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Geopolitical risk, financial constraints, and tax avoidance☆

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ABSTRACT

We investigate the impact of geopolitical risk on corporate tax avoidance using a sample of all public US firms from 2005 to 2019. We find that an increase in geopolitical risk leads to higher engagement in corporate tax avoidance, as measured by a decline in cash-effective tax rates in both the short run and long run. This effect is more pronounced for firms with higher financial constraints. Furthermore, using the 2016 OPEC agreement as a geopolitical shock, we find that oil-related firms engaged in more aggressive tax avoidance activities than their non-oil-related counterparties. Our findings are robust to an alternative measure of industry exposure.

1. Introduction

Geopolitical risk has surpassed cyber risk to be recognized as the foremost global corporate risk in 2020 (WTW, 2022). Distinct from political risk, which primarily emanates from political uncertainty, geopolitical risk encompasses adverse events and shocks that extend beyond political borders. These shocks can dramatically influence macroeconomic variables, imperil the financial stability of global enterprises, and force businesses to navigate precarious balances concerning people, operations, and performance on a broader scale (Caldara & Iacoviello, 2022). Prior literature has emphasized the adverse effects of geopolitical risk on bank stability (Phan et al., 2022), the price of essential commodities like food, oil, and gold (Bouoiyour et al., 2019; Su et al., 2019; Gkillas et al., 2020), common business cycles (Gupta et al., 2018), stock return predictability (Ma et al., 2022) and corporate cash reserves (Lee & Wang, 2021). However, when discussing managerial inclinations towards tax avoidance, current literature leans more towards political than geopolitical risks. For example: Hossain et al. (2023) find that firms facing greater political risk tend to engage more actively in corporate tax avoidance. Liu et al. (2022) further highlight this by revealing how managers craftily amplify political sentiment in earnings conference calls to strategically bolster tax avoidance tactics. Yet, the influence of geopolitical risk on corporate decisions,

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especially tax avoidance behavior, remains an under-explored territory.[1] Thus, our study aims to bridge this gap by investigating the relationship between geopolitical risk and corporate tax avoidance, drawing on a comprehensive sample of all US firms from 2005 to 2019.

Our research contributes to the literature in two ways. Firstly, our study is the first to provide direct empirical evidence of cross-country risk factors on corporate tax avoidance behavior. Tax avoidance is of great interest to tax authorities, shareholders, and the general public because it is a firm's strategy to reduce or avoid its taxes, which might benefit shareholders, but at the expense of society (Sikka, 2010; Huseynov & Klamm, 2012). Prior research has documented the impact of some internal risk factors on corporate tax avoidance engagement, namely corporate governance (Minnick & Noga, 2010; Khan et al., 2017), executive incentives (Desai & Dharmapala, 2006; Dyreng et al., 2010), financial reporting behavior (Hope et al., 2013), and the level of pre-tax income (Rego, 2003). Our paper extends the existing literature by exploring the direct impact of geopolitical risks, an external risk factor, on corporate tax avoidance.

Secondly, our work also extends the stream of literature on geopolitical risks by identifying the role of geopolitical risk in altering corporate management behaviors in both the long run and the short run. Thus, we complement the recent burgeoning studies in geopolitical risk that focus on the effect of the risks on the investment and the operation of financial markets (Clance et al., 2019; Ma et al., 2022; Phan et al., 2022; Saâdaoui et al., 2022).

We propose two hypotheses to examine the direct effect of geopolitical risks on corporate tax avoidance and a potential channel of the impact. First, we hypothesize that geopolitical risks affect firms' engagement in corporate tax avoidance. We begin by hypothesizing that geopolitical risks have a direct influence on firms' engagement in corporate tax avoidance. In anticipation of increased risks, firms are inclined to maintain elevated cash reserves, leveraging these holdings as a buffer against potential adverse impacts arising from geopolitical tensions (Lee & Wang, 2021). This aligns with findings from Kotcharin and Maneenop (2020), who observe that an increase in aggregate global geopolitical risk positively correlates with higher cash reserves, leading to greater cash holdings. Consequently, a rise in geopolitical risk might intensify a firm's engagement in corporate tax avoidance, a response induced by effects on cash holdings.

However, the relationship between geopolitical risk and tax avoidance is not straightforward. Hanlon et al. (2017) highlight substantial variations in cash holdings among both multinational and purely domestic firms, even when exposed to similar geopolitical risks. Moreover, an alternative hypothesis posits that escalating geopolitical risks at the firm level may intensify scrutiny over firms, making tax avoidance more problematic and potentially costly during these times. The risk of negative publicity in periods of heightened tensions could compel firms to abandon or alter their tax avoidance strategies. Thus, geopolitical risks might indeed influence firms' tax avoidance strategies, but the nature and direction of this impact remain elusive. Our study seeks to shed light on this intricate relationship, aiming to furnish empirical evidence that clarifies the true influence of geopolitical risks on corporate tax avoidance.

Next, we hypothesize that the impact of geopolitical risks on corporate tax avoidance varies across firms with different levels of financial constraints. Prior studies indicate that higher cash holdings are more valuable for financially constrained firms than for unconstrained firms (Almeida et al., 2004; Faulkender & Wang, 2006). Furthermore, financially constrained firms tend to pursue more aggressive tax planning relative to their non-financially constrained counterparts (Chen & Lai, 2012; Law & Mills, 2015)[2]. Since geopolitical risks affect corporate tax avoidance strategies via their induced effect on a firm's cash holdings, the impact of geopolitical risks on tax avoidance will likely differ across firms depending on the firm's financial constraints. However, Denis and Sibilkov (2009) find that despite the apparent benefits of high cash holdings for financially constrained firms, some of these firms have low cash holdings because of persistently low cash flows. Thus, the role of financial constraints in enhancing or dampening the impact of geopolitical risks on corporate tax avoidance remains unexplained in the literature, which we aim to address in this study.

To examine the hypothesized relationships, we employ Caldara and Iacoviello's (2022) newly proposed geopolitical risk measures for all public firms in the US in the Compustat database from 2005 to 2019 and implement various empirical analyses including the ordinary least square (OLS) regression, propensity score matching, and difference-in-differences analyses. We find statistically significant evidence supporting our hypothesis that geopolitical risk increases corporate engagement in tax avoidance activities. Specifically, we observe that a one-percent increase in geopolitical risk proxy leads to higher tax avoidance, which is shown by an average 0.94 standard deviation decrease in effective tax rates.

In addition, we find that this effect is more pronounced for firms with higher financial constraints. To eliminate potential concerns about the endogeneity issue in our empirical setting, we perform an event study using the 2016 Organization of the Petroleum Exporting Countries (OPEC) agreement on cutting oil production as a quasi-natural experiment. The 2016 OPEC agreement could be

[1] It is important to note that political risk describes policy uncertainty resulting from changes in monetary policy, fiscal policy, government spending, regulations, and taxation (Nguyen & Nguyen 2020), which is different from geopolitical risk that develops from geopolitical shocks such as wars, military attacks, and terrorist acts, as well as diplomatic conflicts across the globe (Wang et al. 2019). A couple of prior studies examine the effect of economic policy uncertainty or political risk on corporate tax avoidance (Nguyen & Nguyen 2020; Kang & Wang 2021; Liu et al. 2022; Hossain et al. 2023), but there is no research on the direct impact of geopolitical risk on corporate tax avoidance.

[2] The literature asserts that geopolitical risk heightens corporate financial constraints. Conversely, the interplay between political risk and financial constraint remains unresolved. Ma and Hao (2022) contend that political risk intensifies these constraints, a view countered by Makosa et al. (2021), who argue that Chinese firms reduce investments, thereby easing financial constraints, in response to political risk. It is essential to stress that the influence of geopolitical risk on corporate tax avoidance, mediated by financial constraints, cannot be straightforwardly applied from the impact of political risk on tax avoidance. The relationships are distinct and warrant separate examination.

seen as an exogenous shock to oil-related firms in the US because the global oil supply declined and the price of oil increased after the agreement was announced. Using a propensity score matching procedure and difference-in-differences methods, we find that US oil-related firms engaged in more aggressive tax avoidance activities than their non-oil-related counterparts. This suggests that our findings in the baseline analyses are not biased by the endogeneity problem. Our findings are also robust with alternative measures of financial constraints and industry exposure.

The rest of this study is organized as follows. Section 2 discusses the literature review and hypothesis development. Section 3 outlines our sample and variable measurement. Section 4 presents empirical analyses, including our baseline regression, channel analysis, a quasi-natural experiment, as well as robustness tests. Section 5 concludes the paper.

2. Literature review and hypothesis development

2.1. Geopolitical risk versus political risk

External risk factors, such as *political* risk and *geopolitical* risk, are becoming an increasing concern for corporations, market participants, and central bank officials due to the potential for significant adverse economic effects (Carney 2016). However, one needs to distinguish these two types of risk factors because they refer to distinct risks and lead to different outcomes.

Political risk defines policy uncertainty surrounding monetary policy, fiscal policy, government spending, regulation, and taxation (Nguyen & Nguyen 2020). These uncertainties are also referred to as *economic policy uncertainty*. Recent studies discuss the effects of economic policy uncertainty on corporate behavior and decision-making. Hassan et al. (2019) find that firm-specific stock return volatility and planned capital expenditure are heavily affected by policy uncertainty. Julio and Yook (2012) indicate that firms reduce investment expenditure around election years given the uncertainty surrounding monetary policy and tax policy, as well as potential regulatory changes. The impacts of political risk on corporate behaviors are also explored, including mergers and acquisitions (Bonaime et al. 2018), capital investment (Gulen & Ion, 2016), and firm-level investment (Kang et al., 2014; Wang et al., 2014).

Different from political risk, geopolitical risk arises from geopolitical shocks, which include but are not limited to wars, military attacks, terrorist acts, as well as diplomatic conflicts all over the world (Wang et al., 2019). The adverse impacts of geopolitical risk are explored extensively in the prior literature, and the effects include the effect on the prices of oil and gold (Bouoiyour et al., 2019; Su et al., 2019; Gkillas et al., 2020), the price of essential food commodities (Ma et al., 2022), excess stock return predictability (Ma et al., 2022), bank stability (Phan et al., 2022) and common business cycles (Gupta et al., 2018). Overall, the current literature mainly focuses on the effect of geopolitical risk on macroeconomic factors, while research on its effect on corporate strategies is scarce.

2.2. Determinants of corporate tax avoidance

Corporate tax avoidance, a corporate strategy that reduces tax payments relative to the pre-tax income, is recognized to be a valuable alternative financing method for companies (Dyreng et al., 2010; Edwards et al., 2016). Current studies have explored several firm-related factors that can have an impact on tax avoidance engagement.

Gallemore and Labro (2015) find that a higher quality of corporate internal information promotes tax avoidance, which is more pronounced for firms with geographic dispersion or greater uncertainty on their effective tax rates. In addition, Rego (2003) states that there is a negative correlation between the effective tax rate and pre-tax income. Therefore, firms with higher pre-tax income tend to have more incentives to engage in more tax planning activities.

Furthermore, the reputational costs of tax avoidance are also documented as an important factor to limit tax avoidance activities. Graham et al. (2014) utilize survey data to capture direct information from top management groups and find that executive incentives affect the level of tax avoidance comprehensively. Graham et al. (2014) state that nearly half of all executives in publicly traded companies value generally accepted accounting principles effective tax rates (GAAP ETRs) more than cash taxes paid, and 37 percent of them weighted both equally. In addition, Graham et al. (2012) discuss the limitation of using book-tax difference as a proxy for tax avoidance, whereby they find that book-tax difference captures earnings management, tax laws, as well as differences in accounting standards. Therefore, in this study, we use effective tax rates to capture corporate tax avoidance activities.

Dyreng et al. (2010) find that individual executives have a statistically and economically significant impact in determining the level of tax avoidance that firms engage in, and these are incremental effects that cannot be explained by firm characteristics. Desai and Dharmapala (2006) find that increases in the high-powered incentives for managers effectively reduce tax sheltering incentives. This finding is consistent with the feedback effects between managerial diversion and tax sheltering. Furthermore, for firms with weak governance arrangements, the adverse effects of incentive compensation on tax sheltering are more pronounced relative to well-governed firms.

In summary, the prior literature has focused on the internal determinants of tax avoidance, whereas external factors, such as geopolitical risk, are limited.

2.3. Hypothesis Development: Induced effect of cash reserves and financial constraints

The prevailing literature emphasizes that a rise in geopolitical risk corresponds with an expansion in firm cash reserves, as evidenced by studies from Lee and Wang (2021); Kotcharin and Maneenop (2020); Tekin et al. (2023). Tekin et al. (2023) further demonstrate that firms situated in countries with elevated geopolitical risks maintain more significant cash reserves, presumably as a safeguard against such risks. A plausible rationale for this behavior is the potential escalation in external financing costs and economic

instability resulting from higher geopolitical risks (Lin & Paravisini, 2013). Consequently, firms may enhance their cash savings to offset these detrimental effects, possibly leading to more assertive tax avoidance strategies.

However, Hanlon et al. (2017) uncover substantial variations in cash holdings across multinational and purely domestic firms. The stark contrasts in cash holdings and the enduring presence of low cash reserves within certain firms over time, even within the same country, imply a multifaceted relationship. This complexity gives rise to an alternative hypothesis: escalating geopolitical risks at the firm level may intensify scrutiny over the firms, making tax avoidance during such periods more fraught with costly implications. The threat of negative publicity during periods of increased tensions may compel firms to reassess and possibly abandon their tax avoidance initiatives. Consequently, rather than pursuing aggressive tax avoidance strategies, heightened geopolitical risks might prompt firms to adopt more conservative approaches. In this intricate landscape, while it is apparent that geopolitical risks can affect firms' tax avoidance strategies, the exact nature and trajectory of this influence could not be directly derived from the existing literature. Thus, our study provides empirical evidence on whether geopolitical risks are associated with higher or lower levels of corporate tax avoidance.

Furthermore, the impact of geopolitical risk on corporate tax avoidance is likely to differ across firms with different levels of financial constraints. Chen and Lai (2012) find that financially-constrained firms engage in more aggressive tax avoidance relative to their financially-unconstrained counterparts. Law and Mills (2015) utilize firms' qualitative disclosures as a new measure of financial constraints and conclude that firms that are financially constrained use more negative words in their financial reports and practice more aggressive tax sheltering. In particular, these financially constrained firms exhibit evidence of higher levels of unrecognized tax benefits and lower effective tax rates in both the short run and the long run.

Therefore, we can formulate the following two hypotheses.

Hypothesis 1. *Geopolitical risk is statistically associated with corporate tax avoidance engagement.*

Hypothesis 2. *The impact of geopolitical risks on corporate tax avoidance varies across firms with different levels of financial constraints.*

3. Sample and variable measurement

3.1. Sample selection and data Description

Our sample consists of all publicly listed firms in the US from 2005 to 2019. We download the daily and monthly geopolitical risk (GPR) index for the US, which is a newspaper-based index proposed by Caldara and Iacoviello (2022).[3] This GPR index is based on an automated search coverage of geopolitical-tension-related terms in about 25 million news articles from 10 foremost international newspapers, including *The Chicago Tribune, The Daily Telegraph, The Financial Times, The Globe and Mail, The Guardian, The Los Angeles Times, The New York Times, USA Today, The Wall Street Journal, and The Washington Post*. The inclusion of leading newspapers from the United Kingdom, the United States, and Canada ensures that the estimated index takes into account sufficient global coverage of important geopolitical events and their repercussions (Caldara & Iacoviello, 2022). It is important to note that the GPR index is recognized to be weakly correlated with other widely-used political uncertainty indices (Wang et al. (Forthcoming); Caldara and Iacoviello (2022)). We obtain financial data and firm-level characteristics from Compustat North America Database.

3.2. Variable Construction

3.2.1. Measures of geopolitical risk

The US daily and monthly country-level GPR indices are downloaded from Caldara and Iacoviello (2022). These indices are generated by jointly counting the occurrences of geopolitical-related terms and country names in the leading newspapers. Following the methodologies outlined in Caldara and Iacoviello (2021) and Caldara and Iacoviello (2022), we estimate the firm-specific and industry-specific GPR indices to capture the differential effects of geopolitical risk across firms.

We estimate the firm-level GPR index as embedding three components. The first component, GPR_t, is the average of all monthly GPR indices in quarter t. The second component takes into account the role of industry exposure, γ_t. And the third component,$Z_{i,t}$, is the idiosyncratic firm-level GPR index. For the second component, we estimate the industry exposure by regressing the daily portfolio returns in the 49 industry groups of Fama and French (1997) on changes in the daily GPR index, as presented in the regression equation (1).

$$R_{k,t} = \alpha_k + \beta_k \Delta GPR_t + \varepsilon_{k,t} \tag{1}$$

where $R_{k,t}$ is the annualized daily excess return in industry k over the one-month T-bill rate and ΔGPR_t is the change in the country-level daily GPR index. The estimated beta coefficient of equation (1) was demeaned and the sign was changed to get the industry exposure values. A positive value of this industry exposure indicates high exposure. The value of industry exposure in a quarter is

[3] We thanks Caldara and Iacoviello (2021) for kindly providing the data and the replication codes.

calculated as the average of the estimated beta coefficients in that quarter. The industry exposure is included to capture the instance that certain industries exhibit more sensitivity towards geopolitical risk.[4]

The third component, $Z_{i,t}$, is the idiosyncratic firm-level GPR index. This component is included to isolate any firm-level effects that are not captured at either the country or industry levels, which might happen in the two following situations. First, certain firms exhibit time-varying exposure to geopolitical risks due to unique political connections, risk management, trading exposure, or geographic locations (e.g., Apple in the US-China tension). Second, some firms experience significant geopolitical risks because their headquarters are in countries whose geopolitical risks are not fully captured at the country- or industry-level (e.g., a technology company in Syria). We obtain firm-level political risk (Hassan et al. 2019) and firm-level GPR index (Caldara & Iacoviello 2022), which is derived from textual analysis of firms' transcripts of the quarterly earnings call, to capture the time-varying exposure and location exposure. Collectively, these components consider all GPR-related words for each single firm. The calculation of the firm-level GPR index is then determined by taking the natural logarithm of the ratio of 100 times geopolitical-risk-related words divided by the total number of words in the given newspaper section. The formula for this can be expressed as ln(100 * GPR-related words / total words).

