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Measuring the Expected Effects of the Global Tax Reform

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Over 140 countries agreed on a fundamental corporate tax reform in 2021 to be implemented in 2023 and beyond. To measure its potential effects, we study asset price changes within minutes of the reform announcements. We construct proxies for the reform's costs regarding U.S. companies' tax burdens and countries' public finances. Likely exposed companies exhibit significant negative stock returns. Our lower-bound estimates indicate total shareholder value losses of \$112.6 billion one day after the reform announcements. Further, likely exposed countries experience increases in sovereign debt credit risk. Our findings inform the cost-benefit analysis of a historical international tax reform. (*JEL* H20, H25, H26, G12, E44)

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How to tax companies in today's globalized and digitalized world is one of the most pressing public policy issues. Academics, policy makers, and society have criticized the current tax system as outdated and inequitable. Two related issues are often cited in the critiques. First, countries have engaged in a tax rate race to the bottom to attract global capital (i.e., tax competition). Second, multinational companies (MNCs) can shift profits to favorable tax jurisdictions (i.e., tax avoidance)

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(e.g., Clausing, Saez, and Zucman 2021; Devereux and Loretz 2013; OECD 2013; Tørsløv, Wier, and Zucman 2022). In 2021, more than 140 countries agreed on a fundamental tax reform to address these issues beginning in 2023. Little is known so far about the reform’s potential consequences. Does such a global tax reform affect shareholder value? If so, which companies are affected the most, and what is the reform’s expected aggregate impact on shareholder value? Which countries’ public finances are likely worse off, and which are better off with the reform? This paper seeks to provide the first answers to these important questions.

The reform will introduce the biggest changes to the international tax system in history and represents a remarkable diplomatic agreement. For instance, Larry Summers described it as “the most significant international economic pact of the 21st century so far” (Summers 2021). It aims to limit international tax planning opportunities, increase and reallocate global tax revenues, and curb tax competition among countries. To this end, policy makers agreed to introduce a consumer-location-oriented approach to tax a portion of the profits of the largest companies and a global minimum tax rate of 15% for most MNCs (OECD 2021a).¹ The reform package is a significant departure from the current tax regime, which lets MNCs choose how to allocate taxable income to countries if MNCs’ management can argue that functions, assets, and risks are attributable to an MNC’s legal entities in the pertinent country. Further, countries can set very low tax rates or offer preferential tax treatments that reduce MNCs’ tax burdens in these countries to far below an effective tax rate of 15%.

Because the reform targets both companies’ tax payments and entire countries’ tax revenues, our study collectively examines the potential costs and benefits of the reform for these two key stakeholders based on market expectations. At the company level, the reform likely increases the tax burden for companies that benefit from the current tax system. Thus we expect negative stock price responses for companies that have so far reported a higher fraction of foreign earnings in low-tax countries, in particular if these countries offered tax rates below 15%. At the country level, the reform will potentially affect countries’ public finances

¹ We provide a simplified illustration of these changes. (We will discuss details in Section 1.1.) Assume an internet company has a pretax return on sales of 20% and generates sales of \$100 with customers located in a high tax country, like Brazil or Germany, and incurs costs through its subsidiaries’ operations in several countries across the globe. Under the current system, the company may report almost all of the \$20 of pretax income in a country with a preferential tax regime, like Ireland. The reason is that the company can claim that its revenue relies on the use of intellectual property which is legally owned by the companies’ subsidiaries in the low-tax country Ireland. Under the new rules, at least \$2.5 of these profits will be taxed in the market country, that is, Brazil or Germany. Further, a minimum rate of 15% will be applied on remaining profits in Ireland if the Irish government chooses to apply a corporate income tax rate below 15%.

through the reallocation of MNCs' tax bases and the global minimum tax rate (OECD 2020; Vella, Collier, and Devereux 2021). High-tax countries will likely benefit because their tax rate disadvantage decreases vis-à-vis low-tax countries and because they might be entitled to levy a top-up tax rate on foreign low-taxed income up to an effective rate of 15%. For low-tax countries, the net effect is less clear. These countries might suffer from MNCs' reallocation of resources (De Simone and Olbert 2022a; Dyrda, Hong, and Steinberg 2022). However, they might also enjoy tax revenue increases after applying the new minimum rate (Johannesen 2022). Given that low-tax countries strongly benefit from attracting MNCs' resources through channels other than raising taxes, any negative effects due to MNCs' reallocations will likely outweigh potential tax revenue gains. Thus we expect that countries will be hurt more if they currently attract disproportionately large tax bases of MNCs, in particular, if they apply tax rates below 15%.

Measuring the tax reform's expected effects based on market expectations presents two empirical challenges. First, we need to isolate the tax reform's effect on asset prices. To overcome this challenge, we exploit that the rapid agreement by over 130 countries was largely unexpected and that we can accurately time-stamp the main events of the political consensus process at the OECD level. We then compute changes in U.S. companies' stock prices and countries' sovereign-debt credit default swap (CDS) spreads in a tight window around the events to isolate the impact of the news.² Our identifying assumption is that no other relevant information affecting asset prices in the same systematic way was released coincident with the announcements. The idea behind our tests is that, although the true impact of the reform is unobservable, we can learn about the expected cost and benefits from forward-looking asset price movements around the main legislative events. If the reform will affect companies' cash flows and countries' public finances, it should have a measurable effect on current asset prices.

Second, we require measures that proxy for U.S. companies' and countries' likely exposure to the global tax reform based on these companies' and countries' ex ante characteristics. The granularity and validity of these measures are key to the credibility of our high-frequency identification strategy. At the company level, we combine an array of data sources to measure MNCs' benefits related to international tax planning under the current regime. To pinpoint U.S. companies' likely exposure to the reform, we use the share of foreign-sourced income, hand-collect a measure of the allocation of income to low-tax countries, and exploit data on MNCs' subsidiary ownership structures

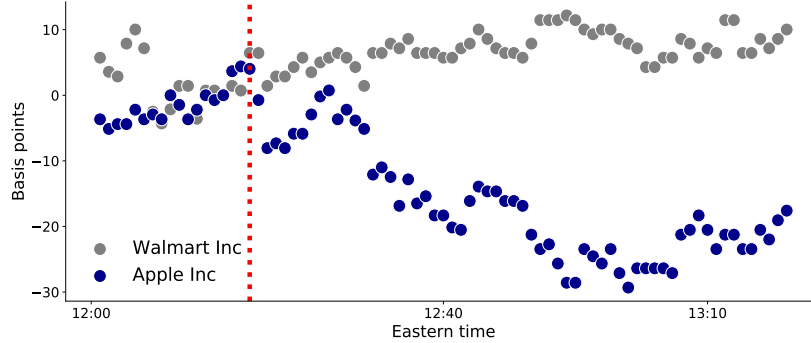
² We focus on U.S. companies because high-frequency stock price data from the NYSE Trade and Quote (TAQ) database are only available for U.S.-listed equities.

to gauge the extent to which companies pay taxes in countries with tax rates below 15%. As our measures incorporate the reform's elements that target disproportionate tax base allocations to relatively small real with tax rates below 15%, they should proxy for the reform's impact on companies' cash flows. At the country level, we propose a new methodology to combine aggregated country-by-country reporting and macroeconomic data to measure the disproportionate attraction of global capital and corporate tax bases under the current tax regime. In 2016, the OECD mandated that companies must produce reports to make their international tax strategies more transparent (e.g., De Simone and Olbert 2022b). This type of data allows us to observe the tax bases that MNCs allocate to a certain country. Further, it allows us to construct country-level proxies that are conceptually aligned with the company exposure measures. Specifically, the latter capture MNCs' propensity to shift profits to low-tax countries. Our country-level measures, in turn, capture the aggregate consequences of MNCs' tax planning by country. For instance, our main measure scales MNCs' revenues reported in a given country by this country's total household consumption. Thus we effectively gauge the extent to which MNCs' reported tax bases are disproportionately high, relative to a country's market size.³ We also construct a measure that incorporates low-tax countries' tax rate distance to the proposed minimum rate of 15%.

Our baseline analysis shows that companies with higher exposure to the reform experienced significant losses in shareholder value within minutes of the announcement events of the reform. Figure 1 provides evidence for the intuition underlying these findings. It shows that Apple's stock price dropped sharply within minutes after the main event on July 1, 2021. In contrast, we find no significant stock price movements for companies that generate most of their pretax income in their domestic market, such as Walmart. In our main tests, we find consistent results using the full sample of U.S. companies and the three measures of companies' exposure to the global tax reform changes. For example, the 10% of U.S. MNCs that report the most pretax income as *foreign* for tax purposes experience an average stock price drop of 27 basis points within minutes of the reform announcements. Considering all exposure measures combined, we document an average stock price

³ Our statistics reveal that, under the current tax regime, MNCs from around the globe disproportionately allocate tax bases to countries with favorable tax regimes but relatively small consumer markets. Scaling the total sum of global MNCs' revenue reported in these countries by these countries' total household consumption yields the following figures: Brazil, 0.58; India, 0.014; and China, 0.42; on the one hand, and Ireland, 2.38; Luxembourg, 3.55; Singapore, 3.52; Bahamas, 2.38; on the other. Consistent with our prediction, the OECD estimates that the consumer-location-based taxation of profits would decrease corporate tax revenues in investment hub countries, like Singapore, Luxembourg, and Ireland, by almost 6% and increase tax revenues in low-income countries by almost 2% (OECD 2020).

Figure 1
Case-study evidence on stock prices around the global tax reform announcement



This figure shows the minute-level normalized stock prices of Walmart and Apple in a narrow time window surrounding July 1, 2021, 12:19:26 EDT. At this time, it was first released to the public that 130 countries had agreed to the international tax reform (Pillars 1 and 2 of the OECD’s reform proposal). The red dotted line represents the exact time of the OECD’s press release.

decrease of about 18 basis points for a one-standard-deviation higher exposure to the tax reform 20 minutes after the reform announcements.

While examining high-frequency stock price changes around the reform’s announcements allows for clean identification, the estimated baseline effects might not capture the full market response as investors probably need some time to fully price in the new information revealed during the events. Consistent with this view, we find that the effects grow over time. Comparing the stock price responses of highly exposed and only slightly exposed U.S. MNCs reveals statistically significant differences in cumulative abnormal returns of 40 basis points within 20 minutes of the reform announcement. These differences grow to 60 basis points after 90 minutes and persist beyond that period. Further, our analysis of daily stock returns shows stock price responses that are twice as large as those observed in the baseline high-frequency analysis. Importantly, the estimated effects endure after adjusting for standard risk factors.⁴

⁴ The magnitude of our results is economically meaningful, given that even our conservative estimates are comparable to the estimated effects of the 2017 U.S. tax reform (the largest overhaul of the U.S. tax code in three decades) or corporate legislation on stock prices in general. For example, our estimated CARs a few days after the reform are about two times larger than the return drifts of Cohen, Diether, and Malloy (2013), who form portfolios based on companies negatively and positively affected by different types of corporate legislation. Also, Wagner, Zeckhauser, and Ziegler (2018a) and Gaertner, Hoopes, and Williams (2020) document 47 to 60 basis points stock price increases for U.S. companies benefiting from the significant domestic tax rate reduction after the 2017 U.S. tax reform (TCJA). See Section 2.3.7 for a more detailed discussion of the economic magnitudes in light of certain assumptions about changes in companies’ cash flows.

Interpreting the documented price responses at face value might only capture a fraction of the total effect due to market anticipation of the reform. For example, on one of the main event dates on July 1, 2021, asset prices had likely already incorporated a portion of the reform's effect because proposals had been discussed in advance and several countries had expressed their support. To quantify the full impact of the reform on shareholder value, we thus need to account for investors' expectations of the news (Bhattacharya et al. 2000; Borochin et al. 2021; Huberman and Schwert 1985). To approximate changes in investors' perception that the reform will happen after they learn about the news on July 1, 2021, we follow Subramanian (2004), Barraclough et al. (2013), Borochin and Golec (2016), and Borochin et al. (2021) and exploit information in stock and option prices. We derive an option-implied anticipated probability of the reform passage of approximately 31%. Once we account for this degree of anticipation, our estimate of the reform's impact on stock prices increases by at least 50%. For instance, when we use a daily event window, the expected full value effect of the global tax reform is -\$112.6 billion, compared to -\$76.6 billion when market anticipation is ignored. These estimates represent a lower bound, as they are based on the assumption that there was no uncertainty regarding the reform's passage after the event.

In an additional analysis, we leverage the varying informational content along the regulatory process to tighten identification and shed light on the specific effects attributable to Pillar 1 of the reform (consumer-location-based taxation of profits). On October 8, 2021, the OECD announced that only the largest MNCs, those with more than EUR 10 billion or 20 billion sales, would be affected by Pillar 1. Exploiting this institutional detail in a regression discontinuity design, we find that stock prices of MNCs above the size thresholds decrease by around 16-25 basis points, relative to MNCs just below the thresholds. This finding is consistent with the consumer-market-based approach of taxation posing a significant cost to MNCs benefitting from the current regime.

At the country level, we find that countries that attract disproportionately high corporate tax bases under the current system experience a significant increase in CDS spreads after the reform. We interpret higher CDS spreads as an indication that investors have a more negative perception of a country's future public finances.⁵ These effects are

⁵ We use CDS spreads on sovereign debt to measure the reform's impact on public finances because CDS spreads reflect investors' perception of the risks of a country's future public finances. Sovereign debt CDS are frequently traded and thus allow us to observe market expectations with respect to the outcomes of an entire country in a short time window (Augustin et al. 2014; Lando 2020). We discuss construct validity and how the global tax reform should affect public finances in Section 3.

concentrated among countries that currently offer corporate income tax rates below 15%. In terms of economic magnitude, a one-standard-deviation higher of MNC revenues reported in a country, relative to total household consumption, is associated with approximately 30 basis points higher CDS spreads. These effects grow over time. These findings suggest that market participants expect that emerging countries like Brazil, India, and China will likely enjoy substantial economic benefits from higher tax revenues under the reformed tax regime. In contrast, countries at the forefront of tax competition under the current system, like small tax havens, likely expect a decline in corporate tax revenues and a lower allocation of MNCs' resources like intellectual property or cash holdings.

The key feature of our study is that it shows how a globally coordinated tax reform affects both U.S. MNCs as taxpayers and the governments of entire countries as tax collectors. Consistent with theoretical predictions, our results suggest that investors valued previously successful tax planning strategies and expect the new rules to result in collecting more taxes from MNCs. We derive an important statistic for assessing the reform by documenting the cross-sectional differences in stock price responses based on our granular exposure measures and quantifying the full impact of the reform on shareholder value. We acknowledge the challenge in inferring the economic impact of the reform on tax revenues from our analyses using sovereign debt CDS data. However, our study provides the first macroeconomic evidence on how a globally coordinated reform potentially affects on the allocation of global corporate tax revenues and, more broadly, MNCs' real activities. Our evidence suggests that the reform will change tax competition and should therefore affect the political economy of tax policy design. Specifically, countries currently offering preferential tax treatments, like small financial centers or low-tax jurisdictions like Ireland, will likely lose out in terms of tax revenues and domestic economic activity if they do not change their tax policies. Emerging countries, which currently face outward profit shifting by MNCs, on the other hand, will likely enjoy an increase in corporate tax revenues.

We contribute to two streams of literature. First, we add to the literature using investor responses to measure tax reform effects (e.g., Borochin et al. 2021; Gaertner, Hoopes, and Williams 2020; Wagner, Zeckhauser, and Ziegler 2018a,b, 2020).⁶ This literature examines domestic tax reforms either initiated by one legislator and mainly

⁶ Other studies include Hoopes, Thornock, and Williams (2016), Johannesen and Larsen (2016), Dutt et al. (2019), Gaertner, Hoopes, and Maydew (2019), Müller, Spengel, and Weck (2021), and Klein, Ludwig, and Spengel (2022). Most closely related to the global tax reform is the border adjustment tax studied by Gaertner, Hoopes, and Maydew (2019). This reform was considered, but not implemented, as part of the proposed U.S. corporate tax reform in 2017. Gaertner, Hoopes, and Maydew (2019) document negative market

affecting companies in the respective country or transparency regulation forcing companies to publicize more of their tax information. We extend this literature by providing the first evidence on the impact of a fundamental and historically unprecedented international reform, coordinated and implemented by more than 140 countries. Moreover, we propose a novel method to estimate the effect of an international reform on individual countries' public finances. Our approach of combining of macroeconomic data and information on MNCs' country-level tax data can be used in future research to assess the impact of specific reform elements or other reforms that likely affect several countries simultaneously.

Second, our paper adds to the literature examining the effect of public policies and regulation on asset prices (Cohen, Diether, and Malloy 2013; Kelly, Pástor, and Veronesi 2016; Meng 2017) and using high-frequency identification in macroeconomics and finance (Bernanke and Kuttner 2005; Bianchi, Gomez-Cram, and Kung 2021; Bianchi et al. 2023; Gürkaynak, Sack, and Swanson 2005; Haddad, Moreira, and Muir 2021; Känzig 2021; Kuttner 2001; Nakamura and Steinsson 2018). We build on this literature by analyzing asset price responses in a narrow window around the main events of a major global policy change.

Our results have important policy implications, as regulators work to set out the rules for implementing the reform and domestic policy makers consider ways to counteract the potential negative impact on their countries' tax revenues. Our results also inform future research on the real effects of companies' responses to the reform. Specifically, our findings suggest the tax reform imposes a cost on affected companies, likely inducing managers to alter location and investment decisions (e.g., Cloyne et al. 2022; Devereux and Griffith 1998, 2003; Giroud and Rauh 2019; Summers et al. 1981).

1. The Global Tax Reform and the Timeline of News

1.1 Institutional setting

In the last two decades, regulators, the media, and academics have regularly pointed out two core problems of the corporate tax system. First, current corporate tax rules rely on physical factors to determine the tax nexus and liability in a given country, but companies operate increasingly digitally and remotely (e.g., Devereux et al. 2021; Olbert and Spengel 2017). Second, multinationals have faced criticism for aggressively exploiting loopholes in international tax rules to avoid paying taxes in the countries where they operate (Beasley et al. 2020;

reactions for stocks of U.S. companies with high import shares because import costs would not be tax deductible and exports would be tax exempt. In contrast to this U.S. proposal, the tax reform we study was agreed on by 140 countries.

Clausing, Saez, and Zucman 2021; Kinder and Agyemang 2021; Zucman 2014). Part of this problem is that countries have competed for global companies' capital (and profits) by reducing their tax rates. As Table A.2 in the Internet Appendix shows, this has resulted in many countries offering low corporate income tax rates, often below 15%. Consequently, there is a misalignment between the location where companies generate sales and where they pay taxes.

To combat corporate tax avoidance and tax competition and address the tax challenges in the digital economy, global policy leaders began to coordinate at the OECD level and launched the Base Erosion and Profit Shifting (BEPS) project in 2013. The aim of the BEPS project was to fight corporate tax avoidance by improving but not revolutionizing the tax system. However, after the BEPS project concluded in 2018, the consensus was that a more fundamental reform was required (Devereux et al. 2021). Accordingly, working groups at the OECD continued to develop reform options. By November 2019, the OECD had released documents proposing to consider a reform under two pillars. Pillar 1 consists of a change to the allocation of the rights to tax corporate profits, giving more rights to so-called market countries (i.e., where consumers are located). Pillar 2 focuses on rules that allow jurisdictions to tax profits allocated to other jurisdictions in case those jurisdictions would not levy high enough tax rates by introducing a global minimum tax rate. Thus the reform largely removes countries' incentives to engage in tax competition by offering low tax rates (at least below the threshold of the new minimum tax rate).

In 2021, more than 140 countries agreed on these rules. The agreement included the consumer-location-based taxation of profits (Pillar 1) and a global minimum tax rate of 15% (Pillar 2). These core elements constitute a fundamental departure from the traditional corporate tax system, which taxes profits based on companies' location of activities and has no minimum tax rates (i.e., countries can set very low rates). Under the current system, companies file a tax return based on separate entity accounting in each country where they have a taxable nexus (usually through a subsidiary). Because the current system relies on mostly functions, risks, and assets-based allocation factors, companies can strategically influence the amount of profits reported and thus how much they are taxed in a country by using intracompany transactions, that is, profit shifting (for overviews, see, e.g., Dharmapala 2019; Garcia-Bernardo, Janský, and Zucman 2022; Heckemeyer and Overesch 2017; Meier and Smith 2022; Tørsløv, Wier, and Zucman 2022).

Under the new rules, 25% of profits in excess of 10% of sales will be taxed in market jurisdictions. The specific jurisdiction is defined using a consumer-based sales allocation key (Pillar 1). This rule applies to MNCs with more than EUR 20 billion in sales (EUR 10 billion after a

transition phase). Further, companies must calculate their effective tax rate for each jurisdiction where they operate and pay a top-up tax for the difference between their effective tax rate per jurisdiction and the new 15% minimum tax rate (Pillar 2). This rule applies to global companies with more than EUR 750 million in sales (OECD 2021c). Vella, Collier, and Devereux (2021) discuss these rules in detail. In the meeting of the G20 in Jakarta from February 17 to 18, 2022, finance ministers and central bank governors committed to implementing the two-pillar reform by 2023. As of January 2023, policy makers were working on drafting the multilateral convention needed to implement the reform from late 2023 and beyond (OECD 2023).

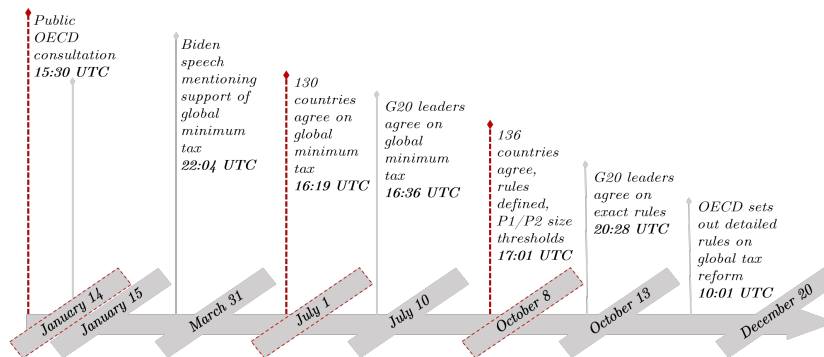
1.2 The timeline of news

Our empirical design examines market responses to different information events around the international political process in 2021. We consider the evolution of the reform's consensus as a suitable laboratory to measure market expectations about the effects of the global tax reform for several reasons. First, the reform will significantly affect companies' global tax payments and the allocation of corporate tax revenues across countries. Second, the rapid agreement on specific rules and their implementation by 2023 was largely unexpected at the beginning of 2021. By then, it seemed unlikely that a global consensus could be reached based on this proposal, due to diverging political interests of the many countries involved and the high coordination required.⁷ Third, we can accurately time-stamp each reform event, enabling us to isolate the news component by computing high-frequency price changes in a narrow window around the events. We achieve this by utilizing various sources, including Factiva, Google News, Bloomberg, and the official websites of the OECD and G20 to create time-stamped records of information releases pertaining to the reform. Figure 2 depicts these events and summarizes the most important information revealed by each.

Three major events significantly shaped the consensus process of the global tax reform. First, the reform proposals gained significant momentum in early 2021, when the OECD started a 2-day consultation meeting on January 14. At this meeting, the OECD invited stakeholders to discuss the Inclusive Framework of Pillars 1 and 2 laid out in November 2020. No other formal meeting with press coverage had occurred since late 2019. As a result of the meeting, political leaders expressed strong support for the tax reform while acknowledging the different views among countries and the need for compromise. The

⁷ Consistent with this argument, our analysis revealed no significant changes in stock prices for exposed companies during events in 2019 when policy makers met at the OECD level to discuss the idea of a global tax reform, as evidenced in Table C.12 in the Internet Appendix. Additional details on these events can be found in the notes to the table.

Figure 2
Global tax reform event dates in 2021



This figure shows the evolution of the consensus process for the global tax reform in 2021. We depict the key political events and summarize the information content at each event date. Red indicates the most important events from January 14, July 1, and October 8. The press release from July 1, 2021, and the document containing the specific rules are available <https://www.oecd.org/newsroom/oecd-releases-pillar-two-model-rules-for-domestic-implementation-of-15-percent-global-minimum-tax.htm> and <https://www.oecd.org/tax/beps/tax-challenges-arising-from-the-digitalisation-of-the-economy-global-anti-base-erosion-model-rules-pillar-two.pdf>.

second major event was on July 1 at 16:19 UTC, when the OECD announced that 130 countries had agreed on the reform. This event marked the official announcement that the reform would happen, which many stakeholders did not expect. The third major event was on October 8 at 17:01 UTC, when the OECD released the detailed rules of the tax reform. For the first time, it was publicly revealed that only the largest multinationals, those with sales of more than EUR 10 billion or 20 billion, would be affected by Pillar 1 (market-based taxation) and that Pillar 2 (global minimum tax rate of 15%) would apply to all large multinationals with sales of more than EUR 750 million. Figure C.6 in the Internet Appendix shows that these last two events received significant attention. Specifically, Google Trends data suggests that public attention regarding the term *global minimum tax*, the key buzzword of the reform, rose significantly on and after these two events.

There were five additional tax reform events in 2021. These provided supplementary information and context but less significantly shaped the emerging consensus. Specifically, on March 31, U.S. President Biden mentioned that the United States would support a global corporate minimum tax as part of the announcement of a US\$2.5 trillion infrastructure plan. The plan focused on public spending in the United States to stimulate the economy post-COVID-19 and included increasing the U.S. domestic tax rate to 28%. These news components were not entirely new to the public. However, the mention of the global

minimum tax at the end of his speech (at 26 minutes and 52 seconds) was unexpected. Three other events were on July 10, October 13, and December 20. The first two dates relate to press releases after the G20 meetings (Jul. and Oct.), officially confirming that the agreements from July 1 and October 8 were backed by the G20 leaders. The last event in December was the public release of the detailed rules to be further discussed and implemented by 2023. This last announcement contained new information regarding which countries would likely collect the tax revenues generated and reallocated by Pillar 2. It was now more likely that countries where MNCs generate and declare profits at the subsidiary level, rather than countries where MNCs' parent entities reside, will collect these revenues (for details, see Vella, Devereux, and Wardell-Burrus 2022).

Our benchmark analysis in Section 2.3.1 focuses on the three main events, which contained significant incremental information about the direction and key elements of the reform. In supplementary tests in Section 2.3.3, we also consider all other events to assess the possibility that these events also revealed incremental news to the market.

2. Expected Effect on Companies

2.1 Predictions

Our goal in this section is to measure the expected effects of the global tax reform on U.S. companies. As the aggregate behavior of investors can reveal a reform's expected costs and benefits to affected companies (Chetty 2009; Meng 2017), we interpret changes in equity valuations around the reform announcement as a measure of the expected impact of the global tax reform for an individual firm.

We expect the overhaul of the global tax system to be costly for U.S. MNCs that employ tax-efficient strategies under the current system because the reform intends to combat aggressive tax avoidance and generally increase the tax burden for MNCs. By introducing customer-location-based taxation of profits and a global minimum tax rate of 15%, the reform reduces the financial incentives for MNCs to operate in tax havens. Even if U.S. MNCs do not change their tax-motivated structures used under the current system, the enforcement of the reform will mandate companies to pay a top-up rate of up to 15% on their foreign profits. Thus effective tax burdens can substantially increase, relative to the current tax system, lowering consolidated after-tax cash flows. Accordingly, affected companies discussed this cash flow risk in their risk factor disclosures of their 2020 10-K annual reports.⁸

⁸ Specifically, Alphabet or Apple, which have been accused of benefiting from aggressive tax avoidance, mentioned that a potential global tax reform was a risk to their businesses

While it may seem counterintuitive that a U.S. administration would support an international reform that could reduce U.S. shareholder value, the reform could also generate more U.S. tax revenues. The reason is that U.S. MNCs might shift less U.S.-sourced income abroad and pay more taxes at home. Even if MNCs still report income in low-tax countries, the United States can apply a top-up rate up to 15% on the low-taxed foreign income. Further, narrowing the gap between the U.S. statutory rate vis-à-vis other countries would make the United States a relatively more competitive location for multinational businesses. As the U.S. President Biden and Treasury Secretary Yellen stated in their declaration and economists estimated, these mechanisms would imply positive tax revenue effects for the United States (Barake et al. 2021; White House 2021), which warrants the reform from a U.S. perspective.

If investors understand these implications when assessing the reform's impact and value companies' tax avoidance opportunities under the current tax regime (e.g., Goh et al. 2016; Heitzman and Ogneva 2019), the stock prices of companies exposed to the reform should decrease after the reform announcements. Specifically, investors should care about how much a company is affected by the shift in the international profit taxation regime and will experience a higher tax burden. Thus we expect heterogeneous stock price responses, depending on MNCs' degree of ex ante exposure to the reform. We expect stronger negative responses for companies with more profits reported abroad, in particular, if these foreign earnings are taxed at low rates because MNCs' profit-shifting under the current regime. Furthermore, stock prices should fall more if companies report a higher share of pretax income in (tax haven) countries with tax rates below the proposed minimum rate of 15% because the increase in these companies' tax burden, due to the new minimum tax, will be higher.

2.2 Data

2.2.1 Measuring companies' exposures. For our main analyses, we construct three variables with an increasing degree of granularity with respect to companies' ex ante exposure to the reform. While more granular measures help us establish causal inferences, less granular ones allow us to plausibly capture the strongest investor responses, as these measures rely on intuitive and salient information that investors likely heed. We use three data sources: Compustat Capital IQ, hand-collected footnote disclosures from companies' 10-K filings, and Bureau van Dijk

and could harm their cash flows. In contrast, Walmart, which has its main operations and revenues within the United States, did not discuss the reform proposals as a risk to its business (see Figure A.1 in the Internet Appendix for exemplary disclosures). See also the *Wall Street Journal's* headline from May 2021, suggesting that the additional tax costs could be material and should trigger stock price drops (Bird 2021).

Orbis historical ownership data. We use information as of the last available period before the tax reform announcement in July 2021.⁹ We then validate these measures using hand-collected data from companies' qualitative disclosures in the latest 10-K annual reports and earnings conference calls before the reform announcements. All variables used in the analysis are defined in Table A.1 in the Internet Appendix.

Our first company-level exposure variable is *Foreign earnings ratio*_{*i*}, which we define as the foreign earnings of company *i* scaled by its total pretax earnings.¹⁰ We retrieve necessary financial information on companies publicly listed in the United States from Compustat Capital IQ. We use *Foreign earnings ratio*_{*i*} as our first main measure because the global tax reform clearly targets foreign-sourced profits, and prior work considers the reported share of foreign earnings a valid proxy for the share of earnings taxed in foreign jurisdictions (Drake, Hamilton, and Lusch 2020; Dyreng et al. 2017; Dyreng and Lindsey 2009; Wagner, Zeckhauser, and Ziegler 2018a). The *Foreign earnings ratio*_{*i*} variable is intuitive and salient because investors can easily observe a company's foreign earnings in publicly available financial reports. However, this proxy is also measured with noise as it likely also includes MNCs with foreign earnings that will not be (much) affected by the tax reform to the extent foreign earnings are taxed at rates above 15%.

Our second variable is *Foreign low tax benefit*_{*i*}, which we define as the tax benefit of company *i* due to its pretax earnings being taxed at low foreign tax rates scaled by the company's total assets. The tax benefit is the USD amount deviation of a company's tax expense, according to the U.S. generally accepted accounting principles (GAAP, i.e., the tax expense observable in a company's income statement) from the expected tax expense if the U.S. statutory tax rate were applied

⁹ We use financial accounting data for all companies for the fiscal year 2020 to observe the most recent financial characteristics before the announcement of the reform agreement. For most companies, this means the December 31, 2020, data. However, for some companies, fiscal years end in other months in early 2021. (For example, Walmart reports as of Jan. 31.) For these companies, the fiscal year 2020 means that most of the calendar year 2020 is captured in the financial accounts, but the reporting date is in the calendar year 2021. Ownership data from Orbis is as of December 31, 2020.

¹⁰ *Foreign earnings* correspond to pretax income classified by the company as generated by foreign operations, which is non-U.S. income for nearly all sample companies. Thus, the foreign earnings ratio proxies for the degree of internationality for tax purposes, which is what our analyses intend to capture, as companies with more of their earnings outside their home jurisdiction will likely be more affected by the tax reform. We obtain qualitatively and quantitatively nearly identical results when disregarding the approximately 5% non-U.S. headquartered but U.S. cross-listed sample companies. We use the 3-year average of the foreign earnings ratio to mitigate the effect of companies reclassifying foreign and domestic income in response to the 2017 U.S. tax reform, which incentivized U.S. MNCs to reclassify income and cost items to mitigate the adverse impact of the U.S. reform's provisions (Garcia-Bernardo, Janský, and Zucman 2022; Laplante et al. 2021). Inferences remain unchanged when we use the foreign earnings ratio as of fiscal year 2020.

to all pretax earnings.¹¹ Similar to the approach of Drake, Hamilton, and Lusch (2020), we access the SEC's API and use XBRL tags to scrape the relevant information from companies' income tax footnotes disclosures in their 10-K annual reports. This measure directly captures by how much a company benefits from reporting a part of its tax base in foreign jurisdictions with lower rates under the current tax regime and explains a significant part of the negative difference between many U.S. MNCs' GAAP effective tax rates and the U.S. statutory tax rate (Drake, Hamilton, and Lusch 2020; Dyreng et al. 2017).¹² The *Foreign low tax benefit*_{*i*} variable precisely measures a company's cash flow benefit, due to low foreign taxes under the current system. A key feature for the purpose of our tests is that investors can directly observe this information in the tax footnote of companies' financial reports. However, the proxy does not directly capture by how much future taxes will increase, due to the minimum tax of 15%, as the foreign tax benefit in U.S. companies' 10-Ks is benchmarked against the U.S. statutory tax rate of 21%.

Our third variable is *Foreign tax differential to minimum tax*_{*i*}, which we define as the sum of the tax rate differentials between the proposed minimum tax rate of 15% and countries' statutory corporate income tax rates across all countries where a company owns at least one subsidiary. We calculate tax differentials using a max operator; that is, a tax differential is zero for subsidiary countries with tax rates above 15%. Table A.2 in the Internet Appendix shows the distribution of tax rates across countries in 2020. When an MNC has a subsidiary in a country with a rate below 15%, we consider the corresponding tax differential. To account for the fact that this summed cross-country variable naturally correlates with firm size, we scale it by total assets, consistent with the approach for the *Foreign low tax benefit*_{*i*} variable. To arrive at our measure, we exploit granular ownership data from Orbis, as in Coppola et al. (2021), and first assemble an MNC's ownership tree of all majority-owned subsidiaries, following the procedure of De Simone and Olbert

¹¹ We use the 3-year average prior to the tax reform, consistent with our measurement of the first exposure variable *Foreign earnings ratio*_{*i*}.

¹² Panel B in Figure A.1 in the Internet Appendix provides an example for the tax benefit of Apple in 2020. Apple reported pretax income of US\$109 billion, which, if taxed at the U.S. statutory rate of 21%, would have resulted in a tax expense of US\$22.9 billion. However, Apple's actual GAAP tax expense was only US\$14.5 billion, resulting in a GAAP effective tax rate of 13.3%. The foreign low tax benefit was US\$4.7 billion and thus helped determine this low effective rate. The average 3-year foreign low tax benefit was 1.2% of total assets for Apple, 0.8% for Alphabet, and 0.2% for Walmart. We document no negative stock price reaction for Walmart around the reform announcement, although Walmart's foreign low tax benefit is higher than that of many predominantly domestic companies. This finding is consistent with Walmart reporting foreign taxable income in countries where its consumers reside (Canada and Latin America) and the tax rates in these countries being above the reform's minimum rate of 15%. Thus investors seem to expect that Walmart is unlikely to be harmed by the reform.

(2022b) and Olbert (2023). We then merge country-specific corporate income tax rates from KPMG to measure the difference between the foreign and the 15% minimum tax rates.¹³ The main advantage of this measure is that it benchmarks a company's foreign tax rate benefits under the current against the proposed global minimum tax rate of 15%. As only companies currently paying less than 15% will be much affected by the reform, a large tax differential relative to a company's size should accurately identify a company's exposure to the reform. At the same time, we acknowledge that investors need to access sophisticated information, like the 10-K Exhibit 21 or commercial databases, to assess companies' footprints in below 15% tax rate jurisdictions.

We use qualitative disclosures from companies' earnings conference calls and 10-Ks to validate our company-level exposure measures before conducting the event studies. First, we access the transcripts of companies' last quarterly earnings conference call before the reform announcement to identify company-specific tax risk in the vein of Hassan et al. (2019) and Gallemore et al. (2021). Specifically, we search for mentions of the global tax reform to construct an indicator variable equal to one if the company's managers mentioned the reform in the call.¹⁴ Second, we scrape the risk factor disclosures (Item 1A) of companies' 10-Ks and search for mentions of the global tax reform.¹⁵ Panels A and C of Figure A.1 in the Internet Appendix provide two examples of risk factor disclosures, with Alphabet clearly describing the potential overhaul of the international tax framework as a risk to its business and Walmart not mentioning the reform.

If investors care about the impact of the tax reform on companies, they likely ask managers about it in conference calls or managers will mention the reform in the calls. Further, according to the SEC,

¹³ As a simplified example, consider a U.S. MNC with a domestic parent firm, one U.S. subsidiary, one in Ireland, and one in the Cayman Islands. The summed tax rate differential will be 17.25% ($= \max[0, 15 - 21] + \max[0, 15 - 21] + \max[0, 15 - 12.5] + \max[0, 15 - 0]$). Consequently, the measure does not weight an MNCs' presence in a given country but only considers whether the MNC has at least one subsidiary in a given country. Ideally, we would weight this measure by revenues or pretax income reported in a given tax jurisdiction. However, representative and high-quality data on MNCs' subsidiaries' revenues or other financial statement items are mostly unavailable outside the European Union, because of the lack of financial reporting mandates (Breuer 2021; Kim and Olbert 2022).

¹⁴ Specifically, we search for mentioning of the terms "international tax," "global tax," "minimum tax," "Pillar 1," "Pillar one," "Pillar 2," "Pillar two," and "taxation of multinational corporations." We also search for mentions of OECD and Organisation for Economic Cooperation and Development but impose the restriction that these appear in proximity to the term "tax". Table A.7 in the Internet Appendix provides two examples of such mentions.

¹⁵ We follow the approaches of Hope, Hu, and Lu (2016) and Dyer, Lang, and Stice-Lawrence (2017) to identify business risk factor disclosures in 10-Ks. Lyle, Riedl, and Siano (2022) show that companies' risk disclosures inform investors, as they influence market measures of firm risk.

companies should mention the global tax reform in their 10-K risk factor section if the reform has enough potential to (negatively) affect their cash flows. Thus, we should, on average, observe higher values in the company-level exposure variables for companies that mention the reform in their earnings conference calls or risk factor disclosures. In the descriptive statistics in Tables A.3 and A.4 in the Internet Appendix, we indeed document higher means and medians across all exposure variables for the subsample of companies mentioning the reform in their either conference calls or 10-K risk factor disclosures, consistent with our measures capturing this cash flow risk.

2.2.2 Asset prices: Company stock prices. To measure market perceptions of the effects of the global tax reform, we use high-frequency stock market data to compute price changes in narrow time windows around reform announcement dates. To do so, we combine data from several sources. We use the NYSE Trade and Quote (TAQ) database to obtain intraday transactions data for all companies' shares listed on the New York Stock Exchange, American Stock Exchange, and Nasdaq National Market System. As such high-frequency stock price data from TAQ are only available for U.S.-listed equities, we focus on a U.S. sample to study the tax reform's effects on firm values throughout our analyses. In supplementary tests, we use daily asset price data from the Center for Research in Security Prices (CRSP). We use daily data to show that the stock price responses persist and grow when focusing on longer event windows. Finally, we use options data to compute an estimate of investor anticipation of the tax events. The daily options data come from OptionMetrics.

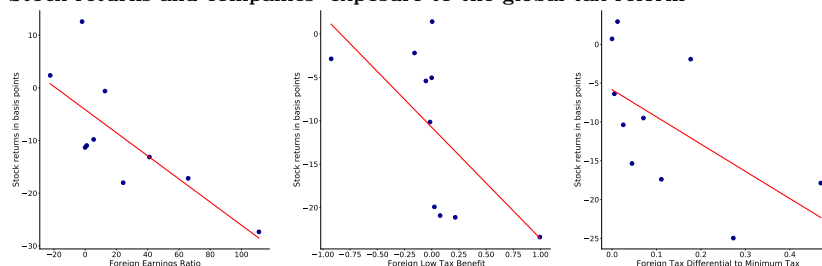
Our analyses can exploit high-frequency stock price changes around four tax reform announcement events (Jan. 14 and 15, Jul. 1, and Oct. 8). Four other tax reform announcement events occurred after the market closed (Mar. 31, Oct. 13, and Dec. 20) or on weekends (Jul. 10), as shown in Figure 2. Stock prices are unavailable in a narrow window around these events, and we thus exclude them from our high-frequency tests. In supplementary tests using daily stock prices, we use all events and compute price changes using the closing prices of the last business day before an announcement and the first business day afterward.

2.3 Empirical strategy and results

2.3.1 Baseline high-frequency analysis. In our benchmark analysis, we examine the effect of the global tax reform using a high-frequency identification approach. Specifically, we organize our results around the following equation:

$$\Delta p_{i,t} = a + b \cdot \text{CompanyExposure}_i + \epsilon_{i,t}, \quad (1)$$

Figure 3
Stock returns and companies' exposure to the global tax reform



We first sort companies into 10 bins based on their $CompanyExposure_i$ measure. We then compute both average $CompanyExposure_i$ and average stock returns for each of the bins. The lines represent the linear regression fit lines. The left panel uses *Foreign earnings ratio* as the sorting variable. The panel in the center uses the *Foreign low tax benefit* as the sorting variable. The right panel uses the *Foreign tax differential to minimum tax* variable. These variables are described in Section 2.2.1 and in Table A.1 in the Internet Appendix.

where $\Delta p_{i,t}$ is the change in log stock prices for company i in a narrow window around tax event t . To identify the effect of the global tax reform on firm values, we consider the difference in log stock prices in an 80-minute window around the tax event t . Specifically, we use the price associated with the last trade at least 60 minutes before the event and the price related to the first trade at least 20 minutes afterward. The variable $CompanyExposure_i$ is the exposure of company i to the global tax reform news. The error term is given by $\epsilon_{i,t}$. The parameter of interest is b , which measures the average effect of the tax reform announcements on $\Delta p_{i,t}$, given the companies' exposure. Our identifying assumption is that, over such a short window of time, changes in stock prices are driven by the information about future taxes released during these events.¹⁶ In our benchmark analysis, we estimate the regressions using the three main tax reform announcement events (Jan. 14, Jul. 1, and Oct. 8), which likely contained the largest surprises to the market, as outlined in Section 1.2. In supplementary tests in Section 2.3.3, we incorporate all events illustrated in Figure 2 to corroborate our inferences and inform the analyses exploiting the individual events on July 1 and October 8.

¹⁶ It is unlikely that other news events that significantly affect asset prices occur in such a time window. For confounding news events to bias our estimates, they would need to affect equity prices in the same systematic and differential way as the tax reform announcements at the OECD level, depending on companies' exposure to the reform. As we use several exposure proxies that account for U.S. MNCs' tax planning benefits under the current system and probable increases in taxes with the reform, it is difficult to imagine news other than those related to the reform that could systematically affect asset prices in the short time windows used in our analyses.

We first provide a graphical representation of our main results in Figure 3. The left panel of the figure shows the stock price reactions for different levels of *Foreign earnings ratio*. We sort all companies into 10 equal-sized bins based on sample deciles of *Foreign earnings ratio*, and compute both the average *Foreign earnings ratio* and the average high-frequency stock returns for each sorted bin. The red line represents the regression fit line. The figure shows a strong negative relation between these two variables. For instance, companies in the last decile experience an average drop in stock prices of about -27.34 basis points (t -statistic = -4.52), while the average stock price movement for companies in the first decile is 2.36 basis points (t -statistic = 0.26). The other two panels of Figure 3 repeat the analysis using *Foreign low tax benefit* and *Foreign tax differential to minimum tax* as sorting variables. Stock prices of companies with high values of *Foreign low tax benefit* and *Foreign tax differential to minimum tax* tend to decrease within minutes after the tax events.

Next, we estimate Equation (1) via a pooled ordinary least squares regression using the three main events. Standard errors are clustered at the firm and date levels. To enhance interpretability of the estimated coefficients, we standardize the $CompanyExposure_i$ measure. Table 1 shows the regression results. In column 1, the coefficient estimate on the *Foreign earnings ratio* variable is -9.55 (t -statistic = -5.45), suggesting that the stock prices of companies with a one-standard-deviation higher *Foreign earnings ratio* decreased on average by 9.5 basis points more shortly after the tax events. Columns 2 and 3 show that the stock price of companies with a one-standard-deviation higher *Foreign low tax benefit* and *Foreign tax differential to minimum tax* decrease by around -5.53 basis points (t -statistic = -8.11) and -4.65 basis points (t -statistic = -4.09), respectively. Finally, in column 4, we observe that, when all three variables are included as regressors, the estimated coefficients for *Foreign earnings ratio* and *Foreign tax differential to minimum tax* slightly change and, in turn, absorb the explanatory power previously attributed to *Foreign low tax benefit*.

2.3.2 Persistence of effects. The previous subsection showed that the global tax reform has a statistically significant effect on stock price in a short window around the main tax events. Next we show that these effects grow in magnitude when focusing on longer event windows. By augmenting the event window, we can better measure the economic magnitude of the effects, as it may take market participants time to fully price in the new information contained in the tax events.

Figure 4 shows the effect of the global tax reform on stock prices for various event windows. First, we sort stocks into 10 deciles based on their *Foreign tax differential to minimum tax* exposure measure.

Table 1
High-frequency stock price responses to the global tax reform

	High-freq. stock returns $\Delta p_{i,t}$			
	(1)	(2)	(3)	(4)
<i>Foreign earnings ratio</i>	-9.55 [-5.45]			-8.46 [-3.62]
<i>Foreign low tax benefit</i>		-5.53 [-8.11]		-1.65 [-1.04]
<i>Foreign tax differential to minimum tax</i>			-4.65 [-4.09]	-8.05 [-2.93]
Constant	19.10 [1.29]	19.51 [1.42]	23.15 [1.62]	21.79 [1.28]
<i>R-squared (%)</i>	0.41	0.14	0.12	1.49
Observations	3511	5600	6282	2389

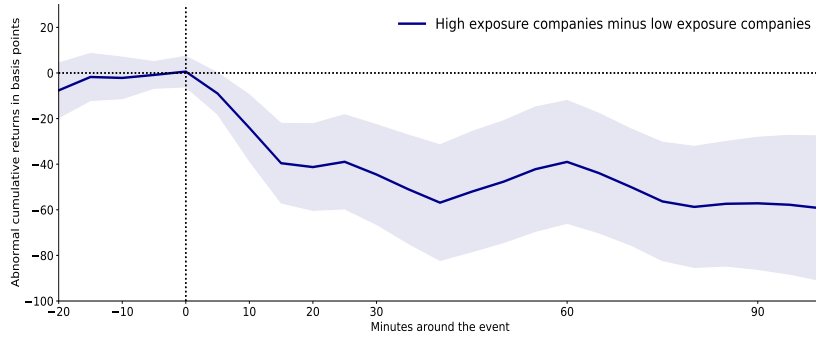
The table reports the regression estimates for the following Equation:

$$\Delta p_{i,t} = a + b \cdot \text{CompanyExposure}_i + \epsilon_{i,t},$$

where $\Delta p_{i,t}$ denotes the change in log stock prices for stock i around the tax event t . To compute these price changes, we use an 80-minute window around the tax event t (60 minutes before and 20 minutes after). CompanyExposure_i denotes the exposure of company i to the tax event as defined in Section 2.2.1. CompanyExposure_i is a company's foreign earnings scaled by total pretax earnings (*Foreign earnings ratio* _{i}), a company's tax savings, due to low-taxed foreign earnings, benchmarked against the U.S. statutory tax rate scaled by total assets (*Foreign low tax benefit* _{i}) or the sum of the tax rate differentials between the proposed minimum tax rate of 15% and countries' 2020 statutory corporate income tax rates across all countries in which company i owns at least one subsidiary, scaled by total assets (*Foreign tax differential to minimum tax* _{i}). We estimate the regressions using the three events outlined in Section 1.2: Jan. 14, Jul. 1, and Oct. 8. Standard errors are clustered at the firm and date levels. t -statistics are in brackets. CompanyExposure_i is standardized, while $\Delta p_{i,t}$ is in basis points. R -squared statistics are in percentage.

Then, for each stock in each decile, we compute the cumulative return from 20 minutes before the tax event to 100 minutes afterward. The figure displays the average difference in cumulative returns between the high- and low-exposure stocks for the main tax events. The blue shading represents the 95% error bands. The plot illustrates that, (a) in the minutes preceding the tax events, the stock prices of high-exposure companies did not trend differently from those of low-exposure companies; (b) the tax events caused an immediate drop in stock prices for high-exposure companies, compared to low-exposure ones; and, (c) as the post-event window extends to up to 100 minutes, the estimated effects almost doubled, relative to the high-frequency benchmark estimates that use a 20-minute event window. Finally, Figure C.4 in the Internet Appendix shows that this return spread is due to a significant decrease in firm value for high-exposure companies in the minutes immediately following the tax events.

Figure 4
Event-study plot: Minutes around the event



This figure shows the effect of the global tax reform on stock prices for various event windows. First, we sort stocks into 10 deciles based on their *Foreign tax differential to minimum tax* exposure measure. Then, for each stock in each decile, we compute the cumulative return from 20 minutes before the tax event to 100 minutes afterward. The figure displays the average difference in cumulative returns between the high- and low-exposure stocks for the main tax events. The blue shading represents the 95% error bands.

Next, we extend the event window to a day. Using data from all trading days in 2021, we estimate the following pooled ordinary least squares (OLS) regression:

$$r_{i,t} = a + b \cdot TaxEvent_k + c \cdot CompanyExposure_i + d \cdot (CompanyExposure_i \times TaxEvent_k) + \epsilon_{i,t}, \quad (2)$$

where $r_{i,t}$ denotes the daily stock return for company i , $TaxEvent_k$ is a dummy variable equal to one if there was a main tax reform announcement on day k and zero otherwise, and $\epsilon_{i,t}$ is the error term. We expect the coefficient d to be negative, that is, stock returns decrease for companies that have a higher exposure to the global tax reform as measured by $CompanyExposure_i$ on tax reform announcement dates.

Table 2 presents the daily regression results. We clustered standard errors at the firm and date levels. We report regression results for raw returns (column 1), CAPM-adjusted returns (column 2), Fama–French three-factor model-adjusted returns (column 3), and Fama–French/Carhart four-factor model-adjusted returns (column 4). The table shows that market participants responded strongly to cross-sectional differences in $CompanyExposure_i$ on the main tax announcements mirroring our high-frequency estimates. However, the main takeaway of Table 2 is that the effects are about two times larger when we use a 1-day post-event window. For example, the coefficient for *Foreign low tax benefit* is -17.39 (t -statistic = -2.22) when we use a daily event window, compared to -8.46 using the narrow window from

Table 2
Daily stock price responses to the global tax reform

	Raw	Residualized returns using		
	returns	CAPM	FF3	FF4
	(1)	(2)	(3)	(4)
<i>TaxEvent</i> × <i>Foreign earnings ratio</i>	-17.39 [-2.22]	-17.53 [-2.35]	-14.35 [-10.38]	-13.83 [-11.31]
<i>TaxEvent</i> × <i>Foreign low tax benefit</i>	-8.65 [-2.05]	-8.89 [-1.87]	-6.09 [-0.95]	-5.98 [-0.93]
<i>TaxEvent</i> × <i>Foreign tax differential to minimum tax</i>	-12.38 [-1.84]	-12.38 [-1.94]	-9.86 [-2.97]	-9.69 [-2.88]
<i>Foreign earnings ratio</i>	0.42 [0.33]	1.68 [1.31]	0.94 [1.12]	1.02 [1.23]
<i>Foreign low tax benefit</i>	-0.00 [-0.00]	0.21 [0.33]	0.07 [0.13]	0.04 [0.08]
<i>Foreign tax differential to minimum tax</i>	0.66 [1.29]	1.16 [2.18]	0.89 [2.01]	0.93 [2.17]
<i>TaxEvent</i>	43.23 [0.91]	53.08 [1.16]	-8.66 [-1.22]	-7.78 [-0.99]
Constant	8.15 [1.23]	-6.12 [-1.69]	-5.85 [-4.27]	-5.90 [-4.40]
<i>R</i> -squared (%)	0.03	0.05	0.01	0.01
Observations	212,266	212,266	212,266	212,266

The table reports the regression estimates for the following equation:

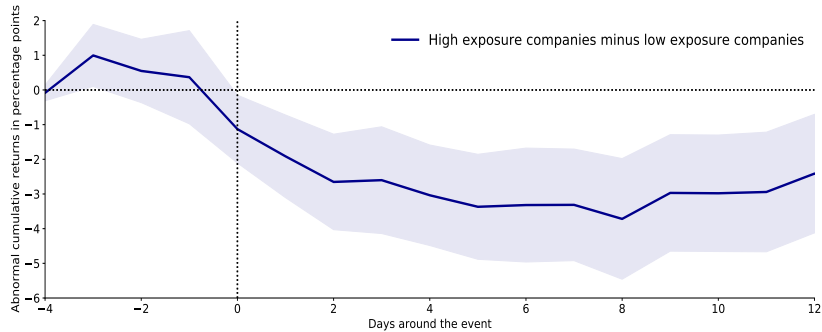
$$r_{i,t} = a + b \cdot TaxEvent_k + c \cdot CompanyExposure_i + d \cdot (CompanyExposure_i \times TaxEvent_k) + \epsilon_{i,t},$$

where $r_{i,t}$ denotes the daily stock return for company i , $TaxEvent_k$ is a dummy variable equal to one if there was a main tax announcement on day k and zero otherwise. $CompanyExposure_i$ measures the exposure of company i to the global tax reform. These variables are described in Section 2.2.1 and in Table A.1 in the Internet Appendix. Column 1 reports results using raw returns; column 2 using CAPM-adjusted returns; column 3 using Fama-French three-factor model-adjusted returns; and column 4 using Fama-French/Carhart four-factor model-adjusted returns. Stock returns are in basis points, and $CompanyExposure_i$ is standardized. We use all trading days during 2021. Standard errors are clustered at the firm and date levels. t -statistics are in brackets.

our benchmark analysis (see column 4 of Table 1). Columns 2 through 4 show that, after adjusting for standard risk factors, the estimated coefficients are somewhat smaller but still economically large. For instance, a one-standard-deviation increase in *Foreign tax differential to minimum tax* is associated with about 9.86 basis points (t -statistic = -2.97) lower Fama-French adjusted returns on the days of the tax event (see column 3). Finally, we find that, on nontax event days, the $CompanyExposure_i$ measure is unrelated to future stock returns since the estimated coefficients \hat{c} are statistically insignificant.

Figure 5 reports the average event-time cumulative return spread between the high-exposure (last decile) and low-exposure stocks (first decile) using *Foreign tax differential to minimum tax* as the sorting

Figure 5
Event-study plot: Days around the event



This figure shows the effect of the global tax reform on stock prices for various event windows. First, we sort stocks into 10 deciles based on their *Foreign tax differential to minimum tax* exposure measure. Then, for each stock in each decile, we compute the cumulative return from four days before the tax event to 12 business days afterward. The figure displays the average cumulative return difference between the high- and low-exposure stocks for the main tax events. The blue shading represents the 95% error bands.

variable. The figure shows no run-up in the days immediately before the main tax events. From day $t-4$ to day $t-1$, the average return spread is statistically indistinguishable from zero. However, following the tax event, from day 0 to business day $t+12$, the cumulative return spread drifts downward by about 300 basis points. The spread in cumulative returns then flattens and stays flat after that. Similar to the high-frequency analysis, Figure C.5 in the Internet Appendix shows that drift in the return spread is due to a significant decrease in firm value for high-exposure companies in the days following the tax events.

2.3.3 Stock price responses across different event dates in 2021.

Our analysis so far has focused on the effect of three main tax events on stock prices. However, as outlined in Section 1.1, the consensus for the global tax reform evolved across five additional events in 2021. In this section, we consider all events and break them down one by one, rather than pooling them. This exercise helps determine which event most significantly affected stock prices.

Table 3 presents the results of the high-frequency event study regression outlined in Equation (1), using all events that occurred during regular trading hours. The estimates are presented event-by-event, providing a detailed examination of the impact of each event on stock prices. We document the largest negative coefficients for two out of the three exposure measures on the first event (Jan. 14). This finding suggests that the incremental news released to the market was significant and unexpected, which aligns with the institutional background, as it

Table 3
High-frequency stock price responses to the global tax reform: Event by event

	High-freq. stock returns $\Delta p_{i,t}$			
	Jan. 14 (1)	Jan. 15 (2)	Jul. 1 (3)	Oct. 8 (4)
<i>Foreign earnings ratio</i>	-13.59 [-2.29]	-8.54 [-1.30]	-6.29 [-3.80]	-4.35 [-2.26]
<i>Foreign low tax benefit</i>	0.90 [0.17]	2.02 [0.34]	-5.89 [-4.42]	-0.06 [-0.03]
<i>Foreign tax differential to minimum tax</i>	-14.77 [-3.25]	-0.33 [-0.08]	-5.64 [-4.41]	-3.42 [-2.65]
Constant	54.07 [7.89]	-45.01 [-6.69]	9.58 [5.31]	2.89 [1.13]
<i>R-squared (%)</i>	1.77	0.21	7.00	1.08
Observations	815	820	814	760

The table reports the regression estimates for the following Equation:

$$\Delta p_{i,t} = a + b \cdot \text{CompanyExposure}_i + \epsilon_{i,t},$$

where $\Delta p_{i,t}$ denotes the change in log stock prices for stock i around the tax event t . To compute these price changes, we use an 80-minute window around the tax event t (60 minutes before and 20 minutes after). The table reports results for each of the following tax events: January 14, January 15, July 1, and October 8. Standard errors are clustered at the firm level. t -statistics are in brackets. CompanyExposure_i is standardized, while $\Delta p_{i,t}$ is in basis points. R -squared statistics are in percentage.

took policy makers more than one year to formulate the reform proposals since the end of 2019.

Column 3 of the table documents strong results for all exposure measures on July 1, which is consistent with the event being a major surprise to the market, as it was first announced that 130 countries had agreed to the reform. Although the news' surprise character about the reform should have been minor after that date, we still document significant negative coefficients for the *Foreign earnings ratio* and *Foreign tax differential to minimum tax* exposure measures on October 8, as shown in column 4. This result is sensible, as the OECD released the detailed rules on Pillar 1 on that date, confirming that some of the largest and most profitable U.S. MNCs would be subject to the consumer location-based taxation of profits. These companies likely had a high fraction of foreign earnings and many tax haven entities. Finally, note that the results are statistically significant in three out of the four events. We only document insignificant and weaker results on January 15. This finding is consistent with little incremental information being released on this day because the event coincides with the second day of the OECD's 2-day consultation meeting and the market likely already digested most of the news from the first day (Jan. 14).

Table C.11 in the Internet Appendix repeats the event-by-event analysis using daily returns and all global tax events. The results from this analysis mirror those of the high-frequency event-by-event estimates, in that the three main events (Jan. 14, Jul. 1, and Oct. 8) are found to have the largest news component, as measured by the stock price reactions around the events.¹⁷

These event-by-event results indicate that the investors perceived the importance of the news to differ across events. The results are consistent with the institutional setting providing for three arguably significant news releases on January 14, July 1, and October 8, as discussed in Section 1.1. These results also motivate two additional analyses. First, we use July 1 as the key event to measure the tax reform’s full value effect, given that this event constituted the major reform announcement and triggered significant market reactions (Section 2.3.4). Second, we exploit the news released on October 8 to investigate whether investors specifically responded to the Pillar 1 rules, which affected some but not all U.S. MNCs based on their size (Section 2.3.5).

2.3.4 Measuring the reform’s expected full value effect. This section aims to evaluate the global tax reform’s full expected impact on firm values. While the immediate stock price responses documented in Section 2.3.1 are well identified, they only measure a fraction of the effect, as they do not account for market anticipation. Huberman and Schwert (1985) and Bhattacharya et al. (2000) highlight the significance of this factor, as highly anticipated events may generate small measured effects.

The goal is to incorporate changes in the level of investors’ anticipation of reform announcements into the stock price responses. The following equation outlines our approach to do so:

$$V_e = \sum_{i=1}^N V_i = \sum_{i=1}^N \frac{\Delta p_{i,t}}{\Delta \pi_t} \times M_{i,t-1}, \quad (3)$$

where V_i is the full value effect of the reform for company i , $\Delta p_{i,t}$ represents the stock price change for company i at event t , $M_{i,t-1}$ is the market capitalization for company i before the event, and $\Delta \pi_t$ is investors’ perception of the change in the probability of the reform after learning about the event at time t . The full impact of the reform, V_e ,

¹⁷ Table C.9 in the Internet Appendix shows the estimated coefficients from estimating Equation (1) but now pooling across the four events that occurred during regular trading hours. Similarly, Table C.10 in the Internet Appendix presents the results of estimating Equation (1) using all global tax reform dates shown in Figure 2. In both specifications, the estimated effects are found to be statistically significant, but, as expected, the magnitude of the effects decreases for all three exposure measures.

on the corporate sector with N companies is calculated as the sum of V_i for all companies.

The challenge of measuring the full impact of the global tax reform on firm values is that the perceived change in the probability of the reform ($\Delta\pi_t$) is unobservable.¹⁸ We follow prior work and exploit the information contained in option prices to estimate π_t (Barraclough et al. 2013; Borochin et al. 2021; Borochin and Golec 2016; Subramanian 2004).¹⁹ Our focus is on the key event of July 1, 2021, when the OECD announced that 130 countries had agreed on the reform. Following the method of Borochin and Golec (2016), we estimate an average options-implied probability of 31% for the OECD to announce the agreement on July 1, 2021.²⁰ We provide details on the estimation procedures in the Internet Appendix (Section B).

Table 4 presents the results. Column 1 shows the results under the assumption of a complete surprise ($\Delta\pi = 100\% - 0\%$), while column 2 shows the results considering market anticipation ($\Delta\pi = 100\% - 31\%$), based on the estimated average options-implied probability of 31%. We use this estimated change in investors' perceived probabilities of the reform to happen to compute the full value effect first using intraday trading data and then using daily stock returns. Specifically, we first estimate regression specification (1) using intraday stock price data around the July 1, 2021, event (previously reported in column 3 of Table 3) and apply Equation (3). Based on this approach, the full value effect of the global tax reform is $-\$12.59$ billion assuming a complete surprise and $-\$18.51$ billion when considering market anticipation. We

¹⁸ In some cases, π_t is readily available in prediction markets. For instance, Snowberg, Wolfers, and Zitzewitz (2007), Snowberg, Wolfers, and Zitzewitz (2011), Meng (2017), and Wolfers and Zitzewitz (2009) use prices from market trading contracts (bets) tied to political events to measure market participants' expectations of such events. Unfortunately, we cannot use betting data, as the prediction markets did not cover the global tax reform.

¹⁹ Strictly speaking, the estimated event probability π_t is the risk-neutral probability, which equals the physical probability times the pricing kernel. Hence the difference between the risk-neutral and physical probabilities is the market risk premium. Given that we are focusing on very short time windows around the tax events, the change in market risk premium is expected to be relatively small.

²⁰ The median implied probability equals 28%, while the 25th and 75th percentiles equal 25% and 35%, respectively. To put these numbers in perspective, Borochin et al. (2021) estimated the probability of the passage of Tax Cuts and Jobs Act (TCJA) to be around 95% one day before it passed on December 22, 2017. Hence the market largely anticipated the TCJA's passage, which is plausible because the bill had already passed the House of Representatives and the Senate a few days earlier. We also document additional evidence consistent with the perceived probability being nonzero. For example, around 20% of sample companies discussed the reform as a potential risk to their businesses in the Item 1A risk factor disclosures of their 10-Ks just before the main event on July 1, 2021. Around 10% of them also mentioned the reform in their earnings conference calls before the main event on July 1, 2021. Consistent with investors perceiving the reform discussions before the event as uncertain, we document increasing implied volatility leading up to July 1 for the highly exposed companies, consistent with the findings of Kelly, Pástor, and Veronesi (2016) around national elections and global summits.

Table 4
The full value effect of the global tax reform on July 1, 2021

A. High-frequency event window					
	Complete surprise	Adjusting for market anticipation of the event			
		Lower bound	Remaining uncertainty		
Values for	100% - 0%	100% - 31%	80% - 31%	60% - 31%	50% - 31%
$\Delta\pi = \pi_1 - \pi_0$	(1)	(2)	(3)	(4)	(5)
$1/\Delta\pi_t$	1.00	1.47	2.08	3.57	5.55
$\Delta p_{i,t}/\Delta\pi_t$ (in bps)	-8.24	-12.11	-17.15	-29.39	-45.70
V_e in billions	-12.59	-18.51	-26.22	-44.93	-69.87

B. Daily event window					
	Complete surprise	Adjusting for market anticipation of the event			
		Lower bound	Remaining uncertainty		
Values for	100% - 0%	100% - 31%	80% - 31%	60% - 31%	50% - 31%
$\Delta\pi = \pi_1 - \pi_0$	(1)	(2)	(3)	(4)	(5)
$1/\Delta\pi_t$	1.00	1.47	2.08	3.57	5.55
$\Delta p_{i,t}/\Delta\pi_t$ (in bps)	-41.29	-60.70	-85.98	-147.35	-229.11
V_e in billions	-76.59	-112.60	-159.50	-273.34	-425.03

This table reports the immediate full value-effect of the global tax reform on July 1, 2021. The full value effect is estimated by adjusting the price change around the announcement with the model-based estimate of the event probability. We compute the model-implied probabilities from stock and option prices, following Borochin and Golec (2016). $\Delta p_{i,t}/\Delta\pi_t$ reports the immediate value effect for the highly exposed companies (i.e., companies that are one-standard-deviation above all $CompanyExposure_i$ measures ($= a + b_1 + b_2 + b_3$)). To compute the effect in dollars (V_e in \$ (billions)), for each exposed firm i , we multiply the predicted price change $\Delta\hat{p}_{i,t}$ with the equity market value one business day before the announcement and then sum this product across all exposed companies in our sample (i.e., $V_e = \sum_i V_i$, where V_i is defined in Equation (3)). Panel A computes stock price changes using an 80-minute window around the tax event (60 minutes before and 20 minutes after). Panel B computes stock price changes using a daily event window.

then compute $\Delta p_{i,t}$ using a daily event window. Panel B of Table 4 reports the result. Column 2 shows that the full value effect using a daily event window equals -\$112.6 billion, which is six times larger than the -\$18.51 billion effect obtained using a narrow intraday event window.

The estimates in column 2 of Table 4 represent a lower bound of the full value effect, as these are based on investors assuming the probability of passage of the tax reform after the OECD announcement on July 1, 2021, to be 100%. However, there were significant uncertainties regarding passage, such as the need for drafting rules and cooperation from lawmakers from over 100 countries and uncertain translation into national law in key countries, like the United States and EU members (Wall Street Journal 2022). To account for these uncertainties, we adjust the post-event probability that the reform would pass to 80%, 60%, and 50% in columns 3, 4, and 5, respectively. We use this broad range of values to provide ballpark estimates to readers with different priors

about the post-announcement probability of the reform. Based on these probabilities, the immediate full value effect ranges from -\$18.51 billion to -\$69.87 billion when using the narrow event window and from -\$112.60 billion to -\$425.03 billion when using the extended one-day window.

2.3.5 Discontinuity analysis around the OECD Pillar 1 size thresholds. Our analysis so far studies average market reactions around the reform announcement events described in Section 1.2. As such, we interpret the stock price changes as responses to perceived changes in the likelihood of the global tax reform. However, the informational content released on October 8, 2021, also allows us to study investor responses to specific contents of the reform. For the first time, the OECD officially announced that Pillar 1 (the new consumer-location-based taxation of corporate profits) would affect only the largest multinationals. Specifically, companies would be within the rules' scope only if they generated sales of more than EUR 10 billion (conditional on the successful implementation of the specific Pillar 1 rules across all agreeing countries) or more than EUR 20 billion (unconditional on the successful implementation). Further, the scope of Pillar 1 was restricted to companies with a profitability of above 10%, defined as profit before taxes over revenue.²¹

To tighten identification and assess the impact of Pillar 1, we exploit the sharp discontinuities in companies' consolidated revenues and profitability that determine whether companies would fall under the new rules using a regression discontinuity design (Lee and Lemieux 2010; Meng 2017). We perform local regression discontinuity estimations based on the following equation:

$$\Delta p_{i,t} = a \cdot Treated_i + b \cdot RV_i + c \cdot RV_i \cdot Treated_i + \epsilon_{i,t}, \quad (4)$$

where $\Delta p_{i,t}$ denotes the high-frequency (80-minute window) change in log stock prices for stock i around the tax event t on October 8, 2021, at 17:01 UTC. In our main specifications, $Treated_i$ is an indicator variable equal to one if the company reported sales of more than the specified threshold value in consolidated sales in the OECD public announcement on October 8, 2021. In some specifications, we set this treatment indicator equal to one if the company reported sales of at least US\$12 billion in fiscal year 2020 and zero otherwise and in some specifications, we use a value of US\$24 billion. RV_i is the running (or

²¹ The official statement from October 8 is available on the OECD's website (OECD 2021c). We believe market participants considered the EUR 10 billion threshold as the relevant one, given the recent and strong commitment of the agreeing countries to implementing the rules. Also, this threshold was the more frequently mentioned number in news articles after the reform announcement. However, it is reasonable to also expect that companies above the EUR 20 billion threshold would exhibit specifically strong stock price reactions, given the policy makers' revealed preferences for taxing the very large MNCs.

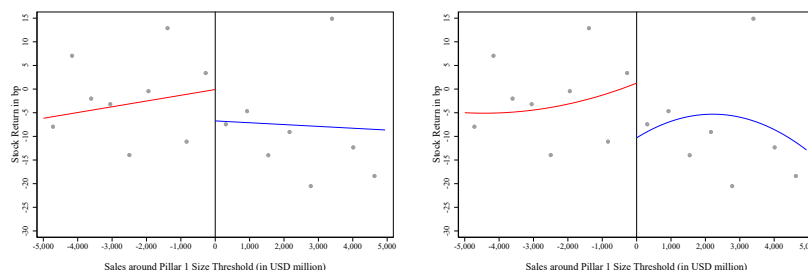
forcing) variable, defined as the difference between a company's sales in fiscal year 2020 and these respective threshold values.²² We believe these size thresholds were the more salient and intuitive element of the announced reform details for investors on October 8, relative to the 10% profitability threshold in addition to the size threshold. Specifically, investors likely found it more intuitive to form opinions about what set of U.S. MNCs would meet the size criteria, relative to the profitability threshold, as of the expected reform implementation years after 2023. However, in additional specifications, we also include the profitability threshold in our discontinuity analysis by using a cumulative cutoff approach, as put forward in Papay, Willett, and Murnane (2011) and implemented by Cattaneo, Titiunik, and Vazquez-Bare (2020). We use robust bias-corrected confidence intervals and inference procedures following Calonico, Cattaneo, and Titiunik (2014).

To identify the effect of the global tax reform on firm values, we exploit these thresholds as quasi-exogenous local variation in treatment assignment. Here the identifying assumption is that differences in stock prices within a narrow time window between companies above and below US\$12 billion or US\$24 billion in sales are driven by the reform's Pillar 1 rules applying only to companies above the threshold. In addition, we must assume that companies did not manipulate their 2020 sales to influence assignment to the treatment.²³ We acknowledge that the policy does not necessarily lead to a sharp discontinuity because two companies near the threshold in 2021 have an arguably similar likelihood to be above the threshold in some future year after 2023. If investors incorporated this type of uncertainty, we will not document local treatment effects based on our research design. However, we believe it is plausible to assume that investors did respond to the published threshold values and related them to companies' contemporaneous financial statement information in light of the complexity of the tax reform and the short time window we observe around the press release.

²² We use US\$12 billion and US\$24 billion as approximations of the EUR 10 billion and 20 billion thresholds. We acknowledge that we observe U.S.-listed companies' sales as of fiscal year 2020 in USD. We argue that the approximated values of US\$12 billion or US\$24 billion most likely reflect investors applying a simple heuristic to convert the threshold into expected USD sales of the affected companies on the day of the event. We acknowledge that this definition may be noisy and that it is not straightforward to use a correct value because investors would need to forecast the USD-EUR currency exchange rate and companies' sales as of fiscal year 2023, when the rule would become effective. However, the noise should, if anything, limit our ability to identify local treatment effects in a regression discontinuity design.

²³ Given the uncertainty in exchange rates and future performance until 2023, it seems highly unlikely that companies could have done this. Nonetheless, we follow the recommendations of McCrary (2008) and test for sales manipulation by inspecting the density of observations around our threshold. We document strongly overlapping 95% confidence intervals at both sides of the threshold in Figure C.7 in the Internet Appendix, consistent with no evidence of manipulations.

Figure 6
High-frequency stock price responses on October 8, 2021, around the EUR 10 billion sales threshold



This figure shows discontinuities in stock price responses of companies around the US\$12 billion sales threshold on October 8, 2021. The graphs plot average values of changes in log stock prices around the tax event t in an 80-minute window surrounding October 8, 2021, 13:01 EDT, for evenly spaced bins of the companies' sales in fiscal year 2020. The graph on the left also shows a linear regression line. The graphs on the right show second-order polynomial fits. At 13:01 EDT on October 8, the OECD announced that 136 countries had agreed on the specific rules of the global tax reform. This was the first announcement that companies with sales of greater than EUR 10 billion (which we approximate by US\$12 billion) would be subject to the new rules under Pillar 1.

We first illustrate our discontinuity analysis results in Figure 6. This figure shows the stock price reactions for evenly spaced bins of companies' 2020 sales and a local linear fit on the left or second-order polynomials on the right. The figure shows a discontinuity in stock prices at the threshold. Specifically, companies in the bins between US\$7 billion and US\$12 billion in sales on average do not experience stock price changes around the event on October 8. Companies in the bins between US\$12 billion and US\$17 billion in sales on average experience negative stock price reactions of 5 to more than 20 basis points, and the fitted linear trend and, in particular, the second-order polynomials indicate a continuing negative trend.²⁴

We estimate several specifications based on Equation (4) and report results in Table 5. In the main specifications in panel A, we use observations on the event date of October 8, 2021, and apply different treatment definitions, depending on the released threshold values. Across all specifications, we estimate negative coefficients, which are statistically significant at conventional levels. The coefficients in columns 1 and 2 suggest that companies' stock prices above the size thresholds

²⁴ As our measurement of the threshold value might be noisy and therefore bias our estimates from the local RDD, we complement our results by providing average stock returns in larger categories of 2020 sales. Consistent with our RDD results, we only document negative average stock returns for companies with sales greater than US\$12 billion. Specifically, we observe a clear discontinuity between average returns for companies reporting between US\$10 billion and US\$12 billion and between US\$12 billion and US\$14 billion (Figure C.8 in the Internet Appendix).

of EUR 10 billion and EUR 20 billion decreased by around 17 and 25 basis points, relative to companies below the thresholds, after the OECD released the detailed rules of the global tax framework on October 8. We find quantitatively and qualitatively similar results when also incorporating the profitability threshold in columns 3 and 4, suggesting that investors viewed the sharp increase in the likelihood of companies being within the scope of the Pillar 1 rules in the future as a significant risk to companies' cash flows.

Panel B presents the results of several robustness specifications based on the specification of column 1 in panel A to corroborate these inferences. In column 1, we include companies' pretax profitability and effective tax rates as predetermined covariance. The treatment coefficient stays almost the same and, unsurprisingly, is estimated with greater precision. In column 2, we exclude companies with reported sales of approximately EUR 9 billion and 10 billion to address the concern that they are likely to be above the threshold in some future year after 2023. We document a substantially larger effect size (35.37 basis points). This finding suggests that companies just below the threshold in 2021 are potentially poor control observations in the local RDD and contaminate identification based on the sharp discontinuity assumption. In column 3, we document no evidence for a negative reform effect using all event dates, except for October 8, suggesting that our results are attributable to the new information regarding the application of the Pillar 1 rules released on October 8. Rerunning our test based on observations on the event date of October 8, 2021, but using a placebo size threshold of US\$5 billion yields an insignificant coefficient with a positive sign (column 4), further supporting our inferences.

2.3.6 Robustness and additional results. We conduct several supplementary tests and report the results in the Internet Appendix. First, we use additional exposure measures that proxy for MNCs' incentives to shift profits across countries to exploit tax rate differentials, intangibility and tax haven use to further pin down the relationship between MNCs' tax planning benefits under the current tax regime and the global tax reform's negative impact on MNCs' values. We discuss details and report results in Internet Appendix Section C.1.

Second, we document nearly identical effects when excluding companies with more than US\$12 billion in sales in fiscal year 2020. This size cutoff approximates the EUR 10 billion threshold used by the regulators to determine whether companies would fall under the new Pillar 1 regulations. Therefore our main results suggest that investors expected that Pillar 2 would impose a significant cost on the average exposed company. These findings also mitigate the concern that our

Table 5
High-frequency stock price changes around the Pillar 1 size thresholds

<i>A. Main specifications</i>				
	<i>High-freq. stock returns $\Delta p_{i,t}$</i>			
	(1)	(2)	(3)	(4)
RD estimate	-17.17 [-1.84]	-24.96 [-2.26]	-16.48 [-3.20]	-25.09 [-2.04]
Observations	887	238	686	1,041
Obs. in BW	260	119	.	.
Threshold	10 billion	20 billion	10 billion & 10% profit	20 billion & 10% profit

<i>B. Robustness specifications</i>				
	<i>High-freq. stock returns $\Delta p_{i,t}$</i>			
	(1)	(2)	(3)	(4)
RD estimate	-18.46 [-1.91]	-35.37 [-1.84]	18.33 [0.49]	0.09 [0.01]
Observations	879	867	2,999	887
Obs. in BW	244	165	444	285
Modification of col. 1, panel A	Covariates included	No sales < threshold	Other event dates	5 billion placebo threshold

The table reports the regression estimates from local linear regression discontinuity estimations. Columns 1 and 2 in panel A and columns 1 to 4 in panel B are based on the following equation: $\Delta p_{i,t} = a \cdot Treated_i + b \cdot RV_i + c \cdot RV_i \cdot Treated_i + \epsilon_{i,t}$. $\Delta p_{i,t}$ denotes the change in log stock prices for stock i around the tax event t . To compute these price changes, we use an 80-minute window around the tax event t (60 minutes before and 20 minutes after). $Treated_i$ is an indicator variable equal to one if the company reported sales of more than the specified threshold value in the OECD's public announcement for the Pillar 1 scope on October 8, 2021. In column 1 of panel A, $Treated_i$ is equal to one if the company reported at least US\$12 billion (approximately EUR 10 billion) in fiscal year 2020 and zero otherwise. In column 2 of panel A, $Treated_i$ is equal to one if the company reported at least US\$24 billion (approximately EUR 20 billion) in fiscal year 2020 and zero otherwise. In this specification, we exclude companies with sales of less than US\$12 billion. In columns 3 and 4 of panel A, we extend the specifications of columns 1 and 2 by adding a second treatment cutoff indicator variable equal to one if the company reported pretax income greater than 10% of sales. We use the framework for cumulative cutoffs developed by Cattaneo, Titiunik, and Vazquez-Bare (2020). RV_i is the running (or forcing) variable, defined as the difference between a company's sales or profitability in fiscal year 2020 and the respective threshold value. Specifications in panel B are based on column 1 of panel A with the following modification for robustness purposes. Column 1 includes a company's profitability running variable and the effective tax rates as covariates. Column 2 excludes companies reporting between US\$9 billion and 10 billion in sales. Column 3 uses trading date from all other tax events, except for October 8. Column 4 uses an arbitrary size threshold of US\$5 billion to calculate a placebo treatment indicator. We use robust bias-corrected confidence intervals and inference procedures following Calonico, Cattaneo, and Titiunik (2014). All specifications use nonparametric local linear (first-order polynomial) regressions. We use mean-squared-error optimal bandwidths at both sides of the threshold. When using the EUR 10 billion threshold, we drop companies with a 0% foreign earnings ratio. Log price changes are in basis points. t -statistics are in brackets.

effects are only driven by the large U.S. MNCs in the technology sector that have been criticized for their aggressive tax avoidance.

Third, Internet Appendix Section C.2 examines the effects of the global tax reform on industries to further analyze its aggregate effects. Each company in our data set is assigned to an industry based on its four-digit SIC code. We use the 48 industry classifications provided on Kenneth F. French's website. We then compute the value-weighted returns for each industry using three-factor-adjusted daily returns on the day of the tax event. We find that industries with a high share of taxable income reported in foreign jurisdictions are affected significantly by the reform. Industries like computer chips, chemicals, electronic engineering, laboratory equipment, container/logistics, and the shipping drop considerably in value minutes after the global tax announcements. Overall these results indicate that these industries have likely exploited the current tax system and will face higher tax burdens under the new rules.

2.3.7 Discussion of economic magnitudes of stock market responses.

The magnitudes of our estimates of stock price reactions to the global tax reform warrant discussion regarding the reform's specific setting and the different estimation procedures we use. First, we discuss our findings in light of the estimates in other studies examining the effects of regulations on stock prices. We acknowledge that our study's unique global regulatory setting requires us to estimate expected probabilities that the reform would be agreed on and implemented by many countries, which is not straightforward. However, our extensive set of tests allows for several benchmarking exercises. For example, our main high-frequency estimate is an approximately 18 basis points stock price drop for a company with a one-standard-deviation higher exposure (derived from summing up the coefficients in column 4 of Table 1). Using daily returns, a one-standard-deviation higher exposure is associated with a 38 basis points stock price drop (derived from summing up the coefficients in column 1 of Table 2). These estimates compare in magnitude to stock price increases of 47 and 60 basis points in Wagner, Zeckhauser, and Ziegler (2018a) and Gaertner, Hoopes, and Williams (2020), respectively, for the average U.S. company attributable to the tax rate cut after the 2017 U.S. tax reform (TCJA). Further, our estimated CARs based on the event-study plot reported in Figure 5 are about two times larger than the CARs in Cohen, Diether, and Malloy (2013), who form portfolios based on companies hurt and helped by different types of corporate legislation. Overall we conclude that the economic impact of the global tax reform on U.S. MNCs with significant exposure is economically meaningful and thus likely to alter corporate decisions and trigger further political debates.

Second, a natural question is whether the stock market reactions plausibly comport with investors' estimates of the impact of the tax

reform on cash flow. Considering our sample companies' descriptive statistics in Table A.3 provides for the following simplified valuation model. Highly exposed MNCs generate around 50% of earnings abroad (the 75th percentile is above 40%). Assuming constant discount rates and that the average tax-aggressive MNC manages to shift around half of these earnings to low-tax jurisdictions and the average low-tax jurisdiction has a corporate income tax rate of 6% (i.e., a rate between 0% for tax havens like Bermuda and 12.5% for Ireland), the MNC will be affected by the new global minimum tax rate of 15% as follows. Approximately 25% ($=50\%*50\%$) of earnings will be taxed at 15% instead of 6%, resulting in a cash flow decrease of 2.25%. Compared to this ballpark figure, our estimate of a 60.7 basis points (0.67%) stock price drop in column 2 in panel B of Table 4 for the full value effect of the reform seems relatively modest but is actually plausible and comports with the simplified cash flow model. Specifically, our estimate is based on the definition of an exposed company having a one-standard-deviation higher exposure, and the standard deviations of our main exposure measures are less than half of the respective 95th percentiles (Table A.3 in the Internet Appendix). As we know that the negative returns are concentrated among highly exposed companies (i.e., those with very high values in the exposure measures), the 0.67% effect from Table 4 still represents a conservative estimate. Further, the results in Table 4 are based on stock price reactions within one day of the reform announcement. The simplified valuation example assumes that investors fully understand and price the 2.25% effect, and our results using a longer time window suggest that it takes time for investors to do so.

Third, we put our estimates in perspective versus the OECD's tax revenue estimates because imposing higher corporate taxes effectively represents a transfer of money from companies (i.e., shareholders) to governments. When proposing the reform details, the OECD estimated that the minimum tax rate of 15% could generate annual global revenue gains of US\$150 billion (OECD 2020). Benchmarked against this annual tax revenue estimate, our lower bound estimate of a U.S. shareholder value drop of \$112.60 billion seems modest. However, it is within a plausible range because the OECD expects to raise the additional tax revenues from all MNCs with revenues of at least EUR 750 million, including private and public companies from the United States and all other countries. Further, investors might have expected that U.S. MNCs will manage to avoid at least part of the proposed increase in tax burdens and they might have incorporated the uncertainty that the reform would actually pass (see our discussion in Section 2.3.4).

Finally, one might question whether the stock price drop after the reform announcements was due to investors anticipating lower future cash flows or discount rates would increase or a combination of both. Our

identification strategy has the advantage of excluding common effects, such as changes in discount rates. This is crucial, as it supports the conclusion that the price responses we document are consistent with a decrease in future cash flows, rather than a change in discount rates. Discount rate movements would have affected both the highly exposed companies as the treatment group and the less exposed ones as the control group, as both groups have positive betas to common risk factors. In principle, there could be other risk factors, such as risk related to tax-payment volatility, due to increased tax authority scrutiny, that are correlated with our firm exposure measures and may only impact the treatment group. However, to attribute the results to discount rate movements, we would expect higher returns for the highly exposed companies in the days after the reform announcement events. Positive risk premiums shocks may explain the initial price drop documented in our high-frequency analyses, but returns going forward should be positive and high, which is the opposite of what we find when using longer event windows.

3. Expected Effect on Countries

3.1 Predictions

Our goal in this section is to measure market perceptions of the effects of the global tax reform on countries' public finances. It is plausible to document macroeconomic effects associated with the reform because a primary function of the international tax system is to allocate taxing rights over business profits among countries, and the global reform fundamentally changes this allocation (Vella, Collier, and Devereux 2021). Importantly, the reform should not only directly affect countries' tax revenues, that is, the collection of more or less corporate income taxes but also likely indirectly affects their public finances, as MNCs might reallocate their real resources like employment, intellectual property, and cash, which will in turn affect countries' economic growth.²⁵ Specifically, the reform can affect countries' public finances in two ways. First, some countries might lose out if MNCs reallocate tax bases and real resources to other countries (De Simone and Olbert 2022a; Dyrda, Hong, and Steinberg 2022). These other countries might then be the winners of the reform. Second, countries might collect more income tax revenues from MNCs tax bases after the reform. The overall impact on countries' public finances crucially depends on how

²⁵ Specifically, tax havens, like the Bahamas, currently levy a 0% tax rate on corporate profits. Thus, by construction, the reform will not lead to lower tax revenues for them. However, if MNCs reallocate their legal entities, staff, intellectual property, or cash holdings away from such countries, their public finances will suffer, due to a drop in fees collected from MNCs, payroll taxes, and growth in the local professional services sector.

much of their tax bases and real activities MNCs reallocate (Johannesen 2022; Keen and Hebous 2021).

For countries currently applying high tax rates, the reform likely comes with benefits for two reasons. First, if MNCs' tax burdens in low-tax countries rise to at least 15%, the gap between a country's statutory rate vis-à-vis the low-tax countries shrinks and makes the high-tax country a relatively more competitive location for multinational business (as discussed from the U.S. perspective in Section 2.1). Second, countries that already applied tax rates above 15% before the reform can now apply a top-up tax up to an effective rate of 15% on tax bases of MNCs headquartered in their country but reporting earnings in foreign countries with tax rates below 15%, potentially raising their tax revenues. Consistent with this prediction, the OECD and independent economists estimated tax revenue gains for low-income countries, as well as major industrial countries, such as the United States and Germany (Barake et al. 2021; OECD 2020).

For countries currently offering low tax rates, the net effects are likely more nuanced, as they depend on the behavioral responses of MNCs with respect to their profit shifting and countries with respect to their tax rates. Recent theoretical work (Johannesen 2022) suggests low-tax investment hub countries will increase their statutory corporate tax rates, such that the reform's effect on their public finances will depend on how much of their tax bases MNCs decide to reallocate. Given that MNCs booked disproportionately high amounts of tax bases in tax havens in the past and that this behavior has been attributed to tax rate differentials (e.g., Tørsløv, Wier, and Zucman 2022), it is likely that the reform induces MNCs to reallocate much of their resources away from low-tax countries. Such reallocations likely outweigh the corporate income tax revenue gains associated with a higher tax rate. The reason is that tax havens benefit from MNCs' recourse through a host of factors unrelated to corporate income taxes, such as fees, payroll, and other non-corporate-income taxes, as well as economic growth in the professional services sectors.

Therefore, countries attracting large tax bases of multinationals and thus benefiting the most from the current tax regime will face the greatest cost associated with the reform. This cost is likely to increase with the extent to which a country's current corporate income tax rate is below the proposed minimum tax rate of 15%. Countries likely hurt by the reform would be Ireland, Hong Kong, and small tax havens. If investors expect these countries to lose out in terms of tax revenues and economic activity of multinationals, CDS spreads will increase, as these countries' macroeconomic outlook will become bleaker. In contrast, countries with large consumer markets but currently receive a paltry piece of the tax revenue pie, like large developing countries, should be the

greatest beneficiaries of the reform. These expectations are supported by the fact that Ireland was one of the last countries to join the agreement in late November 2021, while developing countries have long been pushing for a reform of the international tax rules (Government of Ireland 2021; OECD 2021b).

3.2 Data

3.2.1 Measuring countries' exposures. We construct three measures of countries' exposure to the potential costs with respect to their public finances. Our measures should capture how much of MNCs' tax bases are currently reported in a given country is due to aggressive profit shifting, and how much of these tax bases countries will likely lose due to the reform. Related to this aspect, we need to capture the extent to which a country will suffer or benefit from introducing a 15% minimum tax rate. The reason is that the reform will alter how much taxes companies have to pay on their global profits and how the resultant revenues are allocated across countries, given the country's consumer market size. Specifically, the OECD estimated that Pillar 1 will reallocate the taxing rights of more than US\$125 billion of profits. Pillar 2 is expected to raise new tax revenues of US\$150 billion annually (OECD 2020). To create such measures, we combine macroeconomic data from the World Bank and tax rates from KPMG with information on MNCs' allocation of real factors, revenue, profits, and tax payments in a specific country from the OECD's Country-by-Country (CbC) Reporting database. We specifically use data on total household consumption measured in purchase-price adjusted international dollars as a proxy for a country's market size. The publicly available CbC data are based on all reporting MNCs' individual CbC reports.²⁶

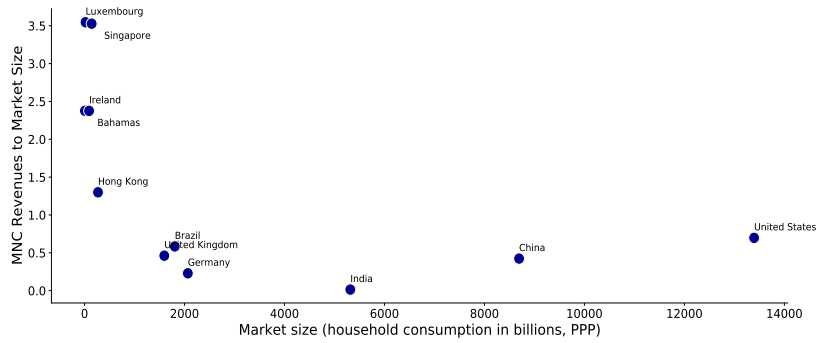
Our first and main country-level exposure variable is *MNC revenues to market size_k*, which we define as the sum of all MNCs' external revenues reported in the CbC files for a given country *k* scaled by

²⁶ The World Bank data are available through the World Bank Open Data API at <https://data.worldbank.org/>. CbC reporting data are available at <https://stats.oecd.org/>. Since 2016, almost all countries in the world mandate that MNCs with sales of more than EUR 750 million produce reports detailing the location of their international operations, including the number and activity of legal entities, revenues, