Do U.S. Multinational Firms Benefit from Competitive Tax Advantages through Advance Tax Rulings in Europe?

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This research aims to provide empirical evidence of competitive tax advantages through advance tax rulings (ATRs) among large U.S. multinational firms engaged in Ireland, Luxembourg, and the Netherlands. We examine stock price reactions to recent State aid investigations of ATRs by the European Commission. Negative stock price reactions to the majority of state aid investigations suggest the existence of advantages that might be diminished through state aid rules. Moreover, positive abnormal returns surrounding interventions by the U.S. government imply a successful attempt to protect U.S. firms' tax avoidance opportunities in Europe.

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1. Introduction

Over the last years, the media and public institutions have revealed how the European Union (EU) Member States Ireland, Luxembourg, and the Netherlands provided large multinational U.S. firms with substantial tax advantages. These advantages were granted via confidential advance tax rulings (ATRs). ATRs are "a procedure that allows taxpayers to achieve certainty concerning the tax consequences of a contemplated transaction" (Givati, 2009, p. 139). A prominent case is Apple (European Commission, 2016a). The firm owns the Irish-incorporated Apple Sales International, which records all profits from European sales. Two ATRs by the Irish tax authorities enabled Apple to attribute nearly all the taxable profits of Apple Sales International to a "head office" that existed only on paper. These profits were not subject to tax anywhere, leading to an effective tax rate (ETR) of 0.005 percent in 2014. The European Commission (2016a) criticized the fact that the two ATRs do not correspond to economic reality and give Apple a significant advantage over other businesses that are subject to the same national taxation rules in Ireland (i.e., preferential ATRs). Since 2014, the European Commission (2014a) has been using a tool of EU competition law to tackle such preferential ATRs: EU state aid rules.[1] State aid rules disallow Member States from granting advantages to certain firms which position them in a more favorable situation than other firms if that measure threatens to distort competition in the European Single Market. Put differently, state aid rules aim to ensure that firms equally benefit from government support in the EU Member States and thus avoid competitive advantages for some firms over others.

It is striking that known cases of preferential ATRs mainly concern U.S. multinational firms (i.e., Starbucks, Fiat Chrysler, Apple, Amazon, and McDonald's). The question is whether more U.S. firms benefitted from competitive tax advantages through ATRs. We use the setting of current state aid investigations by the European Commission to provide empirical evidence of

[1] Art. 107 (1) of the Treaty on the Functioning of the EU (TFEU).

competitive tax advantages through preferential ATRs among large U.S. multinational firms in Europe. In detail, we assess stock price reactions to these investigations as well as to actions of the U.S. government against the application of EU state aid rules.

Prior literature (e.g., Givoly and Hayn, 1992; Amir, Kirschenheiter, and Willard, 1997; Beaver and Dukes, 1972) provides unequivocal evidence that corporate taxes are capitalized into stock prices. Consistent with this view, previous research shows that tax avoidance is positively valued by investors (e.g., Desai and Dharmapala, 2009; Bryant-Kutcher, Guenther, and Jackson, 2012). We therefore assume that potential competitive tax advantages through ATRs were capitalized into prices before the beginning of state aid investigations. State aid rules can lead to recoveries of unlawful tax advantages for a period of up to ten years. Additionally, the firm loses future advantages associated with the preferential ATR. Thus, in line with prior literature on disadvantageous tax reforms (e.g., Edwards and Shevlin, 2011; Hoopes, Thornock, and Williams, 2016), we argue that stock price reactions to state aid investigations should reflect the expected value of past and future competitive tax advantages that might be diminished through the application of state aid rules.

We measure competitive tax advantages indirectly by looking at stock price reactions to a potential loss of these advantages, rather than directly comparing effective tax rates (ETRs), market shares, or after-tax returns between firms. Our design is related to Hoopes, Thornock, and Williams (2016), who, in order to assess competitive advantages for online retailers, examine stock market returns surrounding legislative events that change the collection of sales taxes. Implicitly, we assume that a lower tax cost constitutes a competitive advantage. This view is consistent with Porter (1985), who claims that firms can possess competitive advantages vis-à-vis competitors through low cost or differentiation. Hansmann (1987) emphasizes that exemptions from corporate income taxes for some firms affect competition. In detail, he provides evidence that not-for-profit firms are able to increase their market share vis-à-vis for-profit firms because of an exemption from sales taxes and corporate income taxes.

State aid investigations of preferential ATRs are an optimal setting for our research. First, U.S. multinational firms did not have any reason to question the certainty of their tax benefits prior to the start of the investigations. Tax benefits had been previously assured by confidential, individual ATRs that tax administrations of some EU Member States officially granted to the firms. Moreover, firms could hardly anticipate the recent state aid approach taken by the European Commission. Consequently, we can generally rule out the possibility that firms had already informed the capital market about the uncertainty of these tax benefits, for instance, by accounting for uncertain tax positions according to FIN 48 (DLA Piper, 2016). Second, to qualify as a measure as unlawful state aid, a selective tax advantage over other firms must be granted (European Commission, 2016a). We are thus able to isolate those competitive tax advantages that some EU Member States offered through preferential ATRs from tax benefits that all firms can achieve through tax avoidance.

Our paper contributes to prior research in several ways. Whereas firms are often criticized for their tax strategy (Hanlon and Slemrod, 2009), the discussion has recently shifted towards the responsibility of national governments (Marian, 2017). Extensive research on the role of taxes in competition demonstrates that some countries try to attract foreign investments by offering favorable tax rates or facilitating the avoidance of taxes that might otherwise have to be paid to other countries (e.g., Dharmapala, 2008; Dharmapala and Hines, 2009; Slemrod and Wilson, 2009). Ireland, Luxembourg, and the Netherlands are tax havens according to prior research (Dharmapala and Hines, 2009; Hines and Rice, 1994) and they belong to the most important tax-related locations for U.S. firms in Europe (e.g., Lewellen and Robinson, 2013). Given their confidential nature, little is known about the extent of competitive tax advantages granted by these EU Member States via preferential ATRs to U.S. multinational firms. There is only anecdotal evidence that preferential ATRs granted by Ireland, Luxembourg, and the Netherlands could be widespread. In November 2017, for instance, the “Paradise Papers”

revealed that the U.S. firm Procter & Gamble receives estimated tax benefits of 169 million USD, which the Netherlands granted to the firm through a presumably formally incorrect ATR.[2]

Moreover, this research underlines the crucial role the U.S. government plays when it comes to tax avoidance by U.S. multinational firms in Europe (Kleinbard, 2011). The U.S. government has been criticized for facilitating tax avoidance by U.S. multinational firms outside of the United States. Despite higher statutory tax rates in the United States, Avi-Yonah and Lahav (2010) find that ETRs of the largest U.S. multinational firms are similar or even lower than ETRs of the largest EU multinational firms. They mention lenient U.S. controlled foreign corporation (CFC) rules as one of the reasons for this result. The "check-the box" regulations are an important factor in this respect, since they enable the creation of hybrid entities (Grubert and Altshuler, 2013) and foreign tax base erosion via royalty payments to low-tax countries (Grubert and Mutti, 2009).

We use a sample of 242 large U.S. headquartered multinational firms[3] with subsidiaries in Ireland, Luxembourg, and the Netherlands because these three countries are accused of offering preferential ATRs. Moreover, Nesbitt, Outslay, and Persson (2017) claim that these three countries have one of the most generous and flexible ATR policies. The focus on large firms follows from the political power theory (Siegfried, 1972). Since large firms should exert a stronger influence on political institutions than small firms, preferential ATRs might be predominantly granted to larger firms. We then employ an event study methodology suggested by MacKinlay (1997) and assess stock price reactions to eight events, which we either classify as potentially negative (published investigations and negative decisions by the European Commission regarding U.S. firms) or positive (announced support by the U.S. government for

[2] See *Financial Times* "Netherlands to investigate 4,000 corporate tax deals." November 8, 2017. https://www.ft.com/content/df1156dc-c497-11e7-a1d2-6786f39ef675. In detail, the tax authorities violated double-check principles for appropriate quality control.

[3] Large in this context means being a Fortune 500 firm. Given our aim of assessing competitive advantages beyond those already targeted by the European Commission, we exclude those firms that were publicly targeted by EU State aid investigations and/or decisions during our examination period.

U.S. firms targeted by state aid investigations) from an investor perspective. If there were negative stock price reactions to state aid investigations and decisions, this could indicate the existence of a competitive advantage for some firms beyond those that have been already targeted. Moreover, positive reactions to subsequently announced U.S. governmental support would suggest that investors expect the U.S. government to protect firms' competitive tax advantages in Europe.

Consistent with the likely forfeiture of competitive tax advantages among U.S. multinational firms, we find negative mean cumulative abnormal returns (CARs) for the majority of announced EU state aid investigations and decisions by the European Commission. The effects are economically relevant. For the event that yields the largest effects, for instance, we detect abnormal cumulative changes in market value of 176.68 billion USD for our sample firms. Turning to events that signal support by the U.S. government for U.S. multinational firms, we find positive mean CARs, suggesting that the capital market anticipates that the U.S. government will mitigate the consequences arising from EU state aid investigations and defend the U.S. firms' ability to avoid taxes in Europe. In additional regression analyses, we show that stock price reactions are more negative among firms with a higher level of tax avoidance. To ensure that the identification of effects is sufficiently clear, we use propensity score matching technique to generate a control group of U.S. multinational firms without subsidiaries in the three countries concerned. More negative stock price reactions among large U.S. firms with subsidiaries in Ireland, Luxembourg, and the Netherlands compared to the control sample provide further support for the proposition that this group benefits from competitive tax advantages in Europe.

This paper applies the following outline: Section 2 illustrates EU state aid rules. Next, the relevant events, the sample selection, and the research methodology (section 3) are explained. Sections 4 through 6 present the results.

2. Institutional Background

2.1 EU State Aid Rules

EU state aid rules are part of EU competition law. They aim to ensure that firms equally benefit from government support in Europe, and thus avoid advantaging some firms over their competitors in the European Single Market. Under Art. 107 (1) TFEU, the EU disallows Member States from granting an advantage to certain firms which positions them in a more favorable situation than other firms. If the European Commission, as the competent authority in this regard, deems a measure (i.e., a preferential tax scheme or a preferential ATR) to be unlawful state aid, the EU Member State concerned has to recover the granted and paid out state aid (including interest) from the beneficiary firm for a period of up to 10 years.[4] There are no additional penalties. Beyond these recoveries, firms lose potential future advantages associated with the measure. The respective Member States and firms directly affected have the right to appeal the decision before the Court of Justice of the EU based on Art. 263 TFEU.

In detail, according to the Commission Notice on state aid, the following five major requirements need to be fulfilled to classify a measure as unlawful EU state aid (European Commission, 2016a): (1) notion of undertakings and economic activity, (2) advantage, such as a reduction in the tax base or the amount of tax, (3) state origin of the advantage, (4) selectivity, and (5) effect on trade and competition. With regard to the fifth requirement, the Court of Justice of the EU simply states that "a distortion of competition within the meaning of Article 107(1) of the Treaty is generally found to exist when the State grants a financial advantage to an undertaking in a liberalised sector where there is, or could be, competition." (DG Competition, 2016, 6.2). Selectivity has often been the decisive criterion for a measure to ultimately qualify as unlawful state aid. In order to be "selective", a state has to favor certain undertakings, categories of undertakings, or economic sectors.

[4] Art. 17 of Council Regulation (EU) 2015/1589 of July 13, 2015, OJ 2015 L 248/9.

2.2 Investigation of Individual ATRs

Prior to 2014, state aid investigations focused on preferential tax schemes of Member States that were codified in the respective tax codes or circulars (DG Competition, 2016). In June 2014, the Commission started official inquiries regarding individual, confidential ATRs that Ireland, Luxembourg, and the Netherlands issued to large multinational firms in direct tax affairs. The Commission accused these countries of using ATRs to selectively provide competitive tax advantages in transfer pricing matters. In detail, the Commission stated that such preferential ATRs assured the calculation of a taxable basis that was not based on remuneration on market terms, resulting in a more favorable tax treatment. Subsequently, investigations were extended to confirmatory preferential ATRs regarding hybrid arrangements. Such arrangements provided firms with potential long-term tax deferral or double non-taxation of non-repatriated overseas profits (e.g., Avi-Yonah, 2016; Grubert, 2012).

The first four of the six[5] publicly known state aid investigations in this area deal with ATRs on transfer pricing and profit allocation methods; the last two cases concern confirmatory ATRs regarding a mismatch through a hybrid branch and a hybrid security. All preferential ATRs investigated were granted to large multinational firms, four of which are headquartered in the United States (Apple, Starbucks, Amazon, and McDonald's). Stemming from the merger of Italy-based Fiat and U.S. based Chrysler, Fiat Chrysler Automobiles retains operational headquarters in Detroit.[6] Overall, only Engie (formerly named GDF Suez) has neither a U.S. headquarters nor a significant economic interest in the United States. Table 1 provides an overview of the six EU state aid cases.

[Insert Table 1 about here]

[5] The European Commission mentions two further cases on its website: "Excess profit exemption in Belgium" (SA.37667) and "UK tax scheme for multinationals" (SA.44896). However, these cases directly relate to a specific legal provision of the Belgian or UK tax code instead of challenging advantages granted via ATRs. Therefore, we exclude these cases from our analyses.

[6] See *The Wall Street Journal*. "5 things to know about Fiat Chrysler's U.S. listing." October, 13, 2014. http://blogs.wsj.com/briefly/2014/10/13/5-things-to-know-about-fiat-chryslers-u-s-listing/.

The affected EU Member States, as well as the U.S. government, have raised concerns about the European Commission's approach in this matter. The U.S. Department of the Treasury (2016) stresses that the Commission applies the state aid rules retroactively and under a new legal theory.[7] Moreover, the Treasury complains that the interpretation conflicts with existing double tax treaties and that the right to tax these profits belongs to the United States. In the U.S. worldwide tax system, low-taxed foreign income increases the differential to the U.S. statutory tax rate, and thereby increases the U.S. tax claim (Dyreng and Lindsey, 2009). The affected EU Member States filed appeals against the European Commission's decision and emphasize that the tax benefits granted are not selective and are consistent with their domestic tax law.[8]

3. Research Design

This research employs an event study to test stock price reactions to European Commission's state aid investigations of preferential ATRs granted to U.S. multinational firms and actions of the U.S. government to support the U.S. firms concerned. We describe the relevant event dates, the sample, and the methodological approach in the following subsections.

3.1 Identification of Key Events

Table 2 depicts all key event dates. On June 11, 2014, the European Commission (2014a) officially announced formal state aid investigations with respect to preferential ATRs on transfer pricing (event #1). The investigations concerned ATRs granted by Ireland, Netherlands, and Luxembourg to three multinational firms (Apple, Starbucks, and Fiat). Subsequently, the European Commission (2014b) published additional investigations of Amazon's transfer pricing practices in Luxembourg (event #2, October 7, 2014). The European Commission (2015a) made its first – from the investors' point of view – negative decision with

[7] In detail, the U.S. Department of the Treasury (2016, p. 6) accuses the Commission of merging two of the above-mentioned requirements (i.e., selectivity and advantage) and of simply investigating the joint criterion "selective advantage" instead of doing so in two separate and distinct steps.

[8] E.g., Case T-778/16: Action brought on 9 November 2016 — Ireland v Commission, OJ 2017 C 38/35.

recovery in two state aid cases (Starbucks and Fiat) on October 21, 2015 (event #3) and mentioned recovery amounts of roughly EUR 20 to 30 million for each. Despite the rather small recovery amounts, this event might have demonstrated to other potentially affected firms that the state aid investigations can lead to negative decisions.

So far, the European Commission has focused its investigations on transfer pricing-related aspects. However, the character of the state aid investigations changed on December 3, 2015, when the European Commission (2015b) opened formal investigations in the case of McDonald's (event #4). This investigation concerns a hybrid arrangement where apparently an entire branch, receiving large amounts of European franchising income, was neither taxable in the EU nor in the United States.

Following this announcement, the tone between the EU and the United States became tougher. On February 11, 2016, Jack L. Lew, U.S. Secretary of the Treasury, sent a letter of complaint (Lew, 2016) to Jean-Claude Juncker, President of the European Commission (event #5). On August 24, 2016, the U.S. Department of the Treasury (2016) issued a comprehensive White Paper on the recent EU state aid investigations (event #6), which presents the detailed concerns of the U.S. government. Overall, the letter and the White Paper signaled support from the U.S. government for U.S. multinational firms engaged in the EU and attempted to alleviate investors' concerns to some extent. Nevertheless, a few days later, on August 30, 2016, the European Commission (2016a) concluded that Ireland granted undue tax benefits of up to 13 billion EUR to Apple which would have to be recovered (event #7). About one year after the negative decision in the Apple case, the European Commission (2017) ruled that EUR 250 million would have to be recovered from Amazon (October 4, 2017, event #8).

[Insert Table 2 about here]

When selecting relevant events, we choose all official announcements of investigations and negative decisions by the European Commission with respect to preferential ATRs granted to U.S. firms, and events that signal support from the U.S. government in a written form. Events

#1 to #4 and #7 to #8, which represent announcements and negative decisions by the European Commission, would be expected to trigger negative capital market reactions. By contrast, events #5 and #6 would be expected to cause positive capital market reactions insofar as they signal support by the U.S. government.

3.2 Sample Selection

We choose all Fortune 500 firms with subsidiaries in Ireland, Luxembourg, or the Netherlands before the beginning of the official state aid investigations in 2013. Fortune 500 firms are the largest U.S. incorporated firms by sales. We require firms to be both U.S. headquartered and U.S. listed during the whole examination period. The aim is to achieve a homogeneous sample of firms that are taxable in the United States with their worldwide income and that are likely to be supported by the U.S. government because of economic and fiscal interests. By contrast, back taxes among firms that are not taxable in the United States with their worldwide income (such as inverted firms) are not eligible for foreign tax credits and thus do not affect U.S. tax revenues.

Subsidiaries in at least one of these three countries are determined according to "Exhibit 21" of each firm's 2013 10-K. Exhibit 21 lists every reported material subsidiary of the firm and the country in which it is registered. Since 10-K reports are part of the firms' annual reporting obligations, we assume that investors are aware of these subsidiaries. Two sources help us to determine subsidiaries: First, we use Exhibit 21 data provided by Dyreng and Lindsey (2009). Second, we compare them with the report "The Use of Offshore Tax Havens by 2013 Fortune 500 Companies" published by the non-governmental organization Citizens for Tax Justice (CTJ, 2014). CTJ also looked at Exhibit 21 of each firms' 2013 10-K report to assess subsidiaries in tax havens. Ireland, Luxembourg, and the Netherlands represent tax havens in this regard according to CTJ. We manually check firms' Exhibit 21 in the case of differences between both data sets.

From all firms on the 2013 Fortune 500 list, 404 have available stock price data during the whole period of investigation.[9] Excluding 148 firms without subsidiaries in one of the three countries leads to a sample of 255 firms. We finally remove those firms that had pending state aid cases (4 firms) and inversions[10] during the examination period according to headquarter locations (LOC) as provided by COMPUSTAT (10 firms). Overall, 242 firms remain in our sample as depicted in Panel A of Table 3. Panel B presents an overview of their industries.

[Insert Table 3 about here]

3.3 Methodological Approach

To identify possible stock price reactions, we employ an event study methodology suggested by MacKinlay (1997). It is of central importance to define an appropriate event window that fully captures the effect of the respective event on the value of a firm and at the same time ensures the exclusion of confounding, non-related events. For our study, we employ a four-day event window with one trading day prior and two trading days subsequent to the event, since we expect relevant information to seep through unofficial channels to the investors before the actual event, and to meet potentially delayed stock price adjustments due to the topic's complexity. The impact of an event on a firm's value is measured by calculating daily abnormal stock returns (ARs) for the defined event window, where an abnormal return is the actual ex-post return of the stock minus its expected return. To obtain parameters to compute the expected returns for the event window, we estimate the market model

$$(1)\ R_{\mathrm{i,t}} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t}$$

for a period that comprises 250 trading days and ends prior to the event for every firm,[11] where $R_{\mathrm{i,t}}$ denotes the daily stock return of firm i on day t, $R_{m,t}$ the return of the market portfolio on

[9] Stock prices are obtained from Thomson Reuters Datastream in USD.

[10] Corporate inversions lead to benefits in corporate tax, but costs in personal tax (Babkin, Glover and Levin, forthcoming). We therefore remove these firms from our sample.

[11] Due to our difference-in-differences design in subchapter 6, where we use ARs on the twelve days before, during, and after each event as dependent variable, a period of 12 days has to lie between the estimation window and the actual event day.

day t, and $\varepsilon_{i,t}$ the zero mean disturbance term. In this respect, we use the main national index S&P 500 to proxy the market portfolio.

To allow more generalizable statements for our sample, we aggregate and then average the stocks' daily ARs for every day of the event window to generate four mean abnormal returns (mean ARs) for every event, illustrating the event's impact on the sample on the respective day. Subsequently, to get an impression of the cumulative effect of an event, we cumulate the mean ARs over the event window to obtain a mean cumulative abnormal return (CAR). Moreover, we test for significance of mean CARs using one-tailed t-tests.

Finally, we estimate the total economic effect of every event on our sample.[12] To do so, we first multiply every mean AR on day t during the respective event window with the consolidated market value[13] of the sample on day t-1 to obtain the abnormal market value change (AMVC) of the sample on day t. We subsequently cumulate the AMVCs over the respective four-day event window to a cumulative abnormal market value change (CAMVC).

4. Univariate Results for Individual Event Dates

Table 4 presents mean CARs for the eight EU state aid-related events separately. The mean CARs surrounding initial announcements of state aid investigations related to transfer pricing are −0.31 percent (p = 0.0063, event #1) and −0.89 percent (p = 0.0000, event #2), respectively. More negative reactions to the second announcement (event #2) could result from investor interpretations that the investigations do not represent individual cases, and thus as a signal that further U.S. multinational firms could be affected in the future. In line with our prediction, the first negative decisions with respect to two state aid investigations (event #3) yield negative mean CARs of −0.51 percent (p = 0.0295). The announced investigation of two ATRs related

[12] Due to data availability, one firm was excluded from this analysis.

[13] The consolidated market value of a firm is the aggregated value of all of its listed equity securities (e.g., preferred and common stock). We thereby implicitly assume that the effects of our events are roughly the same for different types of equity securities. Total economic effects based on the individual securities included in the event study are available on request.

to hybrid arrangements (event #4) triggers even more negative mean CARs compared to the transfer pricing announcements (mean CARs = −1.63 percent, $p = 0.0000$). These reactions reflect the fact that a potential negative decision in this case will likely have more severe tax consequences for other U.S. firms that also benefit from long-term U.S. tax deferral on untaxed overseas profits. Overall, these findings imply the existence of competitive tax advantages in the EU for U.S. multinational firms that might be diminished through future state aid investigations beyond those that have been already targeted.

However, the U.S. government started to intervene with an official public letter to the President of the European Commission (event #5) and a detailed Treasury White Paper (event #6). Table 4 shows significantly positive mean CARs from 0.33 percent ($p = 0.0016$) to 0.92 percent ($p = 0.0393$). Apparently, investors expected the U.S. government to successfully act in their favor and mitigate the negative consequences of state aid investigations.

Contrary to our expectations, we do not detect significant negative mean CARs in reaction to the second negative decision (event #7) among the firms in our sample (mean CARs = −0.14 percent, $p = 0.1662$). This could be due to difficulties in isolating the effect of event #7, which directly follows the positive event #6 without any trading days between the event windows. However, stock price reactions to the third decision are significantly negative, with mean CARs of −0.53 percent ($p = 0.0001$, event #8).

[Insert Table 4 about here]

Economic effects (i.e., the CAMVC over the respective four-day event windows) range from −176.68 billion USD (event #4) to +85.48 billion USD (event #5) (Figure 1). The cumulative abnormal losses over all investigations and decisions (i.e., negative events) are 438.78 billion USD, whereas the interventions by the U.S. government (i.e., positive events) result in cumulative abnormal gains of 120.22 billion USD. Figure 1 provides an overview on the CAMVC for every event.

[Insert Figure 1 about here]

We perform some further tests to challenge the robustness of our results (Table 4). First, we calculate median CARs and employ a Wilcoxon signed rank test to account for non-normally distributed CARs and outliers. Except for event #3, the results show similar effect patterns as with mean CARs. Since the European Commission officially announces its investigations only if they have serious concerns that a measure could qualify as unlawful State aid and recovery amounts in this case were rather small, event #3 offers only limited additional information. Second, binomial tests that examine whether the frequency distribution of negative and positive CARs is in line with our prediction reveal comparable results to those of the Wilcoxon tests. Third, we test whether our findings are robust to an alternative specification of the event window and employ a three-day (−1, +1) event window. Table 4 shows consistent but slightly smaller effects.

5. Determinants of CARs

We use panel data regression analysis to assess which firms are affected more by state aid-related events. Specifically, we are interested in whether firms with a higher level of tax avoidance have more negative CARs. Following Larcker, Ormazabal, and Taylor (2011), we employ a pooled multi-event analysis. This analysis is superior to event-specific analyses because small variations in the market reaction that occur consistently across multiple events are more likely to be detected. Pooling across all events, we estimate the following equation:

$$(2)\ CAR_{i,j} = \beta_0 + \beta_1 TAX\_AVOID_{i,j} + \sum_c \beta_c Controls_{i,j}^c + EVENT\ FE + \varepsilon_{i,j}$$

In this pooled equation, observations vary by firm i and event j. Repeated observations on the explanatory variables of the same firm i over several event windows j lead to autocorrelation problems. To correct for dependence, standard errors are clustered by firm. Event fixed effects account for macroeconomic changes.

The dependent variable is *CAR4*, that is, CAR over a four-day event-window. When pooling all events, CARs for events #5 and #6 are multiplied by negative one. All financial variables are measured at the beginning of the respective event year and are taken from the COMPUSTAT database. We measure tax avoidance via three-year average cash ETR (*CASH_ETR3*), calculated as three-year average cash taxes paid divided by three-year average pretax income before special items (Hanlon and Heitzman, 2010). According to Dyreng, Hanlon, and Maydew (2008), long-term ETRs are better proxies for corporate tax avoidance than annual ETRs. *CASH_ETR3* is winsorized at 0 and 1. Control variables are taken from prior literature (Chen, Chen, Cheng, and Shevlin, 2010; Chyz, Leung, Li, and Rui, 2013; Hanlon and Slemrod, 2009; Zhang, 2006). *SIZE* is measured as the natural logarithm of the market value. *EARN_VOL* is defined as the standard deviation of pretax income before special items for the five fiscal years prior to the event, scaled by lagged total assets. To account for profitability, we use return on assets (*ROA*), calculated as pretax income divided by lagged total assets. Leverage (*LEV*) constitutes total debt, scaled by lagged total assets, and controls for the impact of a firm's capital arrangement. *MTB* represents the ratio of market value to book value. *AD* (*RD*) is defined as advertising (research and development) expenses scaled by lagged total assets. If missing, we set both variables to zero. Finally, we use industry fixed effects in line with the Fama-French 17 industry classification (French, 2017). All continuous explanatory variables are winsorized at the 1 and 99 percent level to mitigate the impact of outliers. Appendix 1 describes the variables. From 239 firms with available COMPUSTAT data over the whole examination period, we exclude 144 firm-event observations with negative pretax income and 39 firm-event observations with missing explanatory or control variables. The final sample consists of an unbalanced panel of 239 firms with 1,729 firm-event observations. Table 5 presents the descriptive statistics. Pooled across all events, we find a mean *CAR4* of −0.63 percent, which again emphasizes that, overall, the capital market expects additional U.S. firms to have benefitted from competitive tax advantages in Europe.

[Insert Table 5 about here]

Table 6 shows the results of our regression analysis. Through all specifications, we find a significant positive relationship between *CAR4* and *CASH_ETR3*, meaning that firms with lower ETRs have more negative stock market reactions. A decrease in *CASH_ETR3* by one standard deviation leads to a decrease in *CAR4* of 0.21 percentage points. More negative mean CARs among firms with low ETRs are plausible since they might have benefitted the most from competitive advantages granted by some Member States. Next, we replace *CASH_ETR3* with three-year average additions to unrecognized tax benefits, scaled by three-year average lagged total assets (*UTB_ADDS3*). This measure is intended to account for uncertain forms of tax avoidance (Dyreng, Hanlon, and Maydew, 2017).[14] A significant negative coefficient signals more negative CARs among firms that have higher additions to unrecognized tax benefits. In line with findings on *CASH_ETR3*, an increase in additions to UTBs by one standard deviation decreases *CAR4* by 0.23 percentage points.

There is consistent evidence that larger firms show less negative stock price reactions. The largest firms have the economic resources to bear potential back taxes from state aid decisions and might be able to influence legislation or administrative practices (Siegfried, 1972) and tax-efficiently adjust their global activities to keep their competitive advantages by, for instance, hiring the best tax advisers (Mills, Nutter, and Schwab, 2013). The risk of recoveries for up to ten years due to state aid investigations could explain more negative reactions among firms that are already financially constrained (significant negative coefficients of *LEV*) and that are less profitable (significant positive coefficients of *ROA*). As one would expect, a higher earnings volatility leads to stronger investor reactions. We replicate our estimation based on a three-day event period (*CAR3*) and find similar results.

[Insert Table 6 about here]

[14] Consistent with the flow variable *CASH_ETR3*, we use a flow variable of UTBs instead of the ending balance in UTBs (Dyreng, Hanlon, and Maydew, 2016).

6. Comparison to a Control Group

6.1 Propensity Score Matching

To ensure that the empirical identification of effects is sufficiently clear, we use one-to-one nearest neighbor propensity score matching technique (Rosenbaum and Rubin, 1983) to generate a control group. Control firms should be as similar as possible to our sample firms (=treatment firms) without having subsidiaries in Ireland, Luxembourg, or the Netherlands because this group is less likely to have benefitted from preferential ATRs, and thus competitive tax advantages, in Europe. If stock price reactions were due to state aid investigations, reactions should be less strong among this group.

In creating the first control group, we use all multinational firms[15] from the COMPUSTAT database that are headquartered (*LOC*) in the United States with available stock price and financial data during the examination period. These data are merged with data on the firms' subsidiaries according to Exhibit 21 (Dyreng and Lindsey, 2009). The probit model to estimate the propensity scores includes all explanatory variables previously discussed in section 5. Before our probit estimation, we exclude all non-treatment firms that disclose subsidiaries in Ireland, Netherlands, and Luxembourg. *TREATMENT* is an indicator variable equal to 1 for treatment firms and 0 for potential control firms.

(3) $$TREATMENT_i = \beta_0 + \beta_1 CASH\_ETR3_i + \beta_2 SIZE_i + \beta_3 ROA_i + \beta_4 EARN\_VOL_i + \beta_5 LEV_i + \beta_6 MTB_i + \beta_7 AD_i + \beta_8 RD_i + INDUSTRY\ FE + \varepsilon_i$$

We try to match each treatment firm to one control firm without subsidiaries in one of the three countries targeted with the closest propensity score (caliper = 0.5) before the beginning of the official state aid investigations in 2013. Control firms have to be in the same industry as

[15] We simultaneously use two measures of multinational activity according to Dyreng, Hanlon, Maydew, and Thornock (2017): disclosure of (1) foreign income or of (2) at least one subsidiary outside the United States according to 10K-data.

defined by the Fama-French 17 industry classification (French, 2017). We find appropriate matches for 100 treatment firms. Variable distributions between the treatment group and the control group are very similar, with all t-statistics being nonsignificant in the matching year (Panel A of Table 7).

Univariate statistics give a first impression of differences in stock market reactions between treatment and control firms. Panel B shows that mean and median CARs are significantly more negative for treatment firms compared to the control group (Panel B). Similarly, distributions of negative and positive CARs show significantly more negative CARs among the treatment firms (Panel C).

[Insert Table 7 about here]

6.2 Difference-in-Differences Design

In the next step, a difference-in-differences design (St. Clair and Cook, 2015) compares the treatment firms to the control firms before, during and after the event periods. Our design is based on Hoopes, Thornock, and Williams (2016). The difference-in-differences estimator enables us to assess differences in ARs between the treatment firms and the matched control firms while accounting for unobserved changes over time that might affect stock prices. Specifically, we use ARs as the dependent variable and estimate the following pooled, multi-event equation in OLS:

$$(4)\ AR_{i,t} = \beta_0 + \beta_1\, TREATMENT_i + \beta_2\, EVENT\_DAY_t + \beta_3\, TREATMENT_i * EVENT\_DAY_t + \varepsilon_{i,t}$$

$AR_{i,d}$ represent abnormal returns for firm i on day t. *TREATMENT* is an indicator variable equal to 1 for treatment firms and 0 for control firms. *EVENT_DAY* is an indicator variable, set equal to one if the respective day is an event day and zero otherwise. In line with our prior analyses, we initially test a four-day (−1, +2) event period. We code EVENT_DAY as −1 for the two positive events #5 and #6. The interaction term *TREATMENT* EVENT_DAY* is the variable of interest. If U.S. firms with subsidiaries in Ireland, Luxembourg, and the Netherlands benefitted

from competitive tax advantages that might be diminished through state aid rules, the term should be significantly negative. The coefficient β_2 captures the average abnormal returns from state aid investigations among control firms, whereas the total average abnormal return among treatment firms is represented by $\beta_2 + \beta_3$. We estimate (4) using 25-day windows centered on each of the eight events listed in Table 2.[16] Thus, in general, 11 non-event days precede and 10 non-event days follow each four-day event period. We end up with 179 daily observations of 200 firms. Standard errors are clustered by both firm and day (Petersen, 2009). Panel A of Table 8 provides descriptive statistics.

Panel B presents the results. Consistent with our assumption, the estimated coefficient on *TREATMENT* EVENT_DATE* is significantly negative at −0.09 percent (p=0.0294, one-tailed). Moreover, the coefficient on *EVENT_DATE* is also significant with a negative sign (β_2 = −0.17 percent). On average, treatment firms suffer from daily negative ARs of 26 basis points on each event day compared to control firms, which lose 17 basis points. Losses among all firms can be attributed to two main reasons. The first is effects resulting from co-movement of stock prices (e.g., Pindyck and Rotemberg, 1993; Barberis, Shleifer, and Wurgler, 2005). Co-movement means the tendency that the returns of various investments, for instance in different equity stocks, move in parallel. The second is the requirement for firms listed at the SEC to disclose all subsidiaries which are regarded as significant in Exhibit 21 to Form 10-K.[17] Since firms can declare their subsidiaries as nonsignificant, this regulation offers some discretion. Therefore, investors might expect some firms that do not disclose subsidiaries in the targeted EU Member States to be engaged there anyway. Donohoe, McGill, and Outslay (2012) reveal some prominent cases of firms that significantly reduced the number of reported subsidiaries. Hope, Ma, and Thomas (2013), for instance, show that firms with a higher level

[16] In the case of event #6 and #7, we restrict the window to 14 and 15 days respectively, because of an overlap of both windows.

[17] Item 601 of SEC Regulation S-K (§229.601).

of tax avoidance tend to reduce the disclosure of geographic earnings. Thus, it is plausible that investors expect some firms to actively conceal subsidiaries in these countries. We replicate our estimation based on a three-day event period and find comparable results ($\beta_2 = -0.14$ percent, $\beta_3 = -0.07$ percent). Overall, the difference-in-differences design reinforces the existence of competitive tax advantages through ATRs.[18]

[Insert Table 8 about here]

7. Conclusion

In June 2014, the European Commission started to publicly investigate individual ATRs granted to large, mainly U.S. multinational firms, accusing EU Member States of offering tax advantages that are incompatible with EU state aid rules (i.e., preferential ATRs). We argue that preferential ATRs provide firms with lower tax cost and thus competitive tax advantages over other firms in Europe. Recent state aid investigations offer a unique setting to examine the existence of competitive tax advantages through ATRs that were granted by Ireland, Luxembourg, and the Netherlands beyond those already targeted by the European Commission. Therefore, we assess stock price reactions to state aid-related events that could lead to a forfeiture of past and future presumed competitive advantages. As predicted, we find negative reactions to the majority of announced state aid investigations and decisions among large U.S. firms with subsidiaries in the three countries targeted. We also detect relevant economic effects in this respect: Competitive tax advantages that might be diminished through state aid rules amount to up to 176.68 billion USD by event (e.g., event #5). Investors revise upwards their expectations about interventions by the U.S. government against the application of EU state aid rules, suggesting that the capital market anticipates the government defending the U.S. firms' ability to avoid taxes in Europe. Stock price reactions are particularly strong among firms that

[18] The inclusion of firm and day fixed effects does not alter the results. Results are available on request.

have a higher level of tax avoidance. Comparing our sample firms with U.S. multinational firms without subsidiaries in Ireland, Luxembourg, and the Netherlands yields more negative stock price reactions among U.S. firms engaged in these three countries. These results provide further support for our hypothesis that large U.S. firms benefit from competitive tax advantages granted by some EU Member States.

This research is subject to some limitations. We focus on published investigations and decisions by the European Commission and events where the U.S. government signaled written support in favor of U.S. firms. Since investors could receive information via further communication channels such as media reports, firm disclosure, and statements by politicians, the full effect of state aid investigations and U.S. support might be greater than shown in this paper. An underestimation of effects could further follow from investor expectations of successful appeals against state aid decision. Moreover, the OECD Base Erosion and Profit Shifting (BEPS) Initiative (OECD, 2015) has targeted several tax avoidance arrangements during our examination period. Therefore, we have underestimated the total effect of competitive tax advantages through preferential ATRs on stock prices to the extent that investors have expected the BEPS actions to prevent the continued use of some tax arrangements that underlie ATRs. Finally, we exclusively examine competitive tax advantages among U.S. multinational firms. Our results by no means suggest that the capital market perceives solely these firms to have benefitted from advantages though ATRs. We leave it to future research to investigate whether other multinational firms have done so as well.

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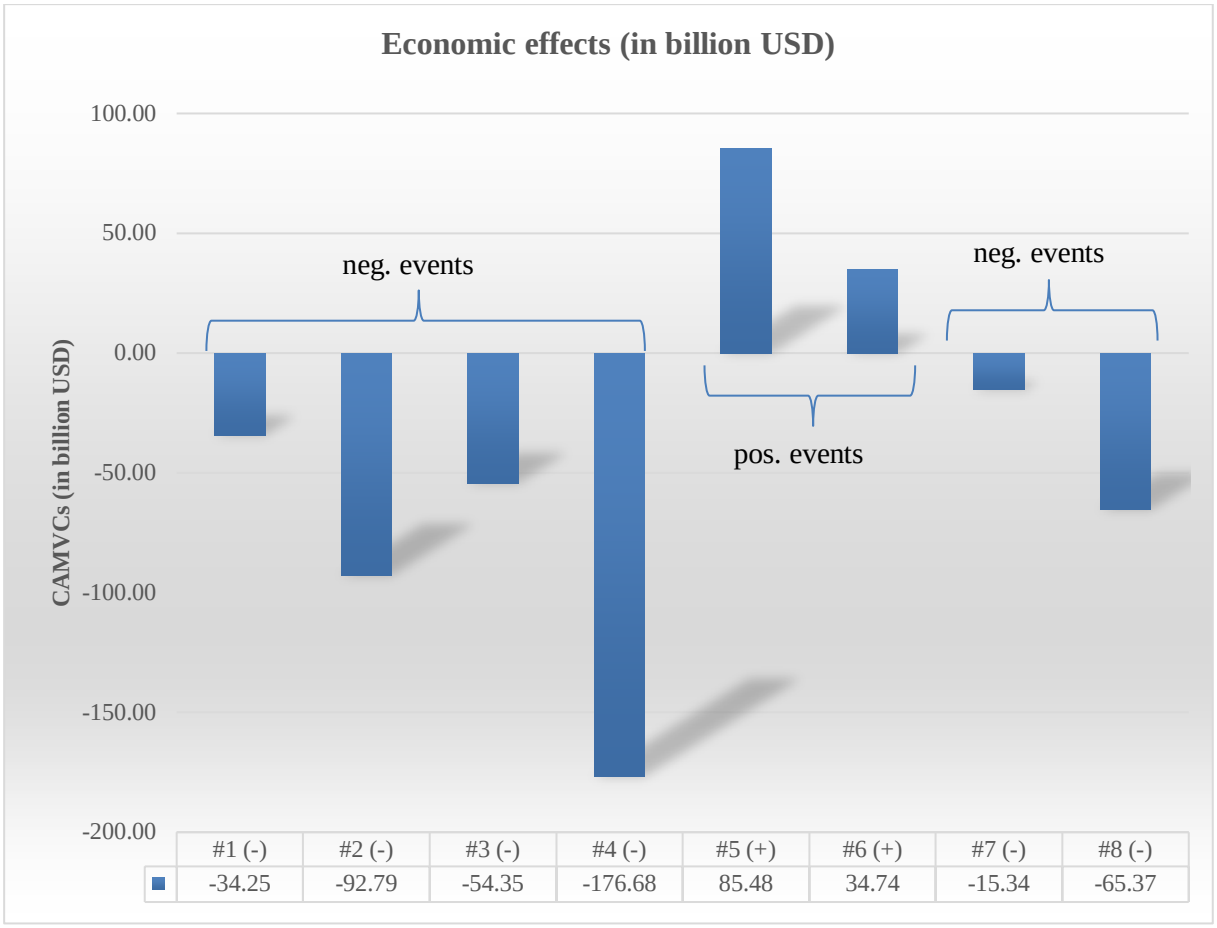
Figure 1

Economic effects by individual event dates.



Notes: This figure presents the CAMVCs of our sample for every event, measured in billion USD. Effects are reported around a four-day (−1, +2) event window. Predicted signs of effects are presented in parentheses.

Table 1

EU state aid: Final decisions and open formal investigations.

Firm (case no.)	Firm location	Primary listing	Member State	Unlawful state aid?	Contested key tax structure	Details on contested tax structure
Starbucks (SA.38374)	USA	USA	Netherlands	Yes (appealed)	Transfer pricing	Substantial royalty payments Inflated prices for purchased goods
Fiat Chrysler (SA.38375)	UK*	USA	Luxembourg	Yes (appealed)	Transfer pricing	Financing company passing on funds with low effective profit margin
Apple (SA.38373)	USA	USA	Ireland	Yes (appealed)	Transfer pricing	Profit allocation between head office and Irish branch, resulting in a small taxable profit in Ireland
Amazon (SA.38944)	USA	USA	Luxembourg	Yes (appealed)	Transfer pricing	Inflated royalty payments
McDonald's (SA.38945)	USA	USA	Luxembourg	Not yet decided	Hybrid	Non-taxation of U.S. branch in Luxembourg, despite knowing of the tax exemption in the U.S.
Engie (SA.44888)	France	France	Luxembourg	Not yet decided	Hybrid	Domestic convertible loan, resulting in tax deductible interest, without corresponding interest income

Notes: This table summarizes the recent ATR cases investigated by the European Commission regarding (potential) unlawful state aid granted to multinational firms. Headquarters locations (*LOC*) are provided by COMPUSTAT. Decisions on unlawful State aid by the European Commission can be subject to review at the Court of Justice of the EU. Official press releases and letters to the Member States of the European Commission provide information on the tax arrangements of the state aid cases (http://ec.europa.eu/competition/state_aid/tax_rulings/index_en.html). *Fiat Chrysler Automobiles maintains operational headquarters in Italy (Turin) and the United States (Detroit), whereas it has its corporate offices in London and holds its board meetings there.

Table 2

Relevant event dates.

#	Dates	Description	Predicted stock price reactions
1	06/11/2014	Decision to open formal investigations in the Starbucks, Apple, and Fiat cases	Negative
2	10/07/2014	Decision to open formal investigations in the Amazon case	Negative
3	10/21/2015	Negative decision with recovery in the Starbucks and Fiat cases (recovery amount of roughly EUR 20 to 30 million each)	Negative
4	12/03/2015	Decision to open formal investigations in the McDonald's case	Negative
5	02/11/2016	Letter by Jacob L. Lew, U.S. Secretary of the Treasury, to Jean-Claude Juncker, President of the European Commission	Positive
6	08/24/2016	U.S. Department of the Treasury White Paper on the European Commission's recent state aid investigations of transfer pricing ATRs	Positive
7	08/30/2016	Negative decision with recovery in the Apple case in Ireland (recovery amount of EUR 13 billion)	Negative
8	10/04/2017	Negative decision with recovery in the Amazon case in Ireland (recovery amount of EUR 250 million)	Negative

Notes: This table summarizes relevant event dates. As negative events, we assessed all official announcements on opening investigations and on negative decisions by the European Commission on state aid regarding preferential ATRs related to U.S. firms. Positive events are events that signal support by the U.S. government to firms affected by EU state aid in written form.

Table 3

Sample selection and industry composition.

Panel A: Sample selection			
		Firms	Firm-event observations
	Fortune 500 firms	500	
−	Missing stock price data	96	
−	No subsidiaries in LU, NL, or IE	148	
=	Firms with subsidiaries in LU, NL, or IE	256	
−	Inverted firms	10	
−	Pending state aid cases	4	
=	Final sample (univariate analysis)	242	1,936
−	Missing financial data	3	63
−	Negative pretax income	0	144
=	Final sample (cross-sectional analysis)	239	1,729

Panel B: Industry composition		
	Frequency	Percent
Food	18	7.44
Mining and minerals	3	1.24
Oil and petroleum products	15	6.2
Textiles, apparel, and footwear	5	2.07
Consumer durables	2	0.83
Chemicals	8	3.31
Drugs, soap, perfumes, and tobacco	15	6.2
Construction and construction materials	8	3.31
Steel works	4	1.65
Fabricated products	3	1.24
Machinery and business equipment	32	13.22
Automobiles	9	3.72
Transportation	7	2.89
Utilities	7	2.89
Retail stores	9	3.72
Banks, insurance, and other financials	32	13.22
Other	65	26.86
Sum	242	100.00

Notes: This table summarizes the sample selection and industry affiliation. Industry affiliations are based on the Fama-French 17 industry classification (French, 2017). All firms are U.S. listed and U.S. based according to headquarters locations (*LOC*) as provided by COMPUSTAT.

Table 4

Univariate results by individual event dates.

	N	Mean *CAR*	*t*-test *p*-val.	Median *CAR*	Sign rank *p*-val.	*CARs* >0	*CARs* <0	Binomial test *p*-val.
Event #1: Announcement of state aid investigations concerning Apple, Fiat, and Starbucks (−)								
CAR4 (−1, +2)	242	−0.0031	0.0063***	−0.0044	0.0001***	89	153	0.0000***
CAR3 (−1, +1)	242	−0.0030	0.0037***	−0.0042	0.0004***	98	144	0.0019***
Event #2: Announcement of state aid investigation concerning Amazon (−)								
CAR4 (−1, +2)	242	−0.0089	0.0000***	−0.0035	0.0000***	97	145	0.0012***
CAR3 (−1, +1)	242	−0.0054	0.0000***	−0.0053	0.0000***	88	154	0.0000***
Event #3: Negative decision with recovery in the cases Starbucks and Fiat (EUR 20−30 million) (−)								
CAR4 (−1, +2)	242	−0.0051	0.0295**	−0.0018	0.1824	116	126	0.2815
CAR3 (−1, +1)	242	−0.0005	0.4208	0.0046	0.9438	143	99	0.9981
Event #4: Announcement of state aid investigation concerning McDonald's (−)								
CAR4 (−1, +2)	242	−0.0163	0.0000***	−0.0054	0.0000***	104	138	0.0168**
CAR3 (−1, +1)	242	−0.0111	0.0000***	−0.0044	0.0000***	106	136	0.0310**
Event #5: Letter by Jacob L. Lew, U.S. Secretary of the Treasury (+)								
CAR4 (−1, +2)	242	0.0092	0.0016***	0.0029	0.0036***	136	106	0.0310**
CAR3 (−1, +1)	242	0.0018	0.2478	−0.0015	0.4985	118	124	0.6736
Event #6: Department of the Treasury White Paper (+)								
CAR4 (−1, +2)	242	0.0033	0.0393**	0.0032	0.0042***	137	105	0.0230**
CAR3 (−1, +1)	242	0.0035	0.0146**	0.0028	0.0002***	151	91	0.0000***
Event #7: Negative decision with recovery in the Apple case (EUR 13 billion) (−)								
CAR4 (−1, +2)	242	−0.0014	0.1662	−0.0003	0.3994	120	122	0.4744
CAR3 (−1, +1)	242	−0.0001	0.4612	0.0001	0.5187	124	118	0.6735
Event #8: Negative decision with recovery in the Amazon case (EUR 250 million) (−)								
CAR4 (−1, +2)	242	−0.0053	0.0001***	−0.0040	0.0000***	87	155	0.0000***
CAR3 (−1, +1)	242	−0.0047	0.0000***	−0.0028	0.0000***	85	157	0.0000***

Notes: This table presents mean and median CARs as well as the number of positive and negative CARs for eight event dates separately. Significance levels are based on a one-tailed t-test for the means, a one-tailed Wilcoxon signed rank test for the medians, and a one-tailed binomial test to assess whether the frequency distribution of negative/positive CARs is in line with our prediction. Predicted signs of effects are presented in parentheses. CARs are reported around a four-day (−1, +2) and three-day (−1, +1) event window. *, **, *** indicate statistical significance at the 0.1, 0.05, and 0.01 levels, respectively. Stock prices are obtained from Thomson Reuters Datastream.

Table 5

Descriptive statistics.

VARIABLE	N	MEAN	SD	P10	P25	P50	P75	P90
CAR4	1,729	−0.0063	0.0331	−0.0361	−0.0164	−0.0028	0.0089	0.0228
CAR3	1,729	−0.0036	0.0279	−0.0273	−0.0125	−0.0016	0.0085	0.0216
CASH_ETR3	1,729	0.2332	0.1254	0.0854	0.1535	0.2347	0.2982	0.3612
UTB_ADDS3	1,597	0.0014	0.0017	0.0000	0.0003	0.0008	0.0019	0.0038
SIZE	1,729	23.6931	1.3343	21.9790	22.8141	23.6871	24.6449	25.5825
ROA	1,729	0.1008	0.0691	0.0217	0.0547	0.0865	0.1321	0.1938
EPS_VOLA	1,729	0.0214	0.0209	0.0041	0.0081	0.0150	0.0275	0.0456
LEV	1,729	0.2954	0.1883	0.0764	0.1594	0.2609	0.4033	0.5340
MTB	1,729	4.0293	5.9333	1.0923	1.6922	2.7287	4.4638	8.0196
AD	1,729	0.0125	0.0251	0.0000	0.0000	0.0000	0.0142	0.0409
RD	1,729	0.0172	0.0297	0.0000	0.0000	0.0007	0.0211	0.0549

Notes: This table presents descriptive statistics. Stock prices are obtained from Thomson Reuters Datastream. All further financial variables are taken from COMPUSTAT. Explanatory variables are winsorized at the 1 and 99 percent level. Appendix 1 summarizes the definition of variables.

Table 6

Regression results.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	*CAR4*	*CAR4*	*CAR4*	*CAR3*	*CAR3*	*CAR3*
CASH_ETR3	0.022**	0.017**		0.020***	0.018**	
	(0.010)	(0.007)		(0.007)	(0.007)	
UTB_ADDS3			−1.374**			−1.173***
			(0.564)			(0.425)
SIZE		0.002***	0.002***		0.002***	0.002***
		(0.001)	(0.001)		(0.001)	(0.001)
ROA		0.031**	0.032**		0.019	0.022*
		(0.015)	(0.014)		(0.012)	(0.011)
EARN_VOL		−0.121***	−0.118**		−0.078**	−0.072*
		(0.045)	(0.050)		(0.035)	(0.040)
LEV		−0.014***	−0.009**		−0.009**	−0.005
		(0.005)	(0.004)		(0.004)	(0.004)
MTB		−0.000	−0.000		−0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)
AD		0.011	0.014		−0.006	−0.002
		(0.039)	(0.038)		(0.028)	(0.027)
RD		0.031	0.054		0.007	0.024
		(0.028)	(0.034)		(0.021)	(0.026)
Intercept	−0.009***	−0.056***	−0.050***	−0.008***	−0.045***	−0.037***
	(0.003)	(0.018)	(0.017)	(0.002)	(0.014)	(0.013)
Observations	1,729	1,729	1,597	1,729	1,729	1,597
R-squared	0.026	0.107	0.165	0.022	0.078	0.108
Event FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	NO	YES	YES
Std. error cluster	firm	firm	firm	firm	firm	firm

Notes: This table presents results from regressing *CAR4* (*CAR3*) for eight state aid-related events on tax avoidance and control variables. Standard errors are presented in parentheses. CARs for events #5 and #6 are multiplied by negative one. *, **, *** indicate statistical significance at the 0.1, 0.05, and 0.01 levels, respectively. All *p*-values are based on two-tailed tests and are calculated based on standard errors that are clustered by firm. Stock prices are obtained from Thomson Reuters Datastream. All further financial variables are taken from COMPUSTAT. Appendix 1 summarizes the definition of variables.

Table 7

Descriptive statistics of treatment and control firms.

Panel A: Treatment and control firms in the matching year 2013

	Treatment firms (n=100)			Control firms (n=100)			
	MEAN	SD	P50	MEAN	SD	P50	t-test *p*-val.
CASH_ETR3	0.2156	0.1521	0.2145	0.2056	0.1600	0.1937	0.6513
SIZE	22.8416	1.0139	22.9051	22.9707	1.1522	22.9715	0.4010
ROA	0.0885	0.0814	0.0779	0.0941	0.0816	0.0794	0.6254
EPS_VOLA	0.0271	0.0221	0.0209	0.0254	0.0226	0.0191	0.5981
LEV	0.2848	0.2030	0.2517	0.2921	0.2198	0.2438	0.8061
MTB	3.9998	8.9516	2.2876	3.4997	9.7512	2.7484	0.7060
AD	0.0080	0.0187	0.0000	0.0071	0.0246	0.0000	0.7845
RD	0.0117	0.0267	0.0000	0.0108	0.0295	0.0000	0.8151

Panel B: Distribution of CARs for pooled events for treatment and control firms

	Treatment firms (n=800)			Control firms (n=800)			
	MEAN	SD	P50	MEAN	SD	P50	t-test *p*-val.
CAR4	−0.0103	0.0346	−0.0067	−0.0068	0.0324	−0.0034	0.0170**
CAR3	−0.0065	0.0288	−0.0049	−0.0045	0.0262	−0.0023	0.0667*

Panel C: Frequency of positive and negative CARs for pooled events for treatment and control firms

	>0	≤0	>0	≤0	Chi2-test *p*-val.
CAR4	300	500	348	452	0.0153**
CAR3	321	479	358	442	0.0145**

Notes: Panel A presents descriptive statistics for the treatment firms and control firms for the matching year. A propensity score matching according to *CASH_ETR3*, *SIZE*, *ROA*, *EPS_VOLA*, *LEV*, *MTB*, *AD*, *RD*, and industry FE led to appropriate matching partners for 100 firms. The control group consists of firms without subsidiaries in Ireland, Luxembourg, and the Netherlands. Control firms had to be multinational, headquartered in the United States, and be in the same industry. T-tests reveal nonsignificant mean differences between both groups for all variables. Panel B presents the distribution of CARs for 100 treatment and 100 control firms pooled across eight state aid events. One-tailed t-tests assess mean differences between both groups. Panel C shows the frequency of positive and negative CARs for 100 treatment and 100 control firms pooled across eight state aid events. Chi2-tests assess how likely it is that an observed distribution is due to chance. *, **, *** indicate statistical significance at the 0.1, 0.05, and 0.01 levels, respectively. Financial variables are taken from COMPUSTAT. Stock prices are obtained from Thomson Reuters Datastream. Variables are winsorized at the 1 and 99 percent level. Appendix 1 summarizes the definition of variables.

Table 8

Difference-in-differences design.

Panel A: Descriptive statistics				
	Treatment firms (n=17,900)		Control firms (n=17,900)	
	MEAN	SD	MEAN	SD
AR	0.0002	0.0156	0.0001	0.0145

Panel B: Difference-in-differences design		
	(1)	(2)
	AR	AR
Event period	(−1, +2)	(−1, +1)
TREATMENT	0.0002	0.0002
	(0.0002)	(0.0002)
EVENT_DATE	−0.0017***	−0.0014**
	(0.0005)	(0.0006)
*TREATMENT*EVENT_DATE*	−0.0009**	−0.0007*
	(0.0005)	(0.0004)
Intercept	0.0003	0.0002
	(0.0003)	(0.0003)
Observations	35,800	35,800
R-squared	0.0036	0.0019
Std. error cluster	firm and day	firm and day

Notes: Panel A presents descriptive statistics of daily ARs for the 100 treatment and 100 control firms pooled across eight events. The control group consists of U.S. headquartered multinational firms without subsidiaries in Ireland, Luxembourg, and the Netherlands. Panel B presents results from regressing daily ARs for eight state aid-related events on *TREATMENT*, *EVENT_DATE*, and an interaction term. *TREATMENT* is an indicator variable equal to 1 for treatment firms and 0 for control firms. *EVENT_DAY* is an indicator variable set equal to one in case the respective day is an event day and zero otherwise. A four-day (−1, +2) and three-day (−1, +1) event period are tested. *EVENT_DAY* is coded −1 for the two positive events #5 and #6. The interaction term *TREATMENT *EVENT_DAY* captures the incremental average abnormal returns from state aid investigations among treatment firms. 25-day windows centered on each of the eight events are employed. After correcting for an overlap of event #6 and #7, the sample consists of 179 daily observations by 200 firms, thereof 32, respectively, 24 event days. Standard errors (in parentheses) are clustered by firm and day (Petersen, 2009). *, **, *** indicate statistical significance at the 0.1, 0.05, and 0.01 levels, respectively. Stock prices are obtained from Thomson Reuters Datastream. Variables are winsorized at the 1 and 99 percent level. Appendix 1 summarizes the definition of variables.

Appendix 1

Variables measurement.

	Description	Source
AR	Daily abnormal return.	Datastream
CAR3	Cumulative abnormal return over the period beginning one trading day before the event and ending on the first trading day after the event.	Datastream
CAR4	Cumulative abnormal return over the period beginning one trading day before the event and ending on the second trading day after the event.	Datastream
CASH_ETR3	Three-year average cash taxes paid (*TXPD*) divided by three-year average pretax income (*PI*) before special items (*SPI*). The variable is winsorized between 0 and 1. Firm-event observations with negative pretax income are excluded.	COMPUSTAT
UTB_ADDS3	Three-year average additions to UTBs (*TXTUBPOSINC*) divided by lagged three-year average total assets (*AT*).	COMPUSTAT
SIZE	Natural logarithm of the market value of equity in USD (*CSHO***PRCC_F*/100).	COMPUSTAT
ROA	Pretax income (*PI*) before special items (*SPI*) in the fiscal year before the event divided by lagged total assets (*AT*).	COMPUSTAT
EARN_VOL	The standard deviation of adjusted income (*PI*−*SPI*) for the five fiscal years prior to the event, scaled by lagged total assets (*AT*).	COMPUSTAT
LEV	Total debt (*DLTT*+*DLC*) scaled by lagged total assets (*AT*). To maximize the sample, total debt is set to zero if the data are missing (Dyreng and Lindsey, 2009).	COMPUSTAT
MTB	Market value of equity (*CSHO***PRCC_F*/100) scaled by the book value of equity (*CEQ*).	COMPUSTAT
AD	Advertising expense (*ADX*) scaled by lagged total assets (*AT*). To maximize the sample, the variable is set to zero if the data are missing (Dyreng and Lindsey, 2009).	COMPUSTAT
RD	Research and development expense (*RDX*) scaled by lagged total assets (*AT*). To maximize the sample, the variable is set to zero if the data are missing (Dyreng and Lindsey, 2009).	COMPUSTAT
TREATMENT	Indicator variable set equal to one if a U.S. firm has a subsidiary in Ireland, Luxembourg, or the Netherlands, and zero otherwise.	Dyreng and Lindsey (2009)
EVENT_DATE	Indicator variable set equal to one in case the respective day is an event day, and zero otherwise.	Own calculation
INDUSTRY FE	Industry dummies according to the Fama-French 17 industry classification with industry 1 (food) being the baseline.	COMPUSTAT