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A reexamination of investors' reaction to tax shelter news: Evidence from the Luxembourg tax leaks

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ABSTRACT

This study examines the stock market reaction to the unprecedented leaks of confidential advance tax rulings between Luxembourg and multinational corporations—also known as the "LuxLeaks." Contrary to the negative market reaction to tax shelter news documented in prior research, we find that investors responded positively to these leaks. This reaction is concentrated among U.S. firms. Furthermore, we document a positive association between abnormal returns and the reduction in firms' tax uncertainty, consistent with a downward revision in investors' perception of the tax uncertainty associated with the firms' Luxembourg operations. We also investigate other firm characteristics and find that, among U.S. firms, investors' reaction is weaker for those over-invested in tax avoidance. Among non-U.S. firms, the market response is muted by concerns about the quality of governance. In summary, our results suggest that investors' reaction to tax shelter news is conditional on their reassessment of the firms' tax uncertainty.

1. Introduction

The International Consortium of Investigative Journalists (ICIJ) released hundreds of confidential advance tax rulings (ATRs) between the Luxembourg tax authority and over 350 multinational firms in 2014.[1] This event, commonly referred to as the LuxLeaks, provided investors, governments, and the public with a rare insight into the sophisticated arrangements that multinational corporations use to engage in cross-border tax avoidance. They also present researchers with a unique opportunity to revisit the literature on investors' valuation of firms' tax avoidance and management of the associated tax uncertainty.

Prior literature finds that shareholders generally reward managers for efforts to minimize firms' tax liabilities (e.g., Desai and Dharmapala, 2009; Drake et al., 2019) and, at times, even incentivize them to engage in risky tax strategies (Armstrong et al., 2012). However, several existing studies consistently document negative market reactions to news about firms' participation in tax avoidance activities such as tax shelters or offshore financial vehicles (e.g., Bauer and Klassen, 2017; Hanlon and Slemrod, 2009; O'Donovan et al., 2019). Instead of focusing on events with negative outcomes—cases in which the tax arrangements are detected and penalties ensue—our study examines an event where the revelation of tax

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[1] The leaked documents can be accessed at https://www.icij.org/project/luxembourg-leaks.

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arrangements is accompanied by news about the firms' management of tax uncertainty using ATRs. Specifically, the documents made public through the LuxLeaks outline firm-specific tax arrangements sanctioned by the Luxembourg government. As such, our study attempts to reconcile these seemingly inconsistent findings by examining the role of perceived tax uncertainty[2] in explaining the market reaction to tax shelter news.

The exogenous event of LuxLeaks provides a unique opportunity for researchers to study how investors value firms' cross-border tax avoidance when those schemes are supported by advance (private) tax rulings. Tax avoidance activities impose different levels of risk on a firm depending on the degree to which tax authorities find the arrangements adhere to prevailing laws. The expected costs and benefits associated with a specific tax strategy vary with both the level of aggressiveness and the probability that tax savings will be sustained under audit. On the one hand, the LuxLeaks could depress firms' stock prices if investors anticipate additional costs arising from future disallowances and penalties by tax authorities, concerns about the quality of governance, potential consumer backlash, and political retaliation following the leaks. On the other hand, the LuxLeaks could boost firms' stock prices if investors reward managers' efforts to maximize shareholder value by reducing cash tax payments and increasing tax certainty using ATRs. The binding nature of these ATRs assures investors that the tax arrangements are approved and legal by the Luxembourg tax authority, and the cash savings generated from these arrangements are likely to be sustained. Depending on investors' assessment of the change in expected net cash flow, LuxLeaks news could result in either a positive or a negative market reaction.

We construct our sample by identifying the publicly listed firms exposed in the leak. This results in a sample of 134 listed multinational firms from 20 countries operating across a wide range of industries. We find that, on average, investors react positively to the new information revealed in the LuxLeaks documents. The mean three- and seven-day cumulative abnormal returns (CAR) centered on the release dates are 0.235 and 0.400 percent, respectively. This response contrasts with the negative market reactions of −0.53 percent to news of tax shelter detection (Hanlon and Slemrod, 2009), −0.9 percent to news of firms' use of secret offshore financial vehicles (O'Donovan et al., 2019), and −1.2 percent to the disclosure of unfavorable tax settlements (Bauer and Klassen, 2017). In terms of economic magnitude, the average (median) increase in firms' market capitalization, based on the seven-day CARs, is US$ 107 (35) million.

The positive market reaction to the LuxLeaks is driven primarily by the U.S. firms in the sample. The average three- and seven-day CAR for the U.S. firms are 1.319 and 2.289 percent, whereas the average market reaction for the non-U.S. firms is statistically insignificant. We perform additional cross-sectional analyses, investigating several firm-level characteristics, to better understand the factors that explain the variation in the market response for all firms in the sample as well as the difference between the U.S. and non-U.S. subsamples. These characteristics are derived from Hanlon and Slemrod (2009)'s model—hereinafter referred to as the "HS model"—of the market reaction to tax shelter news.

First, we examine whether investors' reassessment of firm tax uncertainty explains their reaction to the LuxLeaks. Prior to the leaks, investors could only observe a firm's tax avoidance through the effective tax rates reported in the financial statements; hence, they had limited knowledge about how management achieved these tax savings or the likelihood that these savings would sustain. The LuxLeaks revealed the existence of ATRs with the Luxembourg tax authority, which assured investors that the associated tax savings would not be challenged, at least not by Luxembourg. We use the amount of tax savings originating from these ATRs to measure investors' downward revision of firms' tax uncertainty and find that this proxy is positively associated with CARs. This association holds in both the U.S. and non-U.S. subsamples, suggesting that investors' downward revision of the tax uncertainty related to the Luxembourg arrangements is the primary driver of the positive market reaction to the leaks.

Second, we document that the market reaction to the LuxLeaks is positively associated with the quality of firms' corporate governance, as proxied by the percentage of institutional ownership (Desai and Dharmapala, 2009; Bushee, 1998). This evidence is in line with findings in prior literature that the value of firms' tax avoidance is conditional on the strength of corporate governance (e.g., Desai and Dharmapala, 2009; Drake et al., 2019). However, this association is concentrated among the non-U.S. firms in our sample. Our failure to document a similar association among the U.S. firms is consistent with the limited evidence in the prior literature of a corporate governance effect on firms' tax avoidance (Armstrong et al., 2015; Chen et al., 2019; Seidman and Stomberg, 2017) as well as the lack of evidence of an association between managerial rent extraction and aggressive tax avoidance in U.S. settings (Blaylock, 2016).

Third, we find that investors react more negatively towards U.S. firms that appear to have over-invested in tax avoidance. These are firms with book effective tax rates lower than peer firms headquartered in the U.S. Such a finding confirms Hanlon and Slemrod's (2009) prediction that investors will discount their valuation of a firm's tax avoidance if they perceive its tax-sheltering activities to be excessive. This association, however, is not statistically significant among non-U.S. firms.

Finally, we investigate whether the expected consumer backlash, increased enforcement from the home-country tax authority, or political cost affects how investors react to the LuxLeaks. For all three factors, we are unable to reject the null hypothesis of no effect for either the full sample or the subsamples of U.S. and non-U.S. firms. Our failure to document cross-sectional variations on the consumer backlash factor is consistent with recent empirical studies, which report insignificant results on the reputational costs of tax avoidance (e.g., Gallemore et al., 2014; Chen et al., 2019). For example, Gallemore et al. (2014) examine the potential reputational effects for firms engaged in aggressive tax shelters and do not find evidence of any

[2] Following Dyreng et al. (2019), we define tax uncertainty as "the potential loss of tax savings due to the tax position being challenged" by the tax authorities (p.1).

long-term adverse consequences in terms of the market response, consumer backlash, executive turnover, public media reputation, or future tax avoidance behavior. Regarding the political cost factor, the null effect could be due to a lack of variation in size among firms in our sample, most of which are relatively large multinationals. Lastly, the muted effect of tax enforcement in the presence of the ATRs is consistent with our primary assumption that these rulings provide firms with a form of legal protection against attempts by tax authorities to recoup foregone taxes.[3]

Our study makes several contributions. First, we contribute to the emerging literature on tax uncertainty (or tax risk) as a separate and distinct construct from tax avoidance (e.g., Dyreng et al., 2019; Guenther et al., 2017; Neuman et al., 2020).[4] Whereas prior research in this stream of literature primarily examines the relation between tax uncertainty and tax outcomes (De Simone et al., 2014; Dyreng et al., 2019) and whether tax uncertainty/risk translates into firm risk (Guenther et al., 2017; Hutchens et al., 2020), our study exploits the exogenous nature of the LuxLeaks to shed light on investors' pricing of tax uncertainty. In doing so, we reconcile two streams of literature that document both the value of tax avoidance to shareholders (e.g., Desai and Dharmapala, 2009; Drake et al., 2019) and investors' negative responses to tax shelter news (e.g., Hanlon and Slemrod, 2009; O'Donovan et al., 2019). Because the cash tax savings from past sheltering activities are already known to investors and built into firm stock price prior to the tax shelter news, our study demonstrates that investors' reaction partly reflects an adjustment to their perceived uncertainty about the sustainability of these tax savings. If the news increases tax uncertainty (e.g., Hanlon and Slemrod, 2009; O'Donovan et al., 2019), one should expect a negative response. Vice versa, if the news results in a decrease in tax uncertainty, as in our setting, one should observe a positive response. The outcomes of both settings are consistent with the theory on the value of tax avoidance to shareholders as described in Desai and Dharmapala (2009) and Drake et al. (2019).

Second, our paper contributes to the understanding of firm characteristics that affect investors' valuation of tax avoidance and how the strength of these factors varies between U.S. and non-U.S. firms (e.g., Desai et al., 2007; Blaylock, 2016; Seidman and Stomberg, 2017). The evidence from our study shows that, among the U.S. firms, investors' reaction is weaker for those considered overly tax aggressive. For non-U.S. firms, however, the market response is muted by concerns about the quality of corporate governance. Finally, our study answers the calls for papers examining the economic effects of tax risk and uncertainty.[5] Understanding the economic consequences of tax uncertainty is important for managers and investors and is also a priority for governments (OECD, 2017). Our study demonstrates that, when possible, firms actively seek to obtain certainty about their tax planning and that investors reward those actions.

Our paper proceeds as follows. Section 2 summarizes prior literature and provides background information about the LuxLeaks. Section 3 describes our research design and applies the HS model to examine factors that may explain cross-sectional variation in market reactions. Section 4 describes the sample construction and presents descriptive statistics. The empirical results are presented in section 5. Section 6 discusses the limitations of our study, and section 7 concludes.

