%	28,0%	30,0%	
Slovak Republic	22,0%	22,0%	21,0%	21,0%	
Slovenia	17,0%	17,0%	19,0%	19,0%	
Spain	28,0%	25,0%	25,0%	25,0%	
Turkey	20,0%	20,0%	20,0%	22,0%	
United Kingdom	20,0%	20,0%	19,0%	19,0%	

Notes: We define a country of high (low) tax rate uncertainty if during the given period it changed (didn't change) its STR.

References

Alexander, A., De Vito, A., & Jacob, M. (2020). Corporate tax reforms and tax-motivated profit shifting: evidence from the EU. *Accounting and Business Research, 50*(4), 309-341. doi:10.1080/00014788.2020.1712649

Beer, S., de Mooij, R., & Liu, L. (2020). International Corporate Tax Avoidance: A Review of the Channels, Magnitudes, and Blind Spots. *Journal of Economic Surveys, 34*(3), 660-688. doi:10.1111/joes.12305

Bertrand, M., Mehta, P., & Mullainathan, S. (2002). Ferreting out tunneling: An application to Indian business groups. *Quarterly Journal of Economics, 117*(1), 121-148. doi:Doi 10.1162/003355302753399463

Blouin, J., Huizinga, H., Laeven, L., & Nicodème, G. (2014). *Thin capitalization rules and multinational firm's capital structure.* Retrieved from CESifo: https://ideas.repec.org/p/ces/ceswps/_4695.html

Collins, J., Kemsley, D., & Lang, M. (1998). Cross-Jurisdictional Income Shifting and Earnings Valuation. *Journal of Accounting Research, 36*(2), 209-229. doi:10.2307/2491475

Davies, R. B., Martin, J., Parenti, M., & Toubal, F. (2018). Knocking on Tax Haven's Door: Multinational Firms and Transfer Pricing. *The Review of Economics and Statistics, 100*(1), 120-134. doi:10.1162/REST_a_00673

Delis, M. D., Hasan, I., & Karavitis, P. I. (2020). Profit shifting and tax-rate uncertainty. *Journal of Business Finance & Accounting, 47*(5-6), 645-676. doi:https://doi.org/10.1111/jbfa.12429

Devereux, M. (2007). The Impact of Taxation on the Location of Capital, Firms and Profit: A Survey of Empirical Evidence.

Dharmapala, D. (2014). What Do We Know about Base Erosion and Profit Shifting? A Review of the Empirical Literature. *Fiscal Studies, 35*(4), 421-448. doi:10.1111/j.1475-5890.2014.12037.x

Dharmapala, D., & Riedel, N. (2013). Earnings shocks and tax-motivated income-shifting: Evidence from European multinationals. *Journal of Public Economics, 97*, 95-107. doi:10.1016/j.jpubeco.2012.08.004

Dudar, O., Nicolay, K., & Nusser, H. (2016). On the interdependency of profit-shifting channels and the effectiveness of anti-avoidance legislation. *Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association, 109*, 1-17. doi:10.2307/26816544

Dudar, O., & Voget, J. (2016). *Corporate taxation and location of intangible assets: Patents vs. trademarks*. Retrieved from ZEW - Leibniz Centre for European Economic Research: https://ideas.repec.org/p/zbw/zewdip/16015.html

Dyreng, S. D., & Markle, K. S. (2016). The effect of financial constraints on income shifting by U.S. multinationals. *Accounting Review, 91*(6), 1601-1627. doi:10.2308/accr-51420

Hasegawa, M., & Kiyota, K. (2017). The effect of moving to a territorial tax system on profit repatriation: Evidence from Japan. *Journal of Public Economics, 153*, 92-110. doi:https://doi.org/10.1016/j.jpubeco.2017.06.010

Heckemeyer, J. H., & Overesch, M. (2017). Multinationals' profit response to tax differentials: Effect size and shifting channels. *Canadian Journal of Economics-Revue Canadienne D Economique, 50*(4), 965-994. doi:10.1111/caje.12283

Hines, J. R., & Rice, E. M. (1994). Fiscal Paradise: Foreign Tax Havens and American Business. *The Quarterly Journal of Economics, 109*(1), 149-182. doi:10.2307/2118431

Hopland, A. O., Lisowsky, P., Mardan, M., & Schindler, D. (2018). Flexibility in income shifting under losses. *Accounting Review, 93*(3), 163-183. doi:10.2308/accr-51907

Huizinga, H., & Laeven, L. (2008). International profit shifting within multinationals: A multi-country perspective. *Journal of Public Economics, 92*(5-6), 1164-1182. doi:10.1016/j.jpubeco.2007.11.002

Huizinga, H., Laeven, L., & Nicodeme, G. (2008). Capital structure and international debt shifting. *Journal of Financial Economics, 88*(1), 80-118. doi:https://doi.org/10.1016/j.jfineco.2007.05.006

Karkinsky, T., & Riedel, N. (2012). Corporate taxation and the choice of patent location within multinational firms. *Journal of International Economics, 88*(1), 176-185. doi:10.1016/j.jinteco.2012.04.002

Klassen, K. J., & Laplante, S. K. (2012). Are U.S. Multinational Corporations Becoming More Aggressive Income Shifters? *Journal of Accounting Research, 50*(5), 1245-1285. doi:10.1111/j.1475-679X.2012.00463.x

Klassen, K. J., Lisowsky, P., & Mescall, D. (2017). Transfer Pricing: Strategies, Practices, and Tax Minimization. *Contemporary Accounting Research, 34*(1), 455-493. doi:https://doi.org/10.1111/1911-3846.12239

Markle, K. (2016). A Comparison of the Tax-Motivated Income Shifting of Multinationals in Territorial and Worldwide Countries. *Contemporary Accounting Research, 33*(1), 7-43. doi:10.1111/1911-3846.12148

Marques, M., & Pinho, C. (2016). Is transfer pricing strictness deterring profit shifting within multinationals? Empirical evidence from Europe. *Accounting and Business Research, 46*(7), 703-730. doi:10.1080/00014788.2015.1135782

Martins, J. (2018). *O Profit-shifting de Multinacionais no Contexto da UE-28*.

Masulis, R. W., Wang, C., & Xie, F. (2012). Globalizing the boardroom-The effects of foreign directors on corporate governance and firm performance. *Journal of Accounting and Economics, 53*(3), 527-554. doi:10.1016/j.jacceco.2011.12.003

McGuire, S. T., Omer, T. C., & Wang, D. (2012). Tax avoidance: Does tax-specific industry expertise make a difference? *Accounting Review, 87*(3), 975-1003. doi:10.2308/accr-10215

Saunders-Scott, M. J. (2015). Substitution across methods of profit shifting. *National Tax Journal, 68*(4), 1099-1120. doi:10.17310/ntj.2015.4.09

Schimanski, C. (2017). 'Earnings shocks and tax-motivated income-shifting: evidence from European multinationals' – revisited. *Applied Economics Letters, 24*(21), 1558-1566. doi:10.1080/13504851.2017.1327117

Sugathan, A., & George, R. (2015). The influence of governance infrastructure and corporate governance on profit shifting. *Journal of International Business Studies, 46*(8), 886-916. doi:10.1057/jibs.2015.23

Tørsløv, T. R., Wier, L. S., & Zucman, G. (2018). The Missing Profits of Nations. *National Bureau of Economic Research Working Paper Series, No. 24701*. doi:10.3386/w24701

FACULDADE DE **ECONOMIA**