The industry-level GPR index is calculated by multiplying the logarithm of the changes in the country-level GPR index and an industry exposure dummy. This industry-level index is used to quantify the differential impacts of geopolitical risk across industries (Caldara & Iacoviello 2022).[5]

3.2.2. Measures of tax avoidance

We use two measures of corporate tax avoidance, including the cash effective tax rate (*CETR*) and the long-run effective tax rate (*LRETR*). Following Dyreng et al. (2010), cash effective tax rate (*CETR*) is defined as firms' cash taxes paid divided by pre-tax accounting income in a one-year window. Long-run effective tax rate (*LRETR*) is defined as the cash tax paid dividend by the difference between pre-tax income and special items in each five-year window (Dyreng et al. 2008). Using these two rates as the proxies of corporate tax avoidance offers several advantages. First, Kim et al. (2011) state that the traditional Generally Accepted Accounting Principles (GAAP) effective tax rate does not consider the stock options in employees' compensation packages, whereby the tax benefits of stock options given to an employee are considered in cash effective tax rates. Second, changes in the accounting estimates do not affect the cash effective tax rate, while changes like valuation allowances and tax contingency reserves may affect GAAP effective tax rates (Kim et al. 2011). Furthermore, the two effective tax rates take into account both short- and long-run variations in the engagement in tax avoidance, aim to triangulate the results to avoid the potential limitations of each measure (Hanlon & Heitzman 2010) and provide more confidence if results are consistent between different measures.

We follow Kim et al. (2011) to use a five-year horizon to account for firms' long-run tax behavior. Also, we require at least three consecutive years of non-missing data to calculate the long-run cash effective tax rate (*LRETR*). Compared with the cash effective tax rate, *CETR*, the long-run cash effective tax rate (*LRETR*) has the potential to capture firms that successfully engage in tax avoidance in the long run. Both tax avoidance measures are indirect proxies of corporate tax avoidance given that a lower value for those proxies indicates more aggressive engagement in tax avoidance. We truncate tax avoidance measures to the range of 0 and 1 following Nguyen and Nguyen (2020).

3.2.3. Firm-Level characteristics

Prior literature has extensively discussed firm-level controls that are correlated with tax avoidance (Chen et al. 2010; Dyreng et al. 2010; Gallemore et al. 2014; Cen et al. 2017). We include commonly used controls in the tax avoidance literature, including firm size (*SIZE*), cash holdings (*CASH*), net loss carry-forwards (*NOL*), profitability (*ROA*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*) and equity income in earnings (*EIIE*). In addition, we also include the lagged value of both tax avoidance proxies (*LAG_CETR* and *LAG_LRETR*) to account for the effect of prior tax avoidance engagement on future tax planning.

The firm size (*SIZE*) is constructed by taking the logarithm of the firm's market capitalization. Based on the 'political cost' hypothesis, Zimmerman (1983) states that firms behave more aggressively in tax planning if the firm size is larger than the sample average. An explanation for this finding is that larger firms are generally more sophisticated and experienced in deploying more complex tax avoidance strategies (Hanlon 2005).

The existing literature seems to propose conflicting hypotheses regarding the effect of cash holdings (*CASH*) on corporate tax avoidance. Cen et al. (2017) find that firms with higher levels of cash holdings are reluctant to engage in aggressive tax planning given there are adequate cash reserves for further investment needs. However, Hanlon et al. (2017) state that firms always tend to harbor more cash holdings to prevent any future cash shortfalls payable to the Internal Revenue Service (IRS).

In addition, we also include *ROA* to account for the incentive of aggressive tax avoidance. Edwards et al. (2016) indicate that firms are discouraged to engage in more tax avoidance activities if they have higher profitability (*ROA*). Furthermore, Chen et al. (2010) claim that firms with higher levels of carry-forward losses (*NOL*) have an incentive to conduct more aggressive tax strategies than firms with lower levels of carry forward losses (*NOL*). We include foreign income (*FI*) because multinational firms have more capacity and incentives to avoid taxes due to their potential benefits from low-tax-rate foreign jurisdictions, and geographic earnings disclosure

[4] Harvard Business Review reports that companies in the industry of manufacturing and selling semiconductor products are heavily affected by the growing tension between the US and China. The anxieties in the US around China's manufacturing capacities lead to the US government's restriction of Chinese firms' access to US technology, which results in higher geopolitical tensions in the private sector than at the government level (Lee & Glosserman 2022).

[5] The industry exposure dummy equals one for industries with above-median industry exposure γ_t, and equals zero otherwise.

(Hope et al. 2013). Furthermore, Rego (2003) discusses the importance of foreign income and finds that multinational firms exhibit lower worldwide effective tax rates relative to firms that only operate domestically.

Free cash flow (*FCF*) is constructed as the net change in cash derived from operating activities scaled by the total equity. The inclusion of free cash flow (*FCF*) captures the availability of internal funding that relates to the engagement in tax avoidance (Atawnah et al. 2018). Financial leverage (*LEV*) promotes the tax shield benefit with a higher level of external borrowing. Leverage can effectively reduce the marginal tax rate and disincentivizes aggressive tax planning (Graham 1996).

Chen et al. (2010) argue that the book-tax difference becomes larger when accounting and tax regulations are different for investments, and this difference is captured by equity income in earnings (*EIIE*). In Table 1, we present descriptive statistics for firm-level geopolitical risk, tax avoidance measures, as well as firm-level controls. The summary statistics are in line with prior studies (i.e., (Cen et al. 2017; Nguyen & Nguyen 2020). All variables are defined in Appendix A.

4. Empirical analysis

4.1. Baseline results

We examine the dynamic effect of geopolitical risk on corporate tax avoidance at both the firm and industry levels, respectively, using the following regression equations.

$$TA_{i,t} = \beta_1 Firm\_GPR_{i,t} + \beta_2 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

$$TA_{i,k,t} = \beta_3 \Delta GPR_t \times IDD_{k,t} + \beta_4 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_{i,t} \tag{3}$$

The subscript "*k*" refers to an industry in the US. The subscript "*i, t*" refers to firm *i* in year *t*. *TA* is tax avoidance measures that includes the cash effective tax rate (*CETR*) and the long-run cash effective tax rate (*LRETR*). $FA_{i,t}$ is a vector of firm-level characteristics for firm *i* in year *t*, which include firm size (*SIZE*), cash holdings (*CASH*), net loss carry-forwards (*NOL*), profitability (*ROA*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*), and equity income in earnings (*EIIE*). $TA_{i,t-1}$ is tax avoidance measures in the prior year for any given firm *i*, which are denoted as $LAG\_CETR_{i,t}$ and $LAG\_LRETR_{i,t}$ for cash effective tax rate and the long-run cash effective tax rate, respectively. We include both firm-fixed effects and year-fixed effects to take into account any trend in these factors over time and eliminate omitted variable biases.

In the regression equation (2), the variable of interest, $Firm\_GPR_{i,t}$, is a firm-specific annual GPR index, which captures three components, including the country-level GPR index, the interaction term between the country-level GPR index and industry exposure, as well as the idiosyncratic firm-level GPR index as discussed in the earlier section. In the regression equation (3), ΔGPR_t denotes the logarithm of the change in the country-level GPR index. $IDD_{k,t}$ is an industry exposure dummy, which equals one for industries that have above-median geopolitical risk exposure and equals zero otherwise. $\Delta GPR_t \times IDD_{k,t}$ is the interaction between the log changes in the country-level GPR index, ΔGPR_t, and the industry exposure dummy.

Table 2 reports the estimation results for the regression equations (2) and (3).[6] The dependent variables are *CETR* in columns (1) to (3) and *LRETR* in columns (4) to (6). Following Caldara and Iacoviello (2022), we report the estimation results for firm-fixed effects and firm-year fixed effects in both firm-level and industry-level analyses.

The firm-level analyses show that the coefficient estimates for both tax avoidance measures are negative and statistically significant at the 5 % level (see columns (1) and (4)). The coefficient estimates are also economically significant because a one-standard-deviation increase in *FIRM_GPR* leads to an average 0.94 standard deviation decline in effective tax rates.[7] As stated, a lower value for tax avoidance proxies implies more aggressive engagement in tax avoidance. Therefore, the negative and significant estimated coefficients of *FIRM_GPR* indicate that firms engage in more aggressive tax avoidance activities when they face increased geopolitical risk.

In the industry-level regression analyses, we find that the estimated coefficients for $\Delta GPR \times IDD$ are negative and significant for both tax avoidance measures as presented in columns (2), (3), (5), and (6) at either the 1 % or 5 % levels. The coefficient estimates are also economically significant considering that a one-standard-deviation increase in $\Delta GPR \times IDD$ leads to an average 5.19 % decrease in effective tax rates, calculated as at the relevant mean values.[8] The findings suggest that there is a positive association between geopolitical risk and corporate tax avoidance.

Regarding the firm-level control variables in Table 2, we find coefficient estimates are statistically significant and in line with the prior literature (Chen et al. 2010; Cen et al. 2017; Nguyen & Nguyen 2020). For example, the estimated coefficients for *SIZE* are negative, and this result is supported by Zimmerman (1983) finding that larger firms are more sophisticated and engage in more tax avoidance. In addition, we observe negative estimated coefficients for *FI* and *FCF*, which is consistent with Rego (2003) and Hope et al. (2013). Moreover, we find the estimated coefficients for lagged tax avoidance measures, $LAG\_CETR_{i,t}$ and $LAG\_LRETR_{i,t}$, to be positively significant in all specifications. This is in line with Dyreng et al. (2008), who find that firms engaging in aggressive tax planning

[6] The decline in the number of observations in Table 2, as compared to Table 1, stems from the significant reduction in observations due to the inclusion of lagged values in two tax avoidance measures that are used as control variables in the regressions.

[7] A one standard deviation change in firm-level geopolitical risk is associated with a 1.03 and 0.85 standard deviation decrease in the effective tax rates.

[8] A one standard deviation change in industry-level geopolitical risk is associated with a 7.85%, 5.94%, 3.49%, and 3.49% decrease in the effective tax rates at the mean values.

Table 1
Summary Statistics The sample contains 48,634 firm-year observations from 2005 to 2019. This table provides descriptive statistics for tax avoidance variables, firm attribute variables at the firm-year level, and the firm-level geopolitical risk measure. Detailed variable definitions can be found in Appendix A.

Variable	N	Mean	S.D.	P25	Median	P75
Geopolitical risk measures						
FIRM_GPR	48,634	0.015	0.716	−0.355	0.000	0.000
Tax avoidance measures						
CETR	43,467	0.270	0.139	0.184	0.283	0.359
LRETR	44,682	0.210	0.168	0.067	0.195	0.308
Firm attributes						
SIZE	43,511	6.828	2.219	5.389	6.933	8.348
CASH	43,293	0.187	0.238	0.031	0.098	0.247
NOL	48,634	0.799	0.401	1.000	1.000	1.000
ROA	43,297	0.110	0.112	0.041	0.077	0.139
FI	48,632	0.015	0.033	0.000	0.000	0.013
FCF	43,457	0.043	0.138	0.010	0.046	0.084
LEV	43,175	0.223	0.237	0.010	0.175	0.336
EIIE	43,297	0.001	0.004	0.000	0.000	0.000

Table 2
Baseline regression.

VARIABLES	*CETR*			*LRETR*		
	(1)	(2)	(3)	(4)	(5)	(6)
$FIRM\_GPR_{i,t}$	−0.002**			−0.001**		
	(-2.07)			(-2.08)		
$\Delta GPR_t \times IDD_{k,t}$		−0.008**	−0.006***		−0.003**	−0.003***
		(-2.32)	(-2.76)		(-2.31)	(-3.46)
ΔGPR_t		0.001			−0.000	
		(0.59)			(-0.08)	
Firm-level controls						
$SIZE_{i,t}$	−0.001	−0.001**	−0.001**	0.000	−0.000	−0.000
	(-1.00)	(-2.20)	(-2.22)	(0.65)	(-0.15)	(-0.16)
$CASH_{i,t}$	−0.003	−0.006	−0.006	−0.003	−0.004	−0.004
	(-0.44)	(-1.00)	(-1.03)	(-1.13)	(-1.49)	(-1.56)
$NOL_{i,t}$	−0.011***	−0.012***	−0.012***	−0.005***	−0.005***	−0.005***
	(-4.74)	(-5.00)	(-5.02)	(-4.83)	(-5.22)	(-5.42)
$ROA_{i,t}$	−0.042***	−0.044***	−0.044***	0.009*	0.008	0.008*
	(-3.24)	(-3.57)	(-4.12)	(1.74)	(1.55)	(1.67)
$FI_{i,t}$	−0.048	−0.039	−0.039	−0.033**	−0.028**	−0.028**
	(-1.51)	(-1.39)	(-1.56)	(-2.24)	(-2.17)	(-2.46)
$FCF_{i,t}$	−0.022*	−0.025**	−0.025**	−0.006	−0.006	−0.006
	(-1.74)	(-2.26)	(-2.48)	(-1.26)	(-1.46)	(-1.44)
$LEV_{i,t}$	−0.037***	−0.042***	−0.042***	−0.014***	−0.015***	−0.015***
	(-7.06)	(-8.26)	(-9.59)	(-6.29)	(-7.36)	(-7.72)
$EIIE_{i,t}$	−1.383***	−1.495***	−1.494***	−0.374***	−0.381***	−0.381***
	(-5.66)	(-6.41)	(-6.69)	(-2.92)	(-2.96)	(-3.00)
$LAG\_CETR_{i,t}$	0.305***	0.312***	0.312***			
	(24.08)	(26.31)	(28.04)			
$LAG\_LRETR_{i,t}$				0.699***	0.697***	0.697***
				(76.98)	(80.17)	(76.88)
Other Controls						
Firm fixed effect	YES	YES	YES	YES	YES	YES
Year fixed effect	YES	No	YES	YES	No	YES
Observations	21,004	20,987	20,987	21,561	21,547	21,547
Adjusted R-squared	0.321	0.290	0.290	0.822	0.815	0.815

activities in the past tend to continue their participation in aggressive tax avoidance in the current period. Our regression results confirm this persistence in tax avoidance behavior, whereby the magnitude of the estimated coefficients of $LAG\_LRETR_{i,t}$, a measure of long-run tax avoidance, is larger than the estimated coefficients of $LAG\_CETR_{i,t}$ that measures short-run tax avoidance.

Overall, our regression results suggest that firms that experience increased geopolitical risk engage in significantly higher tax avoidance. This relationship is discovered at both firm and industry levels. This relationship is also important as it gives insight into how firms revise their engagement in tax avoidance strategy when they experience external geopolitical events and shocks.

4.2. Channel analysis

In this section, we explore the underlying economic channels through which geopolitical risk affects engagement in corporate tax avoidance. Lee and Wang (2021) state that firms tend to hoard more cash reserves when facing geopolitical risk. In addition, as a precautionary measure, financially constrained firms tend to maintain a certain level of cash reserves as a buffer against geopolitical risk. Prior literature examines the impact of financial constraints on corporate tax avoidance. Chen and Lai (2012) and Law and Mills (2015) find that financially-constrained firms tend to pursue more aggressive tax planning and have lower effective tax rates in both the short and long run. The internally generated funds are attained by aggressive tax planning for firms that have an increase in financial constraints (Edwards et al. 2016). Thus, we investigate the role of financial constraints in channelling the impact of geopolitical risks on corporate tax avoidance strategies.

Following Hasan et al. (2014), we use two dummy variables, *HIGH* and *LOW*, to indicate the level of financial constraints in any given firm *i*. Firm sales and their Z-score are employed to measure the level of the firm financial constraints, following Lee and Wang (2021). We define the variable *HIGH* as equal to one if the firm's financial constraint level is less than the sample median value and equal to zero otherwise. The variable *LOW* equals one minus *HIGH*, which indicates firms with a lower level of financial constraint. We then generate two interaction terms between firm-level geopolitical risk and these dummy variables, *HIGH* and *LOW*. The intuition is to delineate the effect of firm-level geopolitical risk on highly financially constrained firms as opposed to less financially constrained firms. We perform a similar firm-level regression analysis as in equation (2), but we replace firm-level geopolitical risk with the interaction terms between financial constraint dummy indicators. The regression model is written as follows:

$$TA_{i,t} = \beta_1 Firm\_GPR_{i,t} \times HIGH_{i,t} + \beta_2 Firm\_GPR_{i,t} \times LOW_{i,t} + \beta_3 FA_{i,\ t} + TA_{i,t-1} + \varepsilon_t \quad (4)$$

where $TA_{i,t}$ is the tax avoidance measure, $Firm\_GPR_{i,t}$ is the firm-specific geopolitical risk index, and $FA_{i,\ t}$ is a vector of the firm characteristics. Firm and year-fixed effects are utilized in all regression specifications. We report the regression results in Panel A of Table 3 where the estimation results using Sales and Z-score are presented in Panels A1 and A2, respectively.[9]

In Panel A1 of Table 3, we find that the estimated coefficients (β_1) on the interaction term $Firm\_GPR \times HIGH$ are statistically significant for both short-run and long-run tax avoidance measures. Since a lower value of the tax avoidance measure indicates more aggressive engagement in corporate tax avoidance, the regression result suggests that the geopolitical risk effect is associated with more aggressive corporate tax avoidance strategies in firms with high financial constraints, as indicated by below-median sales. The estimated coefficients (β_2) on the interaction term $Firm\_GPR \times LOW$ are insignificant for both tax avoidance measures. We find similar results when using the Z-score as a proxy for financial constraints (see Panel A2, Table 3). Furthermore, we perform the Chow test to examine whether the coefficient estimates for the interaction terms are equal. The reported F-statistics and associated *p-value* for the tests in each panel of Panel A of Table 3 suggest a rejection of the null hypothesis ($\beta_1 = \beta_2$) in all four specifications.

In addition to the channelling role of financial constraints on the impact of geopolitical risk on corporate tax avoidance, the existing literature proposes that firms with foreign operations are necessarily financially constrained and engage in more tax avoidance than their domestically operated peers. Prior research has documented the home bias of investment and operations (Feldstein & Horioka 1980; Coval & Moskowitz 1999; Bun 2021). Multinational firms are likely to face more financial constraints because of cognitive bias towards lower information costs (Merton 1987) and familiar investments (Huberman 2001). Furthermore, firms with more extensive foreign operations avoid more taxes relative to their domestic-only counterparts by shifting taxable income to low-tax jurisdictions (Rego, 2003; Bustos et al., 2014; Dyreng & Hanlon, 2021). Thus, we split our sample into firms with foreign operations and firms without foreign operations to investigate if financially constrained firms with foreign operations engage in more tax avoidance activities relative to their domestic-only peers.

We perform a similar firm-level regression analysis as in equation (4) in two groups. In both panels of Panel B of Table 3, we find that the estimated coefficients on the interaction term $Firm\_GPR \times HIGH$ are statistically significant for firms with foreign operations in both short-run and long-run tax avoidance measures. Since a lower value of effective tax rate suggests more aggressive engagement in corporate tax avoidance, the regression result indicates that the geopolitical risk effect is associated with more aggressive corporate tax avoidance plannings in highly financially constrained firms with foreign operations relative to their domestically operated peers.

Overall, our findings support Hypothesis 2, that the impact of geopolitical risks on corporate tax avoidance varies across firms with different levels of financial constraints. Highly financially constrained firms engage in more aggressive tax avoidance when they encounter increased geopolitical risk than their counterparts with low financial constraints. This effect is more pronounced for firms with foreign operations compared to firms that only operate domestically.

4.3. Additional analyses: firm-level investment and managerial entrenchment

Firms that experience severe geopolitical risk suffer the effect of uncertainty on investment. Wang et al. (2019); Caldara and Iacoviello (2022) document that the negative consequences of geopolitical risk have a greater impact on companies operating in more vulnerable industries, and companies with a higher level of geopolitical risk experience reduced investment levels. Wang et al. (2019) also find that the investment rate depresses by 14 % relative to the sample mean when the GPR index doubles. Using asset redeployability as a proxy for investment irreversibility, (Kim & Kung 2017) also find that the negative association between geopolitical

[9] For brevity, only estimates for the interaction terms are tabulated and reported in Table 3. The full estimation results are available upon request.

Table 3
Channel analysis: the role of financial constraints.

VARIABLES	*CETR*	*LRETR*		
Panel A: Full Sample				
Panel A1: HIGH indicates highly financial constraint firms with Sales value less than the sample median				
$Firm\_GPR_{i,t} \times HIGH(\beta_1)$	−0.003	−0.001**		
	(-2.69)	(-2.48)		
$Firm\_GPR_{i,t} \times LOW(\beta_2)$	0.000	−0.000		
	(0.05)	(-0.29)		
Other Controls				
All control variables	YES	YES		
F (*p*-value) for test: $\beta_1 = \beta_2$	3.64 (0.03)	3.19 (0.04)		
Firm fixed effect	YES	YES		
Year fixed effect	YES	YES		
Observations	21,004	21,561		
Adjusted R-squared	0.321	0.822		
Panel A2: HIGH indicates highly financial constraint firms with Z-score less than the sample median				
$Firm\_GPR_{i,t} \times HIGH(\beta_1)$	−0.004**	−0.002		
	(-2.48)	(-2.91)		
$Firm\_GPR_{i,t} \times LOW(\beta_2)$	−0.001	−0.000		
	(-0.43)	(-0.33)		
Other Controls				
All control variables	YES	YES		
F (*p*-value) for test: $\beta_1 = \beta_2$	3.17 (0.04)	4.34 (0.01)		
Firm fixed effect	YES	YES		
Year fixed effect	YES	YES		
Observations	21,004	21,561		
Adjusted R-squared	0.322	0.822		
Panel B: Sub-samples: Foreign Operations versus Non-foreign Operations				
Panel B1: HIGH indicates highly financial constraint firms with Sales value less than the sample median.				
Foreign Operations Sample	YES	NO	YES	NO
$Firm\_GPR_{i,t} \times HIGH$	−0.004	0.000	−0.001	0.001
	(-2.89)	(0.13)	(-3.50)	(1.27)
$Firm\_GPR_{i,t} \times LOW$	−0.001	0.000	0.000	−0.001
	(-0.31)	(0.11)	(0.03)	(-0.66)
Other Controls				
All control variables	YES	YES	YES	YES
Firm fixed effect	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Observations	12,718	6,490	12,921	6,753
Adjusted R-squared	0.313	0.410	0.817	0.848
Panel B2: HIGH indicates high financial constraint firms with Z-score less than the sample median.				
Foreign Operations Sample	YES	NO	YES	NO
$Firm\_GPR_{i,t} \times HIGH$	−0.005	−0.001	−0.001**	−0.002
	(-3.00)	(-0.14)	(-2.55)	(-1.33)
$Firm\_GPR_{i,t} \times LOW$	−0.001	0.001	−0.001	0.001
	(-0.93)	(0.44)	(-0.88)	(1.52)
Other Controls				
All control variables	YES	YES	YES	YES
Firm fixed effect	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Observations	12,718	6,490	12,921	6,753
Adjusted R-squared	0.313	0.410	0.817	0.848

risk and investment is more pronounced for firms with more irreversible assets. This indicates that firms with lower asset redeployability find it more challenging to shift their assets among various investment opportunities.

Despite these findings, it should not be assumed that all firms facing geopolitical risk will necessarily avoid valuable investments. Instead, the detrimental impact on investment may be more prominent in firms with higher levels of investment. These firms, when experiencing geopolitical risk, may encounter financial constraints, and their use of tax avoidance strategies might alleviate these fiscal challenges. To further explore and substantiate this hypothesis, we have conducted an additional analysis, categorizing the firm-level baseline regressions into two groups based on investment levels.

To discern how the influence of geopolitical risk on corporate tax avoidance varies between firms with high and low investment levels, we categorized our baseline sample into two groups using the median investment as the threshold. The findings, detailed in Table 4, indicate that for firms with a higher investment magnitude, the coefficient estimates related to *FIRM_GPR* are statistically significant. Conversely, for the group with a lower investment profile, the results are not statistically meaningful. This distinction

Table 4
Effects of firm-level investment.

VARIABLES	*CETR* Firm-level Investment		*LRETR* Firm-level Investment	
	HIGH	LOW	HIGH	LOW
$FIRM\_GPR_{i,t}$	−0.004**	−0.001	−0.002***	−0.001
	(-2.33)	(-0.96)	(-3.55)	(-0.90)
Firm-level controls				
$SIZE_{i,t}$	−0.002**	−0.001	0.000	0.000
	(-2.17)	(-1.17)	(0.26)	(0.09)
$CASH_{i,t}$	0.016	−0.013*	0.010*	−0.011***
	(1.48)	(-1.77)	(1.77)	(-3.33)
$NOL_{i,t}$	−0.010***	−0.005	−0.005***	−0.002
	(-2.85)	(-1.45)	(-3.39)	(-1.53)
$ROA_{i,t}$	−0.036**	−0.035**	0.008	0.017**
	(-2.09)	(-2.33)	(0.98)	(2.53)
$FI_{i,t}$	−0.089**	−0.035	−0.044**	−0.022
	(-1.96)	(-1.01)	(-1.99)	(-1.48)
$FCF_{i,t}$	−0.088***	0.019	−0.026***	0.008
	(-4.43)	(1.19)	(-3.21)	(1.34)
$LEV_{i,t}$	−0.032***	−0.041***	−0.014***	−0.015***
	(-4.75)	(-6.96)	(-4.64)	(-5.62)
$EIIE_{i,t}$	−1.213***	−1.486***	−0.285	−0.451***
	(-3.48)	(-4.28)	(-1.31)	(-2.93)
$LAG\_CETR_{i,t}$	0.297***	0.328***		
	(17.71)	(17.71)		
$LAG\_LRETR_{i,t}$			0.690***	0.695***
			(53.40)	(48.19)
Other Controls				
Firm fixed effect	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Observations	9,998	10,026	10,285	10,256
Adjusted R-squared	0.330	0.359	0.811	0.844

between the two groups is notably significant, emphasizing that firms with higher investments are more influenced by geopolitical risk in terms of increased engagement in corporate tax avoidance.

We also examine tax avoidance from the standpoint of agency theory, considering the possibility that managers may exploit tax benefits for their advantage, thereby diminishing the value-efficiency of avoiding taxes. This scenario might arise particularly during heightened geopolitical risks, as the turbulent environment may present more opportunities for aggressive tax avoidance, and managers may be more inclined to take such risks. Entrenched managers, those who do not provide transparent information to stakeholders, may be especially prone to this behavior.

To explore this connection, we construct the E-index as a measure to gauge a firm's level of managerial entrenchment, dividing the full sample into two subsamples: firms with high and low E-index values, using the median of the E-index as the dividing point. A higher E-index value implies weaker shareholder rights and greater managerial control within the company. The baseline regressions are then performed for both subsamples, and the results are outlined in Appendix A2. Intriguingly, the estimated coefficient of the GRP index is statistically significant only when the cash-effective tax rate serves as the dependent variable in the high E-index sample. In summary, though there are some indications of a relationship between the degree of managerial entrenchment and geopolitical risks, our findings do not consistently support a definitive link between these two factors, calling for further exploration and analysis.

4.4. Endogeneity issue: the quasi-natural experiment of the 2016 OPEC agreement

In the previous sections, we find that there is a positive relationship between geopolitical risk and the aggressiveness of corporate tax avoidance strategies. This relationship is more pronounced for firms with high financial constraints. Although the reverse causality issue is not a concern in our empirical setting because it is unlikely that more aggressive corporate tax avoidance will lead to higher geopolitical risk, one might raise an endogeneity problem relating to omitting variables in the model. We employed fixed effect specification to address the omitting factor concern in all of our empirical analyses. However, Caldara and Iacoviello (2022) state that a firm may encounter elevated geopolitical risks due to its operation in a specific country, and certain geopolitical events and shocks may not be fully reflected in the country- and industry-level indexes that we have previously employed. Therefore, in this section, we alleviate these endogeneity concerns by exploring an exogenous shock, the 2016 Organization of the Petroleum Exporting Countries (OPEC) agreement, to see if the impact of geopolitical risks on corporate tax avoidance strategies differs across industries.

In late 2016, OPEC reached a deal with its 14 member countries to cut oil production, aiming to protect oil prices from falling due to global oversupply. This decision was particularly driven by the imminent threat of a dramatic increase in US crude oil exports (Meredith 2016; Reuters 2020). During the OPEC Ministerial Conference on November 30th, 2016, a new production target was set at 32.5 million barrels per day, reducing the existing output by 1.2 million barrels per day. This cut led to oil prices falling to a lower

bound of $44 per barrel (Reuters 2020). The '2016 OPEC Banning US Oil Exports Agreement' subsequently constrained and limited the global crude oil supply, leading to a steady increase in crude oil prices. However, the agreement had significant repercussions on oil-related industries in the US (NASReport 2016). As geopolitical risk encompasses adverse events and shocks that affect nations beyond their political borders, the 2016 OPEC agreement stands as a prime example. It exposed certain US firms to considerable economic and financial risks, far more than others. Thus, this agreement serves as a quasi-natural experiment to address the potential endogeneity problem previously discussed because US oil-related companies faced heightened geopolitical risk from the price increase than their non-oil-related counterparts.

We perform a propensity score matching procedure to identify a set of matching non-oil-related firms for the treatment sample, which includes all oil-related firms in our sample. It is important to acknowledge the potential concern that the 2017 Tax Cuts and Jobs Act might have contributed to lower corporate taxes in the post-period and that these lower taxes could be interpreted as unrelated to geopolitical risk. However, the methodological framework of this study employs a propensity score matching procedure and difference-in-differences approach, enabling us to mitigate this concern. Specifically, this procedure identifies a set of matching non-oil-related firms for the treatment sample, which includes all oil-related firms in our sample. As both matching non-oil-related firms and oil-related firms operate within the same macroeconomic environment and are subject to identical government policies, including the 2017 Tax Cuts and Jobs Act, the effects of the Act are essentially controlled for, given the use of the difference-in-differences approach in our paper. Thus, any observed changes in tax avoidance strategies for oil-related firms following the 2016 OPEC meeting can be attributed solely to the oil supply shocks, rather than the influence of the Act.

We define a dummy variable, *Treat*, that equals one for all the treatment firms that belong to any of the oil-related Fama-French industry groups and equals zero otherwise. The oil-related Fama-French industry groups include *Petroleum and Natural Gas, Aircraft, Automobiles and Trucks, Coal, Construction, Construction Materials, Precious Metals, Rubber and Plastic Products, Shipbuilding, Railroad Equipment, Shipping Containers, Steel, and Transportation*. We use a nearest-neighbor matching with no replacement to control for differences in firm-level characteristics between the treatment and control firms before 2016.

We then apply difference-in-differences analysis to examine whether firms in oil-related industries are engaged in more aggressive tax avoidance strategies than non-oil-related firms after the 2016 OPEC agreement. We perform an event study for the samples over the investigated period of 2013–2019, i.e., we use a 3-year pre-treatment and a 3-year post-treatment period. We estimate the average treatment effect of the 2016 OPEC agreement using the difference-in-difference regression shown below:

$$TA_{i,k,t} = \beta_1 Treat \times Post + \beta_2 Post + \beta_3 Treat + \beta_4 FA_{i,\ t} + TA_{i,t-1} + \varepsilon_t, \quad (5)$$

Table 5
Quasi-natural experiment of the 2016 OPEC Agreement.

VARIABLES	*CETR*			*LRETR*		
	(1)	(2)	(3)	(5)	(6)	(7)
Treat × *Post*	−0.018**	−0.012*	−0.018**	−0.008**	−0.005*	−0.008**
	(-2.25)	(-1.66)	(-2.20)	(-2.22)	(-1.71)	(-2.30)
Post	−0.007	−0.010*	−0.009	−0.003	0.000	−0.003
	(-1.27)	(-1.76)	(-1.63)	(-1.17)	(0.17)	(-1.41)
Treat	0.003			0.001		
	(0.44)			(0.31)		
Firm-level controls						
$SIZE_{i,t}$	−0.002*	−0.025***	−0.000	−0.001	−0.011***	−0.000
	(-1.71)	(-3.92)	(-0.27)	(-1.53)	(-4.10)	(-0.17)
$CASH_{i,t}$	0.006	−0.021	0.005	−0.001	0.000	0.001
	(0.38)	(-0.76)	(0.28)	(-0.11)	(0.03)	(0.16)
$NOL_{i,t}$	−0.002	−0.037***	−0.005	−0.002	−0.006	−0.003
	(-0.38)	(-3.33)	(-0.92)	(-0.73)	(-1.35)	(-1.26)
$ROA_{i,t}$	−0.024	−0.206***	−0.035	0.038***	−0.013	0.028**
	(-0.92)	(-4.68)	(-1.30)	(3.33)	(-0.68)	(2.34)
$FI_{i,t}$	0.159**	−0.081	0.087	−0.007	−0.149**	−0.036
	(2.26)	(-0.51)	(1.16)	(-0.21)	(-2.23)	(-1.10)
$FCF_{i,t}$	−0.017	−0.070***	−0.014	−0.012	−0.025**	−0.010
	(-0.86)	(-2.88)	(-0.68)	(-1.35)	(-2.51)	(-1.12)
$LEV_{i,t}$	−0.046***	0.008	−0.037***	−0.016***	0.007	−0.014***
	(-4.81)	(0.48)	(-3.76)	(-3.73)	(0.91)	(-3.15)
$EIIE_{i,t}$	−0.999**	−2.630***	−0.905*	−0.584***	−0.907**	−0.476**
	(-2.09)	(-2.69)	(-1.84)	(-2.81)	(-2.22)	(-2.23)
$LAG\_CETR_{i,t}$	0.497***	0.049***	0.464***			
	(34.24)	(2.65)	(31.08)			
$LAG\_LRETR_{i,t}$				0.814***	0.497***	0.794***
				(109.04)	(38.60)	(101.11)
Other Controls						
Firm fixed effect	NO	YES	NO	NO	YES	NO
Industry fixed effect	NO	NO	YES	NO	NO	YES
Observations	3,500	3,464	3,500	3,464	3,233	3,294
Adjusted R-squared	0.286	0.574	0.308	0.574	0.895	0.807

Similar to the baseline regression model, the dependent variables, *TA*, are tax avoidance measures including the cash effective tax rate (*CETR*) and the long-run cash effective tax rate (*LRETR*); $FA_{i,\ t}$ is a vector of the firm attributes including firm size (*SIZE*), cash holdings (*CASH*), net loss carry-forwards (*NOL*), profitability (*ROA*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*), as well as equity income in earnings (*EIIE*). $TA_{i,t-1}$ are tax avoidance measures in the prior year for firms *i*. The dummy variable, *Treat*, equals one for the treatment firms that belong to any of the above oil-related Fama-French 49 industry groups and equals zero otherwise. The match firms are those that do not belong to any of those oil-related industries. The dummy variable *Post* equals one for the post-event period (2017–2019) and zero for the pre-event period (2013–2015). The interaction term *Treat* × *Post* captures the average treatment effect of the 2016 OPEC agreement on corporate tax avoidance. Following He and Huang (2017), we use various specifications of firm-fixed effect and industry-fixed effect in the regression analysis. The regression estimations are reported in Table 5.

We observe that the estimated coefficients of the interaction term, *Treat* × *Post*, are negative and statistically significant at either the 5 % or 10 % level, across all model specifications. This suggests that firms in oil-related industries (i.e., firms that experience adverse effects due to the 2016 OPEC agreement) exhibit lower effective tax rates than their non-oil-related counterparties, indicating that firms in oil-related industries engage in more aggressive tax avoidance activities than firms in non-oil-related industries.

Overall, our analyses suggest that US oil-related firms engage in more aggressive tax planning than their non-oil-related counterparts due to heightened geopolitical risk (i.e., restricted oil supply and increased oil price) arising from the 2016 OPEC agreement. This indicates that the relationship between geopolitical risks and corporate tax avoidance strategies differs across industries, whereby firms in certain industries adjust their engagement in tax avoidance more than firms in other industries, particularly in response to geopolitical shocks.

4.5. Robustness Analysis: Industry exposure

In the baseline regression, we take into account industry exposure by including the industry exposure dummy variable (*IDD*) in the regression analyses because Caldara and Iacoviello (2022) suggest that the industry exposure dummy makes the regression estimations "more robust to the exact quantification of exposure".

As a robustness check for the earlier industry-level analysis, in this section, we use a continuous value of industry exposure which is the estimated beta coefficient from the regression equation (1). Industry exposure (*ID*) can capture stock return decreases in response to the most dramatic peaks in the GPR index for industries with higher exposure compared to the market average. We perform similar analyses as described in the regression equation (3), but we replace the industry exposure dummy (*IDD*) with industry exposure (*ID*) to

Table 6
Robustness analysis: industry exposure.

VARIABLES	*CETR*		*LRETR*	
	(1)	(2)	(3)	(4)
$\Delta GPR_t \times ID_{k,t}$	−0.005**	−0.005**	−0.002**	−0.002***
	(-2.30)	(-2.50)	(-2.49)	(-2.81)
ΔGPR_t	−0.002		−0.001**	
	(-1.21)		(-2.16)	
Firm-level controls				
$SIZE_{i,t}$	−0.001**	−0.001**	−0.000	−0.000
	(-2.20)	(-2.31)	(-0.15)	(-0.28)
$CASH_{i,t}$	−0.006	−0.006	−0.004	−0.004
	(-1.02)	(-1.07)	(-1.50)	(-1.61)
$NOL_{i,t}$	−0.012***	−0.012***	−0.005***	−0.005***
	(-4.98)	(-5.05)	(-5.20)	(-5.45)
$ROA_{i,t}$	−0.044***	−0.043***	0.008	0.008*
	(-3.54)	(-4.05)	(1.58)	(1.74)
$FI_{i,t}$	−0.038	−0.037	−0.028**	−0.027**
	(-1.36)	(-1.49)	(-2.15)	(-2.38)
$FCF_{i,t}$	−0.025**	−0.024**	−0.006	−0.006
	(-2.25)	(-2.42)	(-1.46)	(-1.37)
$LEV_{i,t}$	−0.042***	−0.042***	−0.015***	−0.015***
	(-8.29)	(-9.61)	(-7.38)	(-7.75)
$EIIE_{i,t}$	−1.494***	−1.495***	−0.381***	−0.381***
	(-6.41)	(-6.69)	(-2.96)	(-3.00)
$LAG\_CETR_{i,t}$	0.312***	0.312***		
	(26.32)	(28.07)		
$LAG\_LRETR_{i,t}$			0.697***	0.697***
			(80.17)	(76.85)
Other Controls				
Firm fixed effect	YES	YES	YES	YES
Year fixed effect	No	YES	No	YES
Observations	20,987	20,987	21,547	21,547
Adjusted R-squared	0.290	0.290	0.815	0.815

examine the industry-level effect of geopolitical risk on corporate tax avoidance. The regression model is written as follows:

$$TA_{i,k,t} = \beta_1 \Delta GPR_t \times ID_{k,t} + \beta_2 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_t \quad (6)$$

where $ID_{k,t}$ is the alternative continuous measure of industry exposure. All other variables are defined as in the baseline model (3). The variable of interest, $\Delta GPR_t \times ID_{k,t}$, is the interaction of the logarithm of the changes in the country-level geopolitical risk times the industry exposure measure. Firm-fixed effects and firm-year fixed effects are applied in the model specifications. The estimation results are presented in Table 6.

We find that the estimated coefficients of $\Delta GPR \times ID$ are negatively significant at the 1 % or 5 % levels for both tax avoidance measures. The regression results indicate that firms engage in more aggressive tax avoidance activities when they face a higher level of industry-related geopolitical risk. These results provide a robustness check to our earlier documented baseline results on corporate tax avoidance at the industry level.

5. Conclusion

This paper investigates whether geopolitical risk affects corporate tax avoidance. We find robust evidence that firms engage in more aggressive tax planning when facing geopolitical risk at both firm- and industry levels in both the short and long run. This is the first evidence highlighting geopolitical risk, as an external risk factor, that can affect firms' engagement in corporate tax avoidance. We also show that this effect is more pronounced for financially constrained firms. In addition, we use as an exogenous shock the 2016 OPEC Banning US Oil Exports Agreement to examine the positive association between geopolitical risk and tax avoidance for firms in different industries. Our results are also robust at the firm and industry levels with the inclusion of industry exposure beta coefficients. Overall, this paper highlights novel findings on the relationship between geopolitical risk and corporate tax avoidance and the role of firm financial constraints in enhancing this relationship.

This table presents the baseline regression results of the below regression models from 2005 to 2019. The regression models are as follows:

$$TA_{i,t} = \beta_1 Firm\_GPR_{i,t} + \beta_2 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

$$TA_{i,k,t} = \beta_3 \Delta GPR_t \times IDD_{k,t} + \beta_4 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

where *TA* is tax avoidance measures including cash effective tax rate (*CETR*) and long-run cash effective tax rate (*LRETR*). $FA_{i,t}$ are the firm attributes including firm size (*SIZE*), cash holdings (*CASH*), firm profitability (*ROA*), net loss carry-forwards (*NOL*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*) and equity income in earnings (*EIIE*). $TA_{i,t-1}$ are tax avoidance measurements in the prior year for any given firm. $Firm\_GPR_{i,t}$ is the firm-specific geopolitical risk; $\Delta GPR_{i,t}$ denotes the logarithm of the changes in country-level geopolitical risk. $IDD_{k,t}$, an industry exposure dummy, equals one for industries that have above-median exposure and equals zero otherwise. The firm-fixed effect and firm-year fixed effects are included, alternatively. The standard errors are corrected for heteroskedasticity and serial correlation, and the t-statistics are given in parentheses. The standard errors are also clustered by firm and year-industry. Significance levels are indicated by *, **, and ***, representing significance at the 10 %, 5 %, and 1 % levels, respectively.

This table presents the estimation results of the following regression equation for the full sample (Panel A) and for subsamples of firms with foreign operations and without foreign operations (Panel B):

$$TA_{i,t} = \beta_1 Firm\_GPR_{i,t} \times HIGH + \beta_2 Firm\_GPR_{i,t} \times LOW + \beta_3 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_t \quad (4)$$

The dependent variables, *TA*, are tax avoidance measurements including cash effective tax rate (*CETR*) and long-run cash effective tax rate (*LRETR*). $Firm\_GPR_{i,t}$ is the firm-specific geopolitical risk, which counts the occurrence of mentions of geopolitical risks in the earning call. *HIGH* equals one if the firm's financial constraint is less than the sample median value. *LOW* equals one minus *HIGH*. $FA_{i,\,t}$ are the firm attributes including firm size (*SIZE*), cash holdings (*CASH*), firm profitability (*ROA*), net loss carry-forwards (*NOL*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*) and equity income in earnings (*EIIE*). $TA_{i,t-1}$ are tax avoidance measurements in the prior year for any given firm. In Panel B, YES indicates firms have foreign operations and NO indicates firms have no foreign operations. For brevity, only estimates for the interaction terms are tabulated. The firm and year-fixed effects are controlled. The standard errors are corrected for heteroskedasticity and serial correlation, and the t-statistics are given in parentheses. The standard errors are also clustered by firm and year-industry. Chow test results are reported to examine whether interaction terms are equal. Significance levels are indicated by *, **, and ***, representing significance at the 10 %, 5 %, and 1 % levels, respectively.

This table presents the below baseline regression results for subsamples divided by the median of firm-level investment. The regression models are as follows:

$$TA_{i,t} = \beta_1 Firm\_GPR_{i,t} + \beta_2 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_{i,t}$$

where *TA* is tax avoidance measures including cash effective tax rate (*CETR*) and long-run cash effective tax rate (*LRETR*). $FA_{i,t}$ are the firm attributes including firm size (*SIZE*), cash holdings (*CASH*), firm profitability (*ROA*), net loss carry-forwards (*NOL*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*) and equity income in earnings (*EIIE*). $TA_{i,t-1}$ are tax avoidance measurements in the prior year for any given firm. $Firm\_GPR_{i,t}$ is the firm-specific geopolitical risk. The firm-fixed effect and firm-year fixed effects are included, alternatively. The standard errors are corrected for heteroskedasticity and serial correlation, and the t-statistics

are given in parentheses. The standard errors are also clustered by firm and year-industry. Significance levels are indicated by *, **, and ***, representing significance at the 10 %, 5 %, and 1 % levels, respectively.

This table presents the multivariate difference-in-differences regression results on the effect of the 2016 OPEC agreement on corporate tax avoidance. The regression model is as follows:

$$TA_{i,k,t} = \beta_1 Treat \times Post + \beta_2 Post + \beta_3 Treat + \beta_4 FA_{i,\ t} + TA_{i,t-1} + \varepsilon_t \quad (5)$$

The dependent variables, *TA*, are tax avoidance measurements including cash effective tax rate (*CETR*) and long-run cash effective tax rate (*LRETR*). *Treat* is a dummy variable that equals one if a firm belongs to any of the following Fama-French industry groups: Petroleum and Natural Gas, Aircraft, Automobiles and Trucks, Coal, Construction, Construction Materials, Precious Metals, Rubber and Plastic Products, Shipbuilding, Railroad Equipment, Shipping Containers, Steel, and Transportation. *Post* is a dummy variable that equals one for the post-event period (2017–2019) and zero for the pre-event period (2013–2015). $FA_{i,t}$ are the firm attributes including firm size (*SIZE*), cash holdings (*CASH*), firm profitability (*ROA*), net loss carry-forwards (*NOL*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*) and equity income in earnings (*EIIE*). $TA_{i,t-1}$ are tax avoidance measurements in the prior year for any given firm. The firm-fixed effect and industry-fixed effect are controlled. The standard errors are corrected for heteroskedasticity and serial correlation, and the t-statistics are given in parentheses. Significance levels are indicated by *, **, and ***, representing significance at the 10 %, 5 %, and 1 % levels, respectively.

This table presents the estimation results of the following regression equation:

$$TA_{i,k,t} = \beta_1 \Delta GPR_t \times ID_{k,t} + \beta_2 FA_{i,\ t} + TA_{i,t-1} + \varepsilon_t \quad (6)$$

The dependent variables, *TA*, are tax avoidance measurements including cash effective tax rate (*CETR*) and long-run cash effective tax rate (*LRETR*). $\Delta GPR_{i,t}$ denotes the log changes in aggregate geopolitical risk. $ID_{k,t}$ is an alternative measure of industry exposure. $FA_{i,t}$ are the firm attributes including firm size (*SIZE*), cash holdings (*CASH*), firm profitability (*ROA*), net loss carry-forwards (*NOL*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*) and equity income in earnings (*EIIE*). $TA_{i,t-1}$ are tax avoidance measurements in the prior year for any given firm. The standard errors are corrected for heteroskedasticity and serial correlation, and the t-statistics are given in parentheses. The standard errors are also clustered by year and industry. Significance levels are indicated by *, **, and ***, representing significance at the 10 %, 5 %, and 1 % levels, respectively.

CRediT authorship contribution statement

Tariq Haque: Supervision, Writing – review & editing. **Thu Phuong Pham:** Conceptualization, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing, Project administration. **Jiaxin Yang:** Conceptualization, Investigation, Methodology, Data curation, Formal analysis, Software, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Appendix A. 1 variable definition

Variables	Acronym	Description	Data Sources
Measures of geopolitical risk:			
Firm-level geopolitical risk	*FIRM_GPR*	Firm-level geopolitical risk, denoted by *FIRM_GPR*, is calculated by the natural logarithm of 100 times geopolitical-risk-related words divided by the total number of words in the given newspaper section. The geopolitical-risk-related considers three embedded components: the average of all monthly GPR indices in quarter t, the industry exposure, and the idiosyncratic firm-level GPR index.	Caldara and Iacoviello (2022)
Measures of tax avoidance:			
Cash effective tax rate	*CETR*	Cash effective tax rate, denoted by *CETR*, is calculated as the cash taxes paid expense (*txpd*) divided by the difference between pre-tax book income (*pi*) and special items (*spi*). The data frequency is annual.	Compustat
Long-run cash effective tax rate	*LRETR*	Dyreng, Hanlon and Maydew's (2008) long-run cash effective tax rate is defined as cash tax paid dividend by the difference between pre-tax income and special items in a five-year window. This measure requires at least three consecutive years with non-missing data. *LRETR* for any firm in a given year is measured as follows:$LRETR_{it}$ =	Compustat

(*continued on next page*)

(*continued*)

Variables	Acronym	Description	Data Sources
		$\frac{\sum_{k=t-4}^{t} Cash\_tax\_paid_{ik}}{\sum_{k=t-4}^{t}(Pretax\_income_{ik} - Special\_items_{ik})}$	
Firm-level controls:			
Firm size	*SIZE*	Firm size is the natural logarithm of the firm's market capitalization, which is calculated by multiple annual close prices ($prcc_f$) and common shares outstanding (*csho*).	Compustat
Cash holding	*CASH*	Cash holding is calculated by the cash and marketable securities (*che*) divided by the lagged asset (*at*).	Compustat
Loss carry-forward	*NOL*	Net loss carry-forward is a dummy variable equal to one if loss carry-forward (*tlcf*) is positioned for a firm in a given year and zero otherwise.	Compustat
Return on asset	*ROA*	Return on asset is measured by the operating income (*pi* −*xi*) divided by the lagged asset (*at*).	Compustat
Foreign income	*FI*	Foreign income (*pifo*) scaled by the lagged asset (*at*). Set missing values to zero.	Compustat
Free cash flow	*FCF*	The firm's net change in cash from operating activities (*oancf*) minus capital expenditures (*capx*), scaled by the market value of equity ($prcc\_f \times csho$).	Compustat
Leverage	*LEV*	The firm's financial leverage at the end of the year, is calculated by long-term debt (*dltt*) scaled by the lagged asset (*at*).	Compustat
Equity income in earnings	*EIIE*	The firm's equity income in earnings, is calculated by the equity in earnings (*esub*) scaled by the lagged asset (*at*).	Compustat
Other variables:			
Firm-level political risk	*PRisk*	Average of the transcript-based scores of the overall political risk for a given firm and year. It is standardized by its respective standard deviation.	Hassan et al. (2019)
Industry exposure	*ID*	The industry exposure measured by using the estimated coefficients on GPR from regressing the daily industry portfolio excess returns on daily GPR.	Caldara and Iacoviello (2022)
Industry exposure	*IDD*	Industry exposure dummy, equals one for industries that have above-median exposure and equals zero otherwise.	Caldara and Iacoviello (2022)
Log changes in country-level geopolitical risk	ΔGPR	Log changes in country-level geopolitical risk	Caldara and Iacoviello (2022)
Change in country-level GPR × Industry exposure	$\Delta GPR \times ID$	The interaction term of the log changes in country-level geopolitical risk times the industry exposure.	Caldara and Iacoviello (2022)
Change in country-level GPR × Industry exposure dummy	$\Delta GPR \times IDD$	The interaction term of the log changes in country-level geopolitical risk times the industry exposure dummy.	Caldara and Iacoviello (2022)
Sale	*SALE*	Sale is the sales of firms (*sale*)	Compustat
Z-score	*Z −SCORE*	Z-Score = 1.2(working capital (*wcap*)/total assets (*at*)) + 1.4(retained earnings (*re*)/total assets (*at*)) + 3.3(earnings before interest and tax (*ebit*)/total assets (*at*)) + 0.6(market value of equity (*ceq*)/total liabilities (*lt*)) + 0.99(sales (*sale*)/total assets (*at*))	Compustat
High sales than the median value	*HIGH*	*HIGH* equals one if the firm's sales value is less than the sample median value (high financial constraint) in that year and zero otherwise.	Compustat
High Z-score than the median value	*HIGH*	*HIGH* equals one if the firm's Z-score is less than the sample median value (high financial constraint) in that year and zero otherwise.	Compustat
Treat	*Treat*	*Treat* is a dummy variable that equals one if a firm belongs to any of the following Fama-French 49 industry groups: Petroleum and Natural Gas, Aircraft, Automobiles and Trucks, Coal, Construction, Construction Materials, Precious Metals, Rubber and Plastic Products, Shipbuilding, Railroad Equipment, Shipping Containers, Steel, and Transportation.	Compustat
Post	*Post*	*Post* is a dummy variable that equals one for the post-event period (2017–2019) and zero for the pre-event period (2013–2015).	Compustat

Appendix A. 2: Entrenchment manager

This table presents the below baseline regression results for subsamples divided by the median of the E-index, a measure of managerial entrenchment. The regression models are as follows:

$$TA_{i,t} = \beta_1 Firm\_GPR_{i,t} + \beta_2 FA_{i,\,t} + TA_{i,t-1} + \varepsilon_{i,t}$$

where *TA* is tax avoidance measures including cash effective tax rate (*CETR*) and long-run cash effective tax rate (*LRETR*). $FA_{i,t}$ are the firm attributes including firm size (*SIZE*), cash holdings (*CASH*), firm profitability (*ROA*), net loss carry-forwards (*NOL*), foreign income (*FI*), free cash flow (*FCF*), financial leverage (*LEV*) and equity income in earnings (*EIIE*). $TA_{i,t-1}$ are tax avoidance measurements in the prior year for any given firm. $Firm\_GPR_{i,t}$ is the firm-specific geopolitical risk. The firm-fixed effect and firm-year fixed effects are included, alternatively. The standard errors are corrected for heteroskedasticity and serial correlation, and the t-statistics are given in parentheses. The standard errors are also clustered by firm and year industry. Significance levels are indicated by *, **, and ***, representing significance at the 10 %, 5 %, and 1 % levels, respectively.

VARIABLES	*CETR*		*LRETR*	
	HIGH E-INDEX	LOW E- INDEX	HIGH E- INDEX	LOW E- INDEX
$FIRM\_GPR_{i,t}$	−0.006***	−0.000	−0.001	0.000
	(-4.10)	(-0.17)	(-1.01)	(0.39)
Firm-level controls				
$SIZE_{i,t}$	−0.003**	−0.002	0.000	−0.001
	(-2.19)	(-1.00)	(0.11)	(-1.24)
$CASH_{i,t}$	−0.023**	−0.044***	−0.003	−0.003
	(-2.02)	(-3.06)	(-0.66)	(-0.36)
$NOL_{i,t}$	−0.015***	−0.016***	−0.007***	−0.003
	(-3.80)	(-3.02)	(-4.38)	(-1.23)
$ROA_{i,t}$	0.039*	0.025	0.042***	0.040**
	(1.95)	(0.93)	(4.92)	(2.41)
$FI_{i,t}$	−0.120***	−0.240***	−0.059***	−0.051
	(-2.67)	(-3.72)	(-2.96)	(-1.36)
$FCF_{i,t}$	−0.027	−0.026	−0.017	0.001
	(-0.98)	(-0.62)	(-1.23)	(0.05)
$LEV_{i,t}$	−0.027***	−0.062***	−0.007**	−0.019***
	(-3.52)	(-5.18)	(-2.15)	(-3.49)
$EIIE_{i,t}$	−0.632	−1.000*	−0.376*	−0.185
	(-1.56)	(-1.66)	(-1.85)	(-0.38)
$LAG\_CETR_{i,t}$	0.431***	0.387***		
	(26.22)	(17.50)		
$LAG\_LRETR_{i,t}$			0.832***	0.812***
			(73.37)	(37.87)
Other Controls				
Firm fixed effect	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Observations	7,592	3,501	7,195	2,294
Adjusted R-squared	0.362	0.353	0.852	0.835

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