2. Literature review and institutional background

2.1. Literature review

Several studies adopt an event-study methodology to examine investors' reactions to news about a firm's involvement in aggressive tax planning strategies (e.g., Hanlon and Slemrod, 2009; O'Donovan et al., 2019). The costs and benefits associated with corporate tax avoidance create tension around the question of how the market perceives this type of news. On the one hand, one would expect a positive response if investors recognize and reward managers for their efforts to maximize shareholders' value by reducing cash tax payments. On the other hand, one would expect a negative reaction if the news prompts investors to anticipate additional costs from future disallowances and penalties by the tax authorities (O'Donovan et al., 2019). Moreover, disclosing tax avoidance strategies that are viewed as socially undesirable could trigger investors to further discount the firm's value due to concerns about consumer backlash, political costs, and quality of corporate governance (Desai and Dharmapala, 2009; Hanlon and Slemrod, 2009).

[3] It is worth noting that, the European Commissioner for Competition, Margrethe Vestager, revealed at a news conference in 2016 that the Commission had reviewed the tax rulings obtained via LuxLeaks and concluded that the majority were consistent with state-aid rules and required no further action (Parker, 2016).

[4] Prior studies have examined both tax risk and tax uncertainty. Dyreng et al. (2019) defines tax uncertainty as "the potential loss of tax savings upon challenge" (p.1). Neuman et al. (2020) define tax risk as "the uncertainty about the future tax outcomes generated by current actions or activities, or the failure to take actions or pursue activities." Both Drake et al. (2019) and Guenther et al. (2017) focus on a view of tax risk that is "akin to the traditional view in the finance literature in which risk refers to the dispersion of potential outcomes from an investment and reflects the degree of uncertainty about the future" (p. 156). Due to the lack of consensus in the literature on how tax risk differs from tax uncertainty and how to measure tax risk, recent empirical papers have shifted the discussions towards tax uncertainty (Dyreng et al., 2019; Hutchens et al., 2020; Jacob and Schütt, 2020). We believe that the construct of tax uncertainty is more closely aligned with the theoretical framework we adopt to analyze the market reaction to LuxLeaks (see Section 3).

[5] These include call for papers from the European Accounting Review's 2015 Special Issue on Tax Research, University of Illinois's Deloitte Tax Symposium XIII to XVII, and the European Institute for Advanced Studies in Management (EIASM)'s 7th to 12th Conference on Current Research in Taxation.

Hanlon and Slemrod (2009) is the first study to examine stock price reactions to news of firms' involvement in tax shelters.[6] The authors focus on 108 news articles related to 97 firms, primarily covering eight types of tax shelters. They observe, on average, a negative market reaction (mean CAR of −0.53 percent) to the initial news about firms' use of tax shelters. This result is somewhat surprising given that "new information suggesting that a firm is tax aggressive should be positive news to the market" (Hanlon and Slemrod, 2009, p. 126). In cross-sectional tests, the authors document that investors react less negatively towards firms whose financial reports indicate they are not tax-aggressive (i.e., firms with high cash effective tax rates [CETRs]). Such a finding is consistent with investors perceiving these firms' involvement in tax shelters as evidence of them trying to avoid taxes more than previously known. The authors also find that firms in the retail sector experience a more negative reaction, suggesting that investors' concern about consumer backlash could be a driver of the market response. Their study provides the first empirical evidence of the market responding to news about tax avoidance strategies previously unobservable from the financial statements.[7]

Similarly, O'Donovan et al. (2019) examine firms implicated in the Panama Papers leaks for their use of secret offshore vehicles with the help of a prominent Panamanian law firm, Mossack Fonseca. The authors find that these firms experience a significant drop in value (mean three-day CAR of −0.9 percent) and that they utilize offshore vehicles to avoid and evade taxes, circumvent regulations, and expropriate shareholders' wealth. With respect to the tax avoidance channel, the authors find that tax-aggressive firms faced significantly more negative market reactions. This finding is consistent with the shareholders' expectation that the Panama Papers leaks will result in fines and back taxes and potentially lower future tax avoidance for the firms.

In addition to the event studies mentioned above, there have also been several studies examining investors' reactions to U.S. firms' announcements of corporate inversions (e.g., Cloyd et al., 2003; Desai and Hines, 2002; Seida and Wempe, 2004). These inversions involve relocating U.S. firms' tax domicile to foreign jurisdictions with lower corporate tax rates. The literature offers mixed evidence on whether shareholders perceive this type of reorganization to be value-enhancing. Cloyd et al. (2003) attribute these mixed findings to the difficulties in identifying the relevant date(s) to measure market reaction—e.g., whether to use the date of board approval, shareholder approval, or an earlier announcement date—and in controlling for nontax factors that may drive merger-related inversions. The mixed reactions to inversions could also be attributable to differences in the costs accrued to shareholders subject to different levels and types of income taxes (Babkin et al., 2017). As such, corporate inversion is a complex setting to study the effect of tax avoidance and tax uncertainty on firm value. In contrast, our setting is more straightforward because we focus on an exogenous event of tax shelter news, similar to those examined in Hanlon and Slemrod (2009) and O'Donovan et al. (2019).

Despite the similarities described above, there are important differences in the nature of information revealed through the events examined in Hanlon and Slemrod (2009) and O'Donovan et al. (2019) and those revealed through the LuxLeaks. Whereas the latter made public the information about legally binding tax agreements between firms and the Luxembourg tax authority, the former exposed firms' use of questionable tax schemes and secret vehicles that managers would have preferred to keep hidden from tax authorities. These schemes tend to exploit loopholes within the tax code (Wilson, 2009), have come under extreme scrutiny, and are occasionally deemed outright illegal (e.g., IRS, 2020a, 2020b, 2020c).[8]

In the case of these questionable schemes, managers opt into what has been referred to as the "audit lottery" (Givati, 2009). In such a lottery, there is a low probability of these tax shelters being detected (Graham and Tucker, 2006); but once they are detected by tax authorities, there is a high probability that the tax benefits will be disallowed and significant penalties will be imposed. Indeed, many firms identified in Hanlon and Slemrod (2009) ultimately paid substantial sums in taxes and penalties to the IRS (Wilson, 2009). Similarly, tax authorities worldwide have recovered more than US$500 million after the Panama Papers release (Gallego, 2017). Therefore, the negative market reactions documented in prior studies partly reflect investors' assessment of the expected cash outflows from back taxes, penalties, and loss of future tax savings (Wilson, 2009).

In contrast, the tax arrangements revealed in the LuxLeaks are distinctive in that these firms proactively sought ATRs from the Luxembourg government before engaging in tax avoidance strategies, ostensibly to secure certainty about the ultimate tax treatment. The legal and binding nature of the ATRs, along with Luxembourg's favorable tax environment and extensive network of bilateral tax treaties, significantly lowered the uncertainty associated with these tax schemes. The legality of these schemes is also evidenced by the fact that other tax authorities have taken little action against the companies exposed in the leaks (Bowers, 2017, 2019; Folwer, 2019).[9]

[6] There is no universally accepted definition of the term "tax shelter." Hanlon and Slemrod (2009) define tax shelters as "complex transactions used by corporations to obtain significant tax benefits probably never intended by the tax code; these transactions may not be illegal *per se* and their use, if detected, may trigger lengthy processes of IRS assessment and judicial appeal" (p. 127). We adopt this broad definition of tax shelter in our study.

[7] A follow-up study by Gallemore et al. (2014) extends the market reaction window to 30 days past the revelation date to examine whether the short-window effects on stock price are permanent or temporary. They find that, although the immediate market reaction is negative, the effect does not persist over the following 30 days. However, it is difficult to draw inferences from their result due to the possibility of new information arriving after the initial news release was incorporated into the stock price.

[8] All tax shelters identified in Hanlon and Slemrod's study have since been added to the IRS's list of recognized abusive transactions (so-called "listed transactions"), invalidating the use of such schemes going forward. For the full list, see https://www.irs.gov/Businesses/Corporations/Listed-Transactions.

[9] The one exception is Accenture Plc, which has settled and paid $200 million to Switzerland's tax authority for understating the value of intellectual property transferred between its Swiss and Luxembourg subsidiaries (Dalby, 2019).

Despite their controversial nature, the legitimacy of Luxembourg-based tax rulings has largely gone unchallenged by the European Commission and European Union (E.U.) member states.[10] The Commission holds that granting generous tax rulings is not problematic *per se*, as members retain sovereignty over their tax policies. However, state-aid rules prohibit members from providing subsidies or aid to select entities or subgroups that distort competition in the E.U. market (European Commission, 2019b).[11] If a member state is found to be in breach of state-aid rules, the Commission can order it to recover the foregone taxes. No such violation has been identified regarding the ATRs contained in the LuxLeaks; hence, this event offers us a unique opportunity to contribute to the literature by examining investors' valuation of tax uncertainty (or, more precisely, a reduction in tax uncertainty through ATRs).

2.2. Institutional background

In 2014, the ICIJ released more than 500 documents detailing the ATRs granted by the Luxembourg tax authority to hundreds of multinational corporations between 2002 and 2010 (ICIJ, 2014). These tax arrangements were set up primarily by PricewaterhouseCoopers, followed by other Big Four accounting firms. The ICIJ leaked these documents in two batches. Most of the tax rulings were released on November 5, 2014, and a smaller batch was made available on December 9, 2014. These leaks attracted global press coverage and the ire of national governments, with calls for actions to curtail such activities (Houlder, 2014; Kanter, 2014; Karnitschnig, 2014). In total, over 350 corporations were involved.[12]

An ATR is a written statement sought by a taxpayer from the tax authority about the tax implications of a pending arrangement. ATRs lessen the risk of future disallowance, penalties, or lawsuits by the issuing tax authority. The issuance of ATRs is common practice in countries with mature tax systems, often due to the complex and ambiguous nature of their tax code. In the U.S., an ATR is also known as a private letter ruling. Each country has sovereignty over the terms and conditions of its tax rulings. This flexibility has allowed some countries to use ATRs to attract foreign direct investment and maximize tax revenue (Givati, 2009).

Among the countries that offer tax rulings in Europe, Luxembourg appears to have one of the most generous and flexible policies (along with Ireland and the Netherlands), attracting trillions of dollars of investment inflows from multinationals worldwide.[13] For many years, the Luxembourg tax authority has been willing to issue private rulings to confirm any tax matters requested by firms, covering questions of both facts and law (Romano, 2002). The tax rulings are generally valid for five years and legally binding for the Luxembourg tax authority (but not the firm). All tax rulings are confidential, and there were no application fees prior to 2014 (Karnitschnig and Van Daalen, 2014; KPMG, 2010).[14]

Our review of the 6000 pages of leaked documents reveals that multinational corporations frequently use Luxembourg subsidiaries as conduits in complex financing structures to exploit the mismatch in countries' tax laws regarding cross-border hybrid entities and financial instruments.[15] The average value of the transactions involved in these rulings is approximately $2 billion, which speaks to the magnitude of the tax savings (Li et al., 2019). It is also clear from reading these rulings that the Luxembourg tax authority was fully aware and approved of these tax-arbitrage structures. The speed at which the Luxembourg tax authority approves ATRs, coupled with an extensive network of bilateral tax treaties, makes Luxembourg an attractive tax haven for multinational corporations. The details of the leaked rulings also indicate that the head of the Luxembourg tax office met with firms to discuss the facts of the arrangements prior to signing the rulings, which generally took place on the same day. The mean (median) turnaround time was 25.6 (3) days, based on the dates in the leaked documents. For 45 percent of the ATRs, the approval was granted on the same day as the request.

The majority of ATRs sought assurance from the Luxembourg government regarding the tax treatments for multiple transactions as part of a larger intercompany financing structure through Luxembourg. In many cases, the deals allowed companies to pay less than 1 percent tax on income shifted from other subsidiaries (Fitzgerald et al., 2014). The most common

[10] It is not until March 18, 2015 when the European Commission proposed an amendment to Directive 2011/16/EU requiring member states to automatically exchange information on reportable cross-border arrangements (which includes tax rulings) (European Commission, 2015). This amendment was eventually adopted in May 2018.

[11] The Treaty on the Functioning of the European Union (Art. 107, para. 1) reads, “Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market.” For more information about E.U. state-aid rules, see http://ec.europa.eu/competition/state_aid/overview/index_en.html.

[12] Two PricewaterhouseCoopers employees that leaked these documents, Antoine Deltour and Raphaël Hale, were charged by the Luxembourg government for participating in the leaks. The appeal trial mainly focused on the parties' arguments regarding the definition of a “whistleblower.” The appeal trial's judgment was delivered in March 2017, upholding monetary fines (€1500 and €1000, respectively) and reducing the suspended jail sentence (12 and 9 months, respectively). Since then, the European Commission has introduced new rules to better protect whistleblowers who report breaches of E.U. laws (European Commission, 2019a).

[13] At the end of November 2014, Luxembourg's investment funds and financial firms held about €3.083 trillion in assets, ranking Luxembourg as the second largest investment fund center after the U.S. (Deloitte, 2015).

[14] After the LuxLeaks and the OECD's Base Erosion Profit Shifting initiatives, the governments of Luxembourg, Belgium, the Netherlands, and Ireland were pressured to strengthen their ruling process and participate in mandatory information-sharing with other member states (KPMG, 2019; Maliy and Greeven, 2015; Wantz and Hecklen, 2019).

[15] According to the OECD, hybrid mismatch arrangements “are used in aggressive tax planning to exploit differences in the tax treatment of an entity or instrument under the laws of two or more tax jurisdictions to achieve double nontaxation, including long-term taxation deferral” (OECD, 2020).

feature among these ATRs includes hybrid entities, financial instruments, and transfers to minimize the taxes due in multiple jurisdictions (Hardeck and Wittenstein, 2018).[16]

Despite the considerably favorable rulings offered by Luxembourg, this practice prevailed for years and was not considered to conflict with E.U. law. The Luxembourg government argued that the ATRs granted fully complied with national and international laws and applicable tax treaties (Roberts, 2014; Brunsden, 2017). In theory, other countries can adopt anti-avoidance rules to combat multinationals' abuse of hybrid instruments to avoid taxes. However, in the global noncooperative equilibrium that existed before the OECD's BEPS initiatives, it was not in a country's interest to adopt such measures unilaterally (Johannesen, 2014). Therefore, the legality of these tax rulings has largely gone unchallenged for many years.

3. Research design

As previously mentioned, we use an event-study methodology to examine the market reaction to the LuxLeaks. We calculate the CAR for the three-, five-, and seven-day windows centered on the release dates—November 5 and December 9, 2014. We follow Hanlon and Slemrod (2009) and estimate CAR using the market model.[17]

To maintain consistency and strengthen comparative inferences between the findings in our study and those in prior literature, we model our research design after the HS model. Hanlon and Slemrod (2009) developed a model to explain the variation in the market reaction to tax shelter news (p. 129–130). For brevity, we discuss the main inferences from their model, its application to our setting, and the proxies we use to test the model empirically. Complete definitions for all variables are presented in Appendix A.

The authors identify five main factors that can influence the direction of market reaction. The first factor is the gain (or loss) from changes in the probability of some amount of sheltering being reversed and penalized by tax authorities. On the one hand, investors may react negatively if they foresee losses due to the future curtailment of favorable tax treatments granted by the Luxembourg government. On the other hand, because the ATRs from the Luxembourg government assure firms that the arrangements they adopted are in line with local tax laws, investors may reassess the sustainability of firms' tax savings and revise their perception of the tax uncertainty (i.e., the expected losses) downward upon learning about the existence of ATRs through LuxLeaks.[18] In such a scenario, the market reaction would be positive.

To empirically test whether tax uncertainty explains the variation in the market reaction, we measure the reduction in investors' perceived tax uncertainty by estimating the amount of tax savings that firms gained from the Luxembourg tax arrangements. Before the LuxLeaks, investors could observe a firm's effective tax rates but with limited knowledge of its tax planning and the associated uncertainty regarding potential disallowances. The more aggressive a firm is, the more likely investors expect the tax authorities to challenge some of the tax benefits (Dyreng et al., 2019). The revelation of ATRs informs investors about the portion of prior years' tax savings that are protected under Luxembourg tax rulings and hence are subject to less uncertainty. Therefore, ATR saving is an appropriate proxy for investors' downward revisions of a firm's tax uncertainty. We estimate the tax saving as the reduction in a firm's CETR after the signing of the ATR (*Delta_CETR*).[19] CETR is measured as the ratio of cash taxes paid to pretax income and is a highly visible measure of tax avoidance that captures both deferral and permanent tax strategies. We obtain the data on cash taxes paid by U.S. listed firms from the Compustat database and hand-collect information about the cash tax payments by non-U.S. firms from their published financial statements. For firms with multiple ATRs, we estimate the tax savings by computing the change in CETR from the fiscal year prior to the signing of the first ATR to the fiscal year following the signing of the last ATR. We expect *Delta_CETR* to be positively associated with firms' abnormal returns around the LuxLeaks.

The second factor is the change in a firm's expected income stream resulting from a change in the perceived value of tax sheltering. Hanlon and Slemrod (2009) predict this change to be positive (negative) if the market perception was that the previous level of tax sheltering was less (greater) than optimal. Their prediction suggests that there is an optimal level of tax avoidance beyond which investors consider it too aggressive (Armstrong et al., 2015). Both over- and under-investment in tax avoidance have been shown to increase firms' cost of capital (Cook et al., 2017) and can be detrimental to shareholders'

[16] Hybrid entities are entities that are transparent for tax purposes in one country and nontransparent in another (Johannesen, 2014). In most cases, the hybrid entities used in these transactions are treated as nontaxable flow-through entities in Luxembourg, allowing income (interest or royalties) received from other subsidiaries to be taxed at minimal rates in Luxembourg. At the same time, these payments are treated as deductible expenses by the counterparty because the Luxembourg entity is treated as a separate taxable corporation by the other jurisdiction. Hybrid securities are financial instruments treated as debt in one country and equity in another. This type of instrument allows firms to deduct interest payments as business expenses on one side but avoid taxes on the other side by treating the receipt as nontaxable dividend income (Johannesen, 2014). The most common hybrid securities revealed in the LuxLeaks include preferred equity certificates, jouissance shares, and mandatorily redeemable stock instruments (Hardeck and Wittenstein, 2018). Hybrid transfers used in the LuxLeaks appear to take advantage of the mismatch in the nature of the asset transfer between two countries to obtain double nontaxation. A typical hybrid transfer allows firms to minimize withholding tax obligations in one country as well as income tax liabilities in another. These transactions are generally aimed at allowing multinationals to make significant profit distributions to offshore tax havens free of taxes.

[17] For the U.S. firms, we use a weighted-average index of all stocks listed on the NYSE, AMEX, and NASDAQ exchanges. For the non-U.S. firms, the index is based on the main stock exchange on which the firm's shares are traded. Appendix C details the firms included in our sample and the stock exchange where they are listed.

[18] In Appendix B, we present a simple mathematical example of how LuxLeaks news can alter investors' assessment of the probability that tax savings from Luxembourg arrangements will be retained and how such a revision can result in net increase in firm value.

[19] We thank the reviewer for this suggestion.

wealth. For this test, we adopt Armstrong et al.'s (2015) measure of tax optimality—the industry- and size-adjusted book effective tax rate—which is a measure of a firm's tax avoidance relative to its peers. We estimate this variable (*TaxAvoid_Adj_Peer*) as of the fiscal year prior to the LuxLeaks and multiply this measure by −1 so that higher values capture more tax avoidance.[20] We create two separate variables from this measure to test Hanlon and Slemrod's prediction. *Above_Optimal* indicates overinvestment in tax avoidance. It equals to *TaxAvoid_Adj_Peers* if the firm's tax avoidance is above its matched peers, zero otherwise. Conversely, *Below_Optimal* indicates underinvestment in tax avoidance. It equals to *TaxAvoid_Adj_Peers* if the firm's tax avoidance is below its matched peers, zero otherwise. We expect that the market will react positively (negatively) if firms' level of tax avoidance prior to the Leaks was perceived to be below (above) that of their peers. In other words, we predict the coefficient on *Below_Optimal* to be positive and the coefficient on *Above_Optimal* to be negative.

The third factor is the quality of the firm's corporate governance. We posit that market reaction to tax shelter news will be more favorable for firms with stronger governance. This is because well-governed firms are more likely to pursue tax planning strategies that maximize shareholder value (Armstrong et al., 2015; Beasley et al., 2021). Investors could also react more positively to well-governed firms due to the lower likelihood of managerial wealth diversion (Desai and Dharmapala, 2006, 2009; Desai et al., 2007).

It is also possible that we may not find evidence of an association between the market reaction and firms' corporate governance. Recent studies provide evidence that casts doubt on the previously documented association between governance and tax avoidance and the link between tax avoidance and managerial wealth diversion. Armstrong et al. (2015) find that corporate governance only affects managers' decision to engage in tax avoidance among firms at the extreme tails but not at the conditional mean or median of the tax avoidance distribution. Likewise, Seidman and Stomberg (2017) find that the negative relation between managerial incentives and tax avoidance documented by Desai and Dharmapala (2006) can also be explained by a concentration of poorly-governed firms with relatively low taxable income and, hence, little incentive to aggressively avoid taxes. Finally, Blaylock (2016) reexamines Desai and Dharmapala's (2006) theory of managerial wealth diversion in the U.S. and does not find consistent evidence supporting this theory.[21] In short, the relationships between tax, managerial wealth diversion, and firm governance have been shown in the recent literature to be more complex than initially theorized. Therefore, it is unclear whether the quality of firms' corporate governance explains variation in the market reaction to LuxLeaks and, if so, for which firms.

Our primary measure of the quality of corporate governance is the percentage of a firm's total outstanding shares held by institutional investors (*Inst_Own*).[22] This proxy is a firm-level measure commonly used in the tax and corporate governance literature (e.g., Aggarwal et al., 2011; Desai and Dharmapala, 2009; Hanlon and Slemrod, 2009). For the U.S. firms, we use 13-F filings from the Thomson Reuters Institutional Holdings database to aggregate the firm's institutional ownership percentage at the end of the fiscal year prior to the LuxLeaks. For the non-U.S. firms, we obtain institutional ownership data from the Orbis database. Consistent with prior literature (e.g., Bushee, 1998), we consider a shareholder to be an institutional investor if it is in one of the following categories: insurance; banking; mutual fund, trust, and pensions; financial company; foundation/research institute; private equity firm; venture capital; and hedge fund.[23]

The fourth factor is the reduction in expected income due to consumer backlash from tax sheltering activities that could be considered socially unacceptable. Hanlon and Slemrod (2009) use the retail industry to identify firms more susceptible to consumer backlash. However, the authors note that the use of this measure is problematic because certain industries, such as retail, may be less likely to pursue aggressive tax shelters, and, even if they do, the expected benefit may be higher to offset the higher expected costs (Hanlon and Slemrod, 2009, p. 135). Because of this endogeneity concern with the retail industry measure, we proxy for the likelihood of consumer backlash by identifying firms that provide products or services directly intended for end consumers.[24] Consumer-facing firms are more susceptible to consumer backlash than firms whose products or services are inputs for other businesses. We set the binary variable *Consumer_Facing* equal to one to indicate these firms and zero otherwise. An advantage of the *Consumer_Facing* proxy is that it allows for within-industry variation and mitigates the endogeneity concern when using the retail industry as a proxy. We expect consumer-facing firms to be more susceptible to consumer backlash and, thus, experience a less positive market reaction to LuxLeaks news.

[20] Armstrong et al. (2015) compute their measure as the firm's three-year average book effective tax rate (ETR) minus the mean for the group of firms in the same Fama-French 48 industry and quintile for total assets. In our study, we also match on headquarters country to control for differences in statutory tax rates. We use the Fama-French 12 industry classification to have an adequate number of peer firms in each country-industry-size group and annual book ETR to maximize sample size. *TaxAvoid_Adj_Peer* is computed for the last fiscal year prior to the LuxLeaks. Positive (negative) values for *TaxAvoid_Adj_Peer* represent book ETR below (above) the mean for the peer firms.

[21] Blaylock (2016) conjectures that the lack of evidence does not rule out the possibility of rent extraction from tax avoidance by managers of U.S. firms, but any such rent extraction is likely too small to be a first-order concern to shareholders of the average U.S. firm.

[22] Hanlon and Slemrod (2009) use entrenchment scores (E-Index) developed by Bebchuk et al. (2009) for their corporate governance test. The E-Index is based on six provisions that set constitutional limits on shareholder voting power and safeguard the firms against hostile takeover. However, the E-Index measure is only available for 45 firms in our sample.

[23] Shareholders not considered institutional investors include named individuals or families, nameless private shareholders, trade and industry organizations, employees/managers/directors, publicly listed companies, state ownership, and self-ownership.

[24] We reviewed each firm's corporate website to identify their goods/services and their customers. For example, Burberry Group is a luxury fashion house that makes trench coats and outerwear, a consumer-facing firm. Acergy Group is a seabed-to-surface engineering and construction contractor for the offshore oil and gas industry, a non-consumer-facing firm.

The fifth factor is the change in investors' perception of the effectiveness of tax authorities in detecting and penalizing tax sheltering activity. The tax arrangements revealed in LuxLeaks are multi-jurisdictional. Although these arrangements were known to the Luxembourg tax authority, they may not be known to all relevant tax authorities. Investors may react negatively if they expect that other tax jurisdictions will attempt to recover taxes on diverted profits or curtail such avoidance activities in the future. To measure investors' perception of the likelihood that enforcement actions will be taken against the firms by their home country's tax authority, we use the tax enforcement score from Beuselinck et al. (2015). The tax enforcement score summarizes six characteristics of the international tax system for each country: (1) tax audit risk, (2) related-party disclosure requirement, (3) existence of a favorable regime on holdings structure for multinationals, (4) existence of thin capitalization rules, (5) the number of double tax treaties in force relative to the maximum number available, and (6) existence of loss offset rules. Beuselinck et al. (2015) find that multinationals' outbound income shifting is more aggressive when the parent country's tax enforcement is weak. To construct the score for 2014, we follow Beuselinck et al. (2015) and collect information for the first two characteristics from the EY's 2014 Worldwide Corporate Tax and Transfer Pricing Guide. We source the data for the other four characteristics from Schanz et al. (2017)'s tax attractiveness index. The values for each characteristic range from 0.0 to 1.0, with higher scores representing weaker tax enforcement. The overall tax enforcement score is the average of the six dimensions. We transform the overall score into a median-split binary variable, *Tax_Enforcement*, which equals one if the score is below the median (i.e., strong tax enforcement) and zero if the score is above the median (i.e., weak tax enforcement).

Finally, given the global coverage of the LuxLeaks in major news media, we examine whether political costs explain the variation in market response. This factor is not part of the HS model but was discussed in their study (Hanlon and Slemrod, 2009, p. 127). Prior studies suggest that political cost influences the tax planning strategies of federal contractors and firms that operate in sin industries in the U.S. (e.g., Mills et al., 2013; Wang et al., 2021). However, only two firms in our sample are in the sin industries, and the data on government contracts are not widely available for non-U.S. firms.[25] As such, we use firms' total assets (*Size*), measured at the end of the fiscal year before the LuxLeaks, to proxy for political costs (Belz et al., 2019; Omer et al., 1993; Zimmerman, 1983). We acknowledge that *Size* is an imperfect proxy given its correlation with other firm characteristics; still, it is the most widely available measure for firms within our sample. If investors believe that the controversy from these leaks will cause Luxembourg to curtail the use of future tax rulings or prompt other governments to take disciplinary actions against the exposed firms, then we would expect a more negative market reaction among the larger firms.

For our empirical tests, we combine all factors into a single multivariable regression, as shown below, to investigate the partial relationship between the six factors and the market reaction to the LuxLeaks.

$$CAR_i = \beta_0 + \beta_1 Delta\_CETR_i + \beta_2 Above\_Optimal_i + \beta_3 Below\_Optimal_i + \beta_4 Inst\_Own_i + \beta_5 Consumer\_Facing_i + \beta_6 Tax\_Enforcement_i + \beta_7 Size_i + \varepsilon_i \quad (1)$$

4. Sample selection

4.1. Sample selection and descriptive statistics

We construct our sample from the 577 confidential tax rulings released by the ICIJ on November 5 and December 9, 2014. We examine each document to identify the ultimate parent firm and whether the parent firm is private or publicly listed.[26] We identify 353 unique parent firms. Next, we remove private firms and firms without stock price data from our sample. Finally, we remove firms whose leaked documents did not disclose an ATR.[27] After these exclusions, we retain a sample of 134 publicly listed firms: 50 headquartered in the U.S., 57 in E.U. member states (including the United Kingdom at the time), and 27 headquartered in other countries. Table 1 summarizes our sample selection process, and Appendix C provides a complete list of the firms in our sample. Next, we crossmatch our sample of publicly listed firms with CRSP for U.S. firms and Yahoo Finance or Google Finance for non-U.S. firms to obtain stock price data. We also rely on Compustat North America, Compustat Global, Orbis, World Bank, and institutional investor data from Brian Bushee to construct our independent variables.[28]

Table 2 provides a breakdown of the sample by headquarters location and industry. The largest cluster of firms is headquartered in the U.S. (50 firms or 37.31 percent), followed by the United Kingdom (21 firms), France (8 firms), and Switzerland (8 firms). The financial services sector is the largest industry group (48 firms or 35.82 percent), followed by the consumer (24 firms) and industrial (18 firms) sectors.

[25] Wang et al. (2021) define sin firms as those producing alcohol, tobacco, gaming, or firearms (SIC codes: 2100–2199, 2080–2085, 7132, and 3480–3489). Mills et al. (2013) rely on data reported on FedSpending.org, a site created by the U.S. Office of Management and Budget for the public to learn how the federal government is spending money. We are unable to find similar sources of data for the non-U.S. firms in our sample.

[26] In our final sample, 12 firms were either acquired or merged with another firm after the signing date of the ruling but prior to the dates of the LuxLeaks. Six of these are U.S.-headquartered firms.

[27] Only two firms were deleted because of this condition. The leaked documents for Amazon and Apple are tax returns and do not detail any tax arrangements or ATRs.

[28] If data are missing from any of these datasets, we attempt to hand-collect the missing data from the firms' 10-K filings or annual reports.

Table 1
Sample selection.

	Firms Identified in the Documents Released on		Overlapping Firms[a]	Total Number of Firms
	Nov 5, 2014	Dec 9, 2014		
Total number of firms identified in LuxLeaks documents	345	11	(3)	353
Less:				
- Firms not publicly traded	(179)	(3)	–	(182)
- Firms without available stock price information[b]	(34)	(1)	–	(35)
- Firms without disclosure of an Advance Tax Ruling[c]	(2)	–	–	(2)
Final sample[d]	130	7	(3)	134
Location based on domiciled headquarters				
Number of U.S.-headquartered firms				50
Number of firms headquartered outside the U.S.				84
Total				134

Notes.
[a] Three firms appeared in both batches of documents.
[b] The majority of these firms either were taken private prior to the releases of the documents or were no longer trading at the time of the releases.
[c] We exclude Amazon and Apple Inc. because their leaked documents are tax returns not advance tax rulings.
[d] If the firm was acquired or merged with another publicly traded firm prior to the LuxLeaks, we use the data for the parent firm at the time of the release. There are 12 firms in this category.

Table 2
Summary statistics of the publicly traded firms in the sample.

Panel A: By Country		Panel B: By Industry	
Headquarters location	Number of firms	Industry	Number of firms
Australia	3	Basic Materials	5
Belgium	4	Communication Services	7
Bermuda	2	Consumer	24
Brazil	3	Energy	7
Canada	6	Financial Services	48
China	1	Healthcare	9
Finland	1	Industrials	18
France	8	Real Estate	7
Germany	6	Technology	8
Hong Kong	2	Utilities	1
Ireland	7		
Israel	1		
Italy	5		
Luxembourg	1		
Netherlands	1		
Sweden	3		
Switzerland	8		
Taiwan	1		
United Kingdom	21		
United States	50		
Total	134	Total	134

Notes: This table identifies the headquarters country and industry for the firms in our sample. Country classification is based on where the firm's headquarters is located at the time of the LuxLeaks. Industry classification is based on the Global Industry Classification Standard.

Table 3 compares the mean and median total assets, revenue, net income, and market capitalization of LuxLeaks firms with firms in the benchmarked indices.[29] Across all four dimensions, LuxLeaks firms appear to be much larger and more profitable than the average firms listed in these major indices.

5. Results

5.1. Descriptive statistics

Descriptive statistics for all variables used in our analyses are provided in Panel A of Table 4. Based on the data available, we are able to calculate *Delta_CETR* for 95 out of the 134 firms in the sample.[30] The mean for *Delta_CETR*, −0.040, indicates an

[29] Due to the data coverage in Compustat Global, we are not able to locate the full list of firms that formed the MOEX Russia Index and the Milano Indice di Borsa as of the October 31, 2014, and their financial information.
[30] Missing values are due to missing data for cash taxes paid or negative values for pre-tax income.

Table 3
Comparison of LuxLeaks firms with firms in the benchmarked indices.

	LuxLeaks Firms	Publicly Listed Firms from the Benchmarked Indices
Number of Firms	134	2842
Mean Total Assets (U.S. $M)	260,065.282	35,108.260
Median Total Assets (U.S. $M)	22,601.941	2124.060
Mean Total Revenue (U.S. $M)	27,763.771	8988.230
Median Total Revenue (U.S. $M)	9016.321	1204.890
Mean Net Income (U.S. $M)	3324.302	589.040
Median Net Income (U.S. $M)	659.391	63.590
Mean Market Capitalization Prior to LuxLeaks (U.S. $M)	39,919.020	4626.200
Median Market Capitalization Prior to LuxLeaks (U.S. $M)	14,102.930	75.160

Notes: This table presents the mean and median total assets, total revenue, net income, and market capitalization of LuxLeaks firms and firms in the benchmarked indices. Due to the data coverage in Compustat Global, we are not able to locate the full list of firms that formed the MOEX Russia Index and the Milano Indice di Borsa as of October 31, 2014, and their financial information.

Table 4
Panel A: Descriptive statistics.

Variables	N	Mean	Std Dev	P25	Median	P75
Cumulative Abnormal Returns						
CAR (−1, +1)	134	0.235	3.433	−0.884	0.161	1.156
CAR (−2, +2)	134	0.320	3.507	−1.555	0.120	1.864
CAR (−3, +3)	134	0.400	4.425	−1.691	0.440	2.108
Measure of Perceived Tax Uncertainty						
Delta_CETR	95	−0.040	0.417	−0.038	0.000	0.094
Measure of Tax Optimality						
TaxAvoid_Adj_Peer	127	−0.015	0.176	−0.089	−0.011	0.084
Above_Optimal	127	0.050	0.081	0.000	0.000	0.084
Below_Optimal	127	−0.066	0.133	−0.089	−0.011	0.000
Above_Optimal (non-zero)	55	0.116	0.086	0.039	0.115	0.178
Below_Optimal (non-zero)	72	−0.116	0.160	−0.122	−0.069	−0.005
Corporate Governance						
Inst_Own	122	0.526	0.317	0.228	0.573	0.794
Consumer Backlash						
Consumer_Facing	134	0.597	0.492	0.000	1.000	1.000
Tax Enforcement						
Tax_Enforcement	132	0.523	0.501	0.000	1.000	1.000
Political Costs						
Size	132	10.316	2.293	8.697	10.026	11.875

Panel B: Correlations

	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) CAR	0.010	−0.088	−0.118	0.315	−0.025	0.212	−0.152
	(0.927)	(0.326)	(0.188)	(<0.001)	(0.778)	(0.015)	(0.082)
(2) Delta_CETR		−0.127	0.212	−0.035	0.260	0.026	0.119
		(0.224)	(0.041)	(0.749)	(0.011)	(0.808)	(0.253)
(3) Above_Optimal			0.311	−0.095	−0.008	0.105	−0.021
			(<0.001)	(0.304)	(0.928)	(0.244)	(0.818)
(4) Below_Optimal				0.065	−0.022	0.023	−0.012
				(0.487)	(0.803)	(0.795)	(0.894)
(5) Inst_Own					−0.216	0.415	−0.294
					(0.017)	(<0.001)	(0.001)
(6) Consumer_Facing						−0.087	0.469
						(0.319)	(<0.001)
(7) Tax_Enforcement							−0.048
							(0.587)
(8) Size							

Notes: This table presents descriptive statistics for the variables used in our analyses. The cumulative abnormal returns are centered on the date the firm is first included in the LuxLeaks documents. All variables are measured in the fiscal year prior to the LuxLeaks. The definitions for all variables can be found in Appendix A.
Notes: This table presents the Pearson correlations for the variables used in our analyses. *P*-values are reported in parentheses. CAR is based on the seven-day window centered on the date the firm is first included in the LuxLeaks documents. The definitions for all variables can be found in Appendix A.

increase in CETR after the signing of ATRs on average. However, the latter period of the ATRs, 2002−2010, includes the Great Recession when many firms incurred losses, which may add noise to this proxy. We observe an unequal distribution of firms reporting tax avoidance levels above/below their peers. Less than half of the firms in our sample (55 out of 127 firms with data for *TaxAvoid_Adj_Peer*) engage in tax avoidance beyond what might be considered the optimal level (i.e., book ETRs lower than

the average of their peers). The average percentage of institutional ownership for firms in the sample is 52.6. Finally, 59.7 percent of firms are consumer-facing. Panel B of Table 4 presents the Pearson correlations for all variables used in our analyses. The correlation between some factors (e.g., *Inst_Own*, *Size*, and *Tax_Enforcement*) suggests that multicollinearity may be a concern. Therefore, we report the mean variance inflation factors (VIF) in the multivariable regression results to quantify the severity of multicollinearity in our analyses.

5.2. Market reaction

Table 5 reports the means of the cumulative raw returns, CAR, and standardized CAR (*Std_CAR*) for the firms in our sample, as well as the results from the event-study tests. Panel A reports the results for all 134 firms on their respective leaked dates (November 5 and December 9, 2014). Panel B reports the results separately for the subgroups of U.S.-headquartered and non-U.S.-headquartered firms.

As shown in Panel A, we observe a positive and statistically significant market reaction for the 134 publicly listed firms exposed in the LuxLeaks. The mean (median) three-day CAR for the full sample is 0.235 percent (with $z_{Patell} = 1.736$). On average, investors responded positively to the news about firms' tax arrangements and their use of ATRs to reduce tax uncertainty. The mean CAR increases to 0.320 ($z_{Patell} = 2.014$) and 0.400 percent ($z_{Patell} = 2.385$) for the five- and seven-day windows, respectively. As the event window expands, the gradual increase in CAR suggests a delayed response as details of the leaked documents are disseminated and digested by market participants. The magnitude of the response is economically significant. The mean (median) increase in firms' market capitalization over the seven-day window is approximately US$ 107 (35) million when estimated using the abnormal returns and approximately US$ 695 (191) million when estimated using the raw returns.

The positive market reaction to the LuxLeaks begs the question of why firms chose not to disclose the ATRs if such disclosure could boost the firms' stock price. Disclosing the ATRs could result in both proprietary costs and nontax costs (as we later analyze in the cross-sectional tests) for the firm. In general, ATRs may contain proprietary information related to sales and transfer pricing arrangements, which might reference proprietary technology, R&D, or trade-secrets (Fédération des Experts Comptables Européens, 2020; Givati, 2009; Van De Velde, 2015). Our review of the leaked documents reveals that many ATRs include organizational structures before and after the transaction and, sometimes, forecasts of expected revenue, profit, and taxes for certain entities/groups of entities. In several cases, the ATRs also disclose the involvement of other tax haven subsidiaries to which the profits are being diverted. These details are proprietary to each firm, which is why firms seek private ATRs in the first place to ensure their specific arrangements comply with the applicable tax laws. This information could be used against the firm by its competitors and other tax authorities. Regarding the additional potential nontax costs, as discussed in Section 3 of our paper, the revelation of firms' use of tax shelters may result in consumer backlash and political retaliations from governments and supra-governmental organizations (e.g., the E.U.).

The direction of the market reaction to the LuxLeaks is opposite to that observed for news of U.S. firms' tax shelter participation in Hanlon and Slemrod (2009). The average three-day CAR in their study is −0.53 percent. To test whether the difference in market reaction is attributable to the presence of non-U.S. firms in our sample, we partition the sample by headquarters location. In Panel B of Table 5, we observe that the mean CAR for the U.S.-headquartered firms is still positive and larger in magnitude than the full sample. The mean three-day CAR for U.S. firms is 1.319 percent (with $z_{Patell} = 4.709$) and increases to 2.289 percent (with $z_{Patell} = 4.995$) for the seven-day window. In comparison, the mean CAR for the group of firms headquartered in non-U.S. countries is negative but not statistically different from zero. For the U.S.-headquartered firms, the benefits of having an ATR appear to outweigh the expected costs, if any, from the leaks (e.g., consumer backlash, political costs, or parent country's tax enforcement action). This, however, does not seem to be the case for the non-U.S. firms. In the next section, we explore the factors in the HS model to explain the variation in market reaction within the full sample as well as the two subgroups of U.S. and non-U.S. firms.[31]

5.3. Multivariable regression results

Table 6 presents the results from the multivariable regression (Equation [1]) using robust OLS estimation. To identify the main factors driving the market reaction within each group, we estimate the regression on the full sample (Column 1) and separately for the U.S. and non-U.S. firms (Columns 2 and 3). The sample sizes in these analyses are smaller than the sample size in the main market reaction tests due to missing values for some of the factors. To mitigate the effect of influential

[31] In supplemental untabulated analyses, we also estimate the CAR using three other conventional models: market-adjusted returns model, Fama-French three-factor model, and Carhart four-factor model (Carhart, 1997). Carhart's four-factor model is an extension of the Fama-French three-factor model and includes a momentum factor for asset pricing of stocks. The magnitude of the market reactions as well as the statistical significance of the tests are similar to the results reported in Table 5 using the market model.

Table 5
Stock market reaction to the Luxembourg tax leaks.

	Event Window	N	Mean Cumulative Raw Returns	Mean CAR	Mean Std_CAR	Pos/Neg	Sign Test	Patell Test	Standardized Cross-sectional Test
Panel A:									
All firms	(−1,+1)	134	0.683	0.235	0.152	79:55	0.598	1.736*	1.385
	(−2,+2)	134	0.359	0.320	0.177	80:54	0.769	2.014**	1.757*
	(−3,+3)	134	2.120	0.400	0.209	83:51	1.282	2.385**	2.023**
Panel B: Firms by location of headquarters									
U.S.-headquartered firms	(−1,+1)	50	1.541	1.319	0.669	37:13	3.394***	4.709***	3.427***
	(−2,+2)	50	1.890	1.557	0.587	37:13	3.394***	4.135***	3.746***
	(−3,+3)	50	4.030	2.289	0.709	39:11	3.960***	4.995***	4.829***
Non-U.S.-headquartered firms	(−1,+1)	84	0.173	−0.410	−0.155	35:49	−1.528	−1.415	−1.288
	(−2,+2)	84	−0.553	−0.416	−0.096	36:48	−1.309	−0.617	−0.547
	(−3,+3)	84	−0.983	−0.724	−0.088	37:47	−1.091	−0.807	−0.680

Notes: This table presents the cumulative raw returns, cumulative abnormal returns (*CAR*), and standardized CAR (*Std_CAR*) centered on the date the firm is first included in the LuxLeaks documents. The ICIJ released the documents in two batches—on November 5 and December 9, 2014. Abnormal returns are calculated using the market model. Panel A reports the results for the full sample, which includes all publicly listed firms identified in the LuxLeaks documents and actively trading at the time of the release. Panel B categorizes the firms based on the location of their headquarters. Statistical tests are based on the *CAR*. Significance levels are as follows: *** indicates significance at 0.01, ** at 0.05, and * at 0.10, two-tailed.

Table 6
Multivariable analyses of stock market reaction to the Luxembourg tax leaks.

	Predicted Sign	Full Sample	U.S. Firms	Non-U.S. Firms
Dependent Var. = CAR		(1)	(2)	(3)
Delta_CETR	+	5.976***	5.810**	7.564***
		(1.811)	(2.616)	(2.397)
Above_Optimal	−	−4.602	−7.764*	−1.754
		(3.595)	(3.792)	(4.929)
Below_Optimal	+	0.719	0.923	−1.277
		(2.955)	(8.550)	(3.495)
Inst_Own	+	2.827***	−1.261	3.007**
		(1.139)	(1.610)	(1.248)
Consumer_Facing	−	−0.376	0.221	−0.318
		(0.673)	(0.851)	(1.096)
Tax_Enforcement	−	0.610	N/A	−0.684
		(0.634)	N/A	(0.961)
Size	−	−0.145	−0.247	−0.161
		(0.123)	(0.202)	(0.153)
Constant	N/A	0.706	5.587**	0.554
		(1.463)	(2.465)	(1.903)
Observations		77	28	49
R-squared		0.2909	0.2893	0.2328
Adj R-squared		0.2190	0.0863	0.1019
Mean VIF		1.32	1.55	1.31

Notes: This table reports the estimates from OLS regressions examining the factors that influence market reactions to the Luxembourg tax leaks. These factors are derived from Hanlon and Slemrod (2009)'s model of the market reaction to tax shelter news. The dependent variable is the seven-day CAR centered on the date the firm is first included in the LuxLeaks documents. Column (1) presents the regression results using the full sample where outliers with Cook's Distance measure greater than 4/n are dropped. Columns (2) and (3) present the results using subsamples of U.S.-headquartered and non-U.S.-headquartered firms, respectively. Robust standard errors are reported in parentheses. The mean variance inflation factor (VIF) is reported at the bottom of each Column. All variables are defined in Appendix A. Significance levels are as follows: *** indicates significance at 0.01, ** at 0.05, and * at 0.10, two-tailed.

observations, we drop observations with a Cook's Distance measure greater than 4/n, where n is the sample size.[32] Still, we are able to retain the majority of firms in both subgroups (28 out of 50 U.S. firms and 49 out of 84 non-U.S. firms).[33]

Overall, investors' downward revision of firm tax uncertainty (Delta_CETR) appears to be the most persistent factor that explains the cross-sectional variation in market reactions for both the U.S. and non-U.S. firms. Across all three columns, the

[32] We lose six firms when we apply the Cook's Distance requirement. The use of Cook's Distance test and robust regression have been shown to be more effective than truncation or winsorization in identifying influential observations (Leone et al., 2019). Recent tax studies have started to adopt this technique (e.g., Dyreng and Markle, 2016). We choose the Cook's Distance approach to keep our analyses within an OLS framework. Our findings are qualitatively similar when we use robust regressions.

[33] It is worth noting that results for the overall market reaction tests hold for the subsample of firms in the multivariable analyses. The mean CAR for the 28 U.S. firms in Table 6 is positive and significant (mean seven-day CAR = 1.983, p-value < 0.001) while the mean CAR for the 49 non-U.S. firms is insignificant (mean seven-day CAR = −0.166, p-value = 0.6746), untabulated. This compares to a mean seven-day CAR of 2.289 percent and −0.724 percent for the U.S. and non-U.S. firms in the total sample, respectively.

coefficients on Delta_CETR are positive (ranging between 5.810 and 7.564) and statistically significant at the 5 percent level or lower. The results are consistent with investors viewing the presence of ATRs as a positive signal of firms' effort to reduce tax uncertainty. In terms of economic magnitude, based on the estimate in Column (1), an interquartile increase in Delta_CETR is associated with a 0.789 percentage point increase in the seven-day CAR (5.976 × 0.132) or US$ 314 million.

The other factors that drive the market reaction to the LuxLeaks appear to differ between the U.S. and non-U.S. firms. For example, the second factor in the HS model—the change in investors' perceived value of tax sheltering—explains the variation in the market reaction for the U.S. firms (column 2) but not for the non-U.S. firms (column 3). For the subsample of U.S. firms, the coefficient on *Above_Optimal* is negative and significant (−7.764, standard error = 3.792), and the coefficient on *Below_Optimal* is positive but statistically insignificant. This evidence is consistent with investors penalizing the U.S. firms that are overly tax aggressive but do not appear to adjust their valuation for firms perceived to under-invest in tax avoidance. In Column (3), the coefficients for *Above_Optimal* and *Below_Optimal* are both insignificant for the non-U.S. firms.[34] Regarding the economic magnitude for the U.S. firms, a one percentage point above the optimal tax avoidance level is associated with a 0.078 percentage point decline in the seven-day CAR (−7.764 × 0.01) or US$ 31 million on average.

The coefficient on *Inst_Own* is positive and statistically significant for the non-U.S. firms (3.007, standard error = 1.248) but statistically insignificant for the U.S. firms.[35] The positive association between the market reaction and the quality of corporate governance among the non-U.S. firms is consistent with investors rewarding managers in well-governed firms for pursuing tax avoidance activities and penalizing managers in poorly-governed firms for potentially diverting shareholders' wealth. An interquartile decrease in *Inst_Own* is associated with a decline of 0.201 percentage points in CAR (3.007 × 0.067) or US$ 80 million on average for the non-U.S. firms.

The higher institutional ownership concentration among the U.S. firms—the average *Inst_Own* for this group is 75.15 percent versus 37.40 percent for the non-U.S. firms—potentially explains the lack of a significant association between CAR and *Inst_Own* within the U.S. subsample. In contrast, the lower institutional ownership concentration among the non-U.S. firms may explain the weaker market reaction for this group (as documented in Table 5). Overall, the results for corporate governance are congruent with prior empirical evidence of a positive association between managerial wealth diversion and tax avoidance among non-U.S. firms but not among U.S. firms (Blaylock, 2016; Desai and Dharmapala, 2006).

Lastly, the coefficients on *Consumer_Facing*, *Tax_Enforcement*, and *Size* are statistically insignificant across all three columns in Table 6.[36] Thus, we fail to reject the null hypotheses that consumer backlash, tax enforcement, or political cost do not explain investors' reaction to the LuxLeaks. The lack of evidence of investors' concern about consumer backlash is consistent with other empirical studies. Gallemore et al. (2014) posit that the lack of an effect could be because firms with reputational costs avoid tax shelters altogether, and only those immune to reputational costs would engage in them. The lack of evidence on the effect of *Size* could be because firms exposed in the leaks are generally large multinational corporations, and so the variation in *Size* is not sufficiently large enough to explain the market response. Finally, the lack of evidence on the effect of *Tax_Enforcement* is consistent with the ATRs providing legal protection from attempts by home-country tax authorities to recoup the foregone taxes.

In all three columns, we report the mean VIF to assess the severity of multicollinearity in each regression. When multicollinearity is high, the regression coefficients remain consistent but are no longer reliable because the standard errors are inflated. VIF is a commonly used tool to detect whether severe multicollinearity exists by measuring how much the estimated coefficient's variance (or standard error) is inflated due to collinearity. Researchers have different rules of thumb regarding when VIFs indicate significant multicollinearity. Whereas some researchers consider VIF above 10 to be problematic (e.g., Hair et al., 1995; Marquardt, 1970; Vittinghoff et al., 2012), others consider values above 4 or 5 to be a cause for concern (e.g., Menard, 2001; Pan and Jackson, 2008; Rogerson, 2001). In any case, the average VIFs of our regressions range from 1.31 to 1.55 and, hence, do not suggest significant multicollinearity concerns in our regressions.

In summary, the results from the multivariable analyses provide consistent evidence that investors' downward revision in tax uncertainty explains the positive market reaction for firms in our sample regardless of the location of their headquarters. The differences in the mix of factors appear to explain the lower market reaction among the non-U.S. firms.

[34] There is a possibility our measure of *Tax_Optimal* is confounded by *Delta_CETR* if the ATR's savings are reflected in the book ETRs at the time of the leaks. We cannot ascertain from the leaked documents whether the ATRs were still in effect at the time of the leaks. As a sensitivity test, we exclude *Delta_CETR* and rerun the multivariable regression. The coefficients for the tax optimality measures are consistent with those reported in Table 6, suggesting that the above-mentioned concern is minimal and likely does not affect our inferences.

[35] Bushee (1998) finds that dedicated (and quasi-index) institutional investors play a greater monitoring role in corporate governance whereas transient investors tend to focus more on the short term. In untabulated analysis, we replace *Inst_Own* with the percentage of dedicated institutional investors. One drawback to using this proxy for our setting is that it is only available for firms covered in institutional investors' 13-F filings with the Securities and Exchange Commission. Our findings hold in the full sample; however, we are unable to perform the multivariate test within the subsamples due to a significant loss of observations. We thank Professor Brian Bushee for sharing the data on dedicated investors.

[36] The results (untabulated) are qualitatively similar when we use *Retail_Industry* as the proxy for the likelihood of consumer backlash except that the coefficient on *Retail_Industry* becomes positive and statistically significant at the 10% level for the subsample of non-U.S. firms. The positive association between *Retail_Industry* and CAR runs counter to our expectation. Prior analysis finds that retail firms are, on average, less tax aggressive than non-retail firms (PwC, 2016). Hence, this result could be explained by investors reacting positively to retail firms' efforts to reduce taxes when their ETRs suggest they are not tax aggressive. The endogenous choice of tax planning strategies among firms in the retail industry is a concern that Hanlon and Slemrod (2009) also mention in their study.

6. Limitations and robustness tests

There are a few caveats and limitations to our study. First, we cannot reliably identify whether investors knew about the existence of ATRs prior to LuxLeaks either through disclosures in the financial statements or other sources. We examine 10-K filings and annual reports for the firms in our sample and find no evidence of disclosure of the ATRs with Luxembourg in either the year the tax ruling was granted or the subsequent years. We find that 43 out of 50 U.S.-headquartered firms in our subsample disclose having at least one subsidiary in Luxembourg in their 2013 financial statements. However, if the investors knew about the ATRs before the leaks, that would go against us observing a positive market response.

In untabulated analyses, we perform additional tests to identify any spillover effects for other multinational firms that investors reasonably expect to have an ATR with Luxembourg. We start with a sample of all U.S. multinational firms that disclose at least one Luxembourg subsidiary in their Exhibit 21 filing between 2010 and 2013. We then match firms in this group to the 50 U.S.-headquartered firms exposed in the LuxLeaks based on market capitalization and industry (Fama-French 12 industry classification). This results in a list of 278 matched firms. We document a positive and significant spillover effect for the matched firms (seven-day CAR = 1.32 percent, approximately two-thirds of market reaction observed for the 50 U.S. firms in our main sample). The results suggest that the leaks provided investors with information regarding the uncertainty of firm tax avoidance, not only for the firms exposed but also for those that investors reasonably expect to employ similar tax risk-management strategies.

Second, the use of an event-study methodology has its limitations. We cannot rule out the possibility that the market reaction is confounded by other news announced during the event windows. To partially mitigate this problem, we cross-check with the Bloomberg database for other news announcements during the seven-day event window. We identify 27 firms (8 U.S. and 19 non-U.S.) with earnings announcements between the first and second leak dates. We rerun our market reaction tests, excluding these firms. Overall, the results (untabulated) are qualitatively similar. The mean seven-day CAR for the subsample of 107 public firms is 0.237 percent, which is smaller than the 0.400 percent reported for the full sample (Panel A of Table 5). The mean CAR for the 42 U.S. firms without earnings announcements is 1.51 percent versus 2.289 percent in the main results (Panel B of Table 5). Whereas the market response is smaller, the mean CARs remain statistically significant.[37] The mean CAR for the non-U.S. firms remains negative but statistically insignificant.

To further mitigate the concern about potential confounding news, we conduct market reaction tests for significant subsequent developments following the LuxLeaks. The results are provided in Online Appendix A. In general, we observe that the market reactions are consistent with investors adjusting their assessment of the firms' tax uncertainty in the direction of the news (i.e., heightened/lowered tax uncertainty is associated with negative/positive abnormal returns). For example, we observe a positive market reaction to news of the E.U. Parliament's rejection of the call for a full inquiry into the LuxLeaks on February 12th, 2015, and a negative reaction to the news that the E.U. had launched an investigation into McDonald's tax arrangements with Luxembourg on December 3rd, 2015.[38] These findings provide additional evidence that the positive market response documented in our study results from a reduction in investors' perceived tax uncertainty.

7. Conclusion

A reduction in corporate tax payments should enhance firms' value. However, prior event studies consistently document negative market reactions to news about firms' involvement in tax-aggressive activities (e.g., Bauer and Klassen, 2017; Hanlon and Slemrod, 2009; O'Donovan et al., 2019). Such findings are somewhat surprising given that new information about firms' involvement in tax avoidance should be positive news to shareholders. Whereas prior studies focus on explanations based on the potential costs (e.g., tax enforcement, reputational and political costs), our study examines tax uncertainty as an unexplored but important additional factor that influences investors' reaction to tax shelter news.

We utilize the exogenous event of the Luxembourg tax leaks to investigate the market reaction to news about firms' aggressive tax strategies and efforts to minimize tax uncertainty via advance tax rulings. Contrary to prior findings, we find that the market reacts positively. This positive reaction is concentrated among the U.S. firms. Using estimates of the tax savings originating from these rulings as a measure of the portion of uncertainty that was resolved after the leaks, we find robust evidence of a positive association between abnormal returns and the reduction in tax uncertainty. This result holds among both the U.S. and non-U.S. subsamples and suggests that the positive market reaction is primarily driven by the downward revision of investors' prior perceptions about firms' tax uncertainty associated with their Luxembourg operations.

Following prior studies, we explore corporate governance, tax optimality, consumer backlash, political cost, and tax enforcement as additional factors that could explain the variation in the market reaction within the U.S. and non-U.S. subsamples. We find that investors react negatively toward poorly-governed non-U.S. firms, indicating concerns about managerial wealth diversion (Desai and Dharmapala, 2006, 2009; Desai et al., 2007). We also document a weaker market reaction among the U.S. firms that appear to have over-invested in tax avoidance (Hanlon and Slemrod, 2009). We fail to document significant associations between the market reaction and the remaining factors. The lack of significant results for the tax

[37] The mean CAR for the subsample of 107 firms is statistically significant at the 5 percent level (z Patell = 1.92; z SignTest = 1.84; and z StdCSTest = 1.83) while the mean CAR for the 42 U.S. firms is statistically significant at the 1 percent level (z Patell = 3.5; z SignTest = 3.09; and z StdCSTest = 4.07).

[38] McDonald's Corporation was not among the firms exposed in the LuxLeaks documents.

enforcement and consumer backlash factors is consistent with our primary assumption that the tax rulings provide legal protection from attempts to recoup foregone taxes and the absence of long-term adverse consequences from tax shelter activities (Gallemore et al., 2014).

Our study makes two broad contributions to the literature. First, we contribute to the understanding of how tax uncertainty affects firm valuation, adding to the emerging literature on tax risk and uncertainty as a separate construct from tax avoidance (e.g., Dyreng et al., 2019; Guenther et al., 2017; Neuman et al., 2020). Our findings suggest that investors' reaction to news of tax shelter activity is conditional on whether the new information heightens or reduces their perception of the uncertainty associated with such tax planning activities. This result reconciles the seemingly inconsistent findings in prior literature, which document investors incentivizing tax avoidance activities that maximize firm value but reacting negatively to news of tax shelter involvement. Second, our findings contribute to the understanding of firm characteristics that affect investors' valuation of tax avoidance and how these relations vary between U.S. and non-U.S. firms (e.g., Desai et al., 2007; Blaylock, 2016; Seidman and Stomberg, 2017). In summary, our study sheds light on the importance of tax uncertainty to investors and should be of interest to shareholders, managers, and tax authorities.

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Declaration of competing interest

None.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jacceco.2022.101537.

Appendices

Appendix A. Variable Definitions

Variable	Definition	Data source
$Above\_Optimal_i$	Equal to *TaxAvoid_Adj_Peers* if *TaxAvoid_Adj_Peers* is greater than zero, i.e., if the firm *i*'s tax avoidance is above its matched peers, zero otherwise.	Compustat North America and Compustat Global
$Below\_Optimal_i$	Equal to *TaxAvoid_Adj_Peers* if *TaxAvoid_Adj_Peers* is less than or equal to zero, i.e., if the firm *i*'s tax avoidance is below its matched peers, zero otherwise.	Same as above
CAR_i	Cumulative abnormal returns are measured over an n-day event window centered on the date firm *i* first appeared in the LuxLeaks documents. Daily abnormal returns are the difference between the actual return (including dividends) and the expected return as derived from the market model ($R_{it} = \alpha i + \beta i\ Rmt + uit$ where R_{mt} = value-weighted index of the major indices of the local stock exchanges where the firms are listed).	CRSP, Yahoo Finance, and Google Finance

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Variable	Definition	Data source
$CETR_i$	Cash effective tax rate (*CETR*) is defined as firm *i*'s cash tax paid divided by pretax income before special items. *CETR* is truncated to range between 0 and 1 or set to missing for loss firms.	Compustat North America, Compustat Global, and firms' financial statements
$Consumer\_Facing_i$	An indicator variable equal to 1 if firm *i* provides goods or services for end-user consumption, zero otherwise.	Firms' websites
$Delta\_CETR_i$	Firm *i*'s CETR in the fiscal year prior to the first signed ATR minus the firm's CETR in the subsequent fiscal year after the last signed ATR.	Compustat North America, Compustat Global, and firms' financial statements
$Size_i$	Natural logarithm of firm *i*'s total assets at the end of the fiscal year prior to the LuxLeaks, measured in US$ millions.	Compustat North America, Compustat Global, and firms' financial statements
Std_CAR_i	Standardized cumulative abnormal return for firm *i* is the cumulative abnormal return (CAR) scaled by the standard deviation of the residual obtained from estimating the market model.	CRSP, Yahoo Finance, and Google Finance
$TaxAvoid\_Adj\_Peers_i$	Firm *i*'s annual book effective tax rate (total tax expense scaled by pretax income) for the fiscal year prior to the LuxLeaks minus the mean book ETR for the portfolio of firms in the same headquarters country, industry, and quintile for total assets, sorted independently. We multiply the measure by −1 so that higher values capture more tax avoidance. Industry classification is based on the 12 industries as defined by Fama and French (1997).	Compustat North America and Compustat Global
$Tax\_Enforcement_j$	An indicator variable equal to 1 if the tax enforcement score for firm *i*'s headquarters country in 2014 is above the median and zero otherwise. Tax enforcement score is based on six characteristics of the international tax system for the headquarters country as designed in Beuselinck et al. (2015).	EY Worldwide Corporate Tax and Transfer Pricing Guides 2014
$Inst\_Own_i$	The percentage of firm *i*'s outstanding shares held by institutional investors at the end of the fiscal year prior to the LuxLeaks.	Thomson Reuters Institutional Holdings and Orbis

Appendix B. Example of How Changes in Tax Uncertainty Affect a Firm's Valuation

We first present a general example of how the reduction in tax uncertainty affects firm value. Assume a firm engages in a single tax avoidance strategy. Shareholders can observe the current period tax savings (S) from the firm's financial statements (e.g., through the cash effective tax rate). However, they are aware that there is a non-zero probability, p, that a portion of the tax savings could be lost in the future if the relevant tax authority contests the tax position. Shareholders form their perception about $p(.)$ from their information set. Their expected future cash outflow from the uncertain tax position equals $p(S)$, which is incorporated into the share price, I. If shareholders receive new information that reduces tax uncertainty, e.g., the existence of a favorable tax ruling, such that the expected cash outflow declines, $p(S) \rightarrow 0$, then share price, I, will increase.

Let's take a numeric example of a firm engaging in a tax avoidance strategy that generates savings of $100 today. The strategy has two possible outcomes within the statute of limitations; the strategy could be accepted (i.e., permanent tax savings of $100) with 60 percent probability or completely disallowed (i.e., permanent tax savings equal $0) with 40 percent probability. Assuming the market knows this distribution, the expected cash flow is $60. This translates into a valuation of $600, assuming $60 into perpetuity and a discount rate of 10%.

Table B.1
Expected Cash Flow from Tax Avoidance Strategy

Tax Savings	Today's Tax Savings	Potential Future Tax Costs	Probability	Expected Costs	Expected Cash Flow
Outcome 1	$100	$(0)	60%	$0	
Outcome 2	$100	$(100)	40%	($40)	
Expected Cash Flow	**$100**			**($40)**	**$60**

Now, let's assume that the firm obtained a favorable tax ruling prior to executing the strategy but did not disclose that information. Subsequently, the shareholders learn about the existence of the tax ruling. This reduces the probability of Outcome 2 to zero; the net expected cash flow is now $100, and the valuation of the tax avoidance strategy increases to $1000.

Appendix C. Names, Headquarters Location, and Main Stock Exchange for Firms in Final Sample

Company Name	Exchange	Country	Company Name	Exchange	Country
3I GROUP PLC	UKX	GBR	COACH INC (later TAPESTRY INC)	SPX	USA
ABBOTT LABORATORIES	SPX	USA	COCA-COLA HBC AG	UKX	CHE
ACCENTURE PLC	SPX	IRL	COMMERZBANK AG	DAX	DEU

(*continued*)

Company Name	Exchange	Country	Company Name	Exchange	Country
AMERICAN INTERNATIONAL GROUP	SPX	USA	COMPANHIA BRASILEIRA DE DISTRIBUIÇÃO	BEL20	BRA
AMERIPRISE FINANCIAL INC	SPX	USA	COMPASS GROUP PLC	UKX	GBR
AMP CAPITAL INVESTORS	XAO	AUS	CRÉDIT AGRICOLE S.A.	CAC	FRA
ANHEUSER-BUSCH INBEV	SPX	BEL	CREDIT SUISSE	SPX	CHE
APOLLO GLOBAL MANAGEMENT LLC	SPX	USA	DEAN FOODS/WHITEWAVE FOODS CO	SPX	USA
ARCH CAPITAL GROUP LTD	SPX	BMU	DEUTSCHE BANK AG	DAX	DEU
AVERY DENNISON CORP	SPX	USA	DEVELOPERS DIVERSIFIED REALTY CORPORATION (later DDR CORP)	SPX	USA
AVIVA PLC	UKX	GBR	DEXIA SA	BEL20	BEL
AXA GROUP (later CREDIT SUISSE)	CAC	FRA	DST SYSTEMS INC	SPX	USA
BALL CORP	SPX	USA	E.ON SE	DAX	DEU
BALOISE HOLDING AG	SMI	CHE	EQT CORP	SPX	USA
BANCA POPOLARE DELL'EMILIA ROMAGNA S.C.	FTSEMIB	ITA	EUSA PHARMA (later JAZZ PHARMACEUTICALS)	SPX	IRL
BANCO BRADESCO SA	SPX	BRA	EVRAZ PLC	UKX	GBR
BAYTEX ENERGY CORP	SPX	CAN	EXPERIAN PLC	UKX	IRL
BJÖRN BORG AB	OMXSPI	SWE	FAIRFAX FINANCIAL HOLDINGS LIMITED	OSPTX	CAN
BLACKSTONE GROUP LP	SPX	USA	FEDEX CORP	SPX	USA
BLUEBAY (later ROYAL BANK OF CANADA)	SPX	CAN	FONCIERE INEA S.A.	CAC	FRA
BNP PARIBAS	CAC	FRA	GENERAL ELECTRIC CO	SPX	USA
BRITISH AMERICAN TOBACCO PLC	UKX	GBR	GIGAMEDIA LIMITED	SPX	TWN
BROOKFIELD ASSET MANAGEMENT	OSPTX	CAN	GLANBIA PLC	UKX	IRL
BUCHER INDUSTRIES AG	SMI	CHE	GLAXOSMITHKLINE PLC	SPX	GBR
BURBERRY GROUP PLC	UKX	GBR	GOODMAN GROUP PTY. LTD.	XAO	AUS
CARLYLE GROUP LP	SPX	USA	GROUPE BRUXELLES LAMBERT S.A.	BEL20	BEL
CATERPILLAR INC	SPX	USA	HARBINGER GROUP (later HRG GROUP INC)	SPX	USA
CBRE GROUP INC	SPX	USA	HENDERSON GROUP PLC (later JANUS HENDERSON GROUP PLC)	UKX	GBR
CHINA PETROLEUM & CHEMICAL CORP	HSI	CHN	HSBC HOLDINGS PLC	UKX	GBR
CHUBB LTD (later ACE GROUP)	SPX	USA	HUTCHISON GROUP/HUTCHISON WHAMPOA	HSI	HKG
CIRCOR INTERNATIONAL INC	SPX	USA	INFORMA PLC	UKX	GBR
CITIGROUP INC	SPX	USA	INTELSAT SA	SPX	LUX
CLIFFS NATURAL RESOURCES INC	SPX	USA	INTERNATIONAL FLAVORS & FRAGRANCES INC	SPX	USA
CNP ASSURANCES SA	CAC	FRA	INTERPUBLIC GROUP OF COMPANIES INC	SPX	USA
INTESA SANPAOLO S.P.A.	FTSEMIB	ITA	STATE STREET CORP	SPX	USA
INVESTCORP/BARCLAYS PLC	UKX	GBR	SUBSEA 7 S.A.	OSEAX	GBR
JARDINE MATHESON GROUP	STI	HKG	SWIRE PACIFIC LIMITED	HSI	GBR
JONES LANG LASALLE INC	SPX	USA	SYKES ENTERPRISES INC	SPX	USA
JPMORGAN CHASE & CO	SPX	USA	TAYLOR WIMPEY PLC	UKX	GBR
LAGARDÈRE SCA	CAC	FRA	TELE2 AB	OMXSPI	SWE
LUBRIZOL (later BERKSHIRE HATHAWAY)	SPX	USA	TELECOM ITALIA GROUP	FTSEMIB	ITA
LVMH MOET HENNESSY LOUIS VUITTON S.A.	CAC	FRA	TELENET GROUP HOLDING NV	BEL20	BEL
MACQUARIE GROUP LIMITED	XAO	AUS	TEMENOS AG	SMI	CHE
MCGRAW HILL FINANCIAL INC (later S&P GLOBAL INC)	SPX	USA	TEVA PHARMACEUTICALS INDUSTRIES LTD	SPX	ISR
MERRILL LYNCH/BANK OF AMERICA CORPORATION	SPX	USA	THE VITEC GROUP PLC	UKX	GBR
METTLER-TOLEDO INTL INC	SPX	USA	TIMBERLAND (later VF CORP)	SPX	USA
MILLIPORE (later MERCK & CO., INC.)	DAX	DEU	TITAN INTERNATIONAL INC	SPX	USA
MYLAN NV	SPX	GBR	UBM PLC	UKX	GBR
NAVISTAR INTERNATIONAL CORP	SPX	USA	UBS GROUP AG	SMI	CHE
NORDSON CORP	SPX	USA	UNIBANCO BRAZIL (later ITAÚ UNIBANCO)	BEL20	BRA
OAKTREE CAPITAL GROUP LLC	SPX	USA	UNICREDIT S.P.A.	FTSEMIB	ITA
OFFICE DEPOT INC	SPX	USA	UNIONE DI BANCHE ITALIANE S.P.A.	FTSEMIB	ITA
PEPSICO INC	SPX	USA	UNITED AMERICA INDEMNITY (later GLOBAL INDEMNITY)	SPX	IRL
PIMCO (later ALLIANZ SE)	DAX	DEU	UNITED TECHNOLOGIES CORP	SPX	USA
PROCTER & GAMBLE CO	SPX	USA	VASTNED OFFICES/INDUSTRIAL NV	AEX	NLD
PROLOGIS INC	SPX	USA	VERIZON COMMUNICATIONS INC	SPX	USA
PRUDENTIAL PLC	UKX	GBR	VERMILION ENERGY TRUST (later VERMILION ENERGY INC)	SPX	CAN
RECKITT BENCKISER GROUP PLC	SPX	GBR	VODAFONE GROUP PLC	SPX	GBR
ROWAN COMPANIES PLC	SPX	USA	VOLKSWAGEN AG	DAX	DEU
SCHAWK INC (later MATTHEWS INTERNATIONAL CORP)	SPX	USA	WALT DISNEY CO	SPX	USA
SCHRODERS PLC	UKX	GBR	WARNER CHILCOTT (later ALLERGAN)	SPX	IRL
SHIRE PLC	UKX	IRL	WEATHERFORD INTERNATIONAL PLC	SPX	CHE
SKANDINAVISKA ENSKILDA BANKEN AB	OMXSPI	SWE	WENDEL S.A.	CAC	FRA

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Company Name	Exchange	Country	Company Name	Exchange	Country
SKYPE (later MICROSOFT CORP)	SPX	USA	WHITE MOUNTAINS INSURANCE GROUP LTD	SPX	BMU
SRV YHTIÖT OYJ	HEX25	FIN	WOLSELEY PLC	UKX	CHE
STANLEY BLACK & DECKER INC	SPX	USA	X-RITE (later DANAHER CORP)	SPX	USA
STAPLES INC	SPX	USA	YAMANA GOLD INC	SPX	CAN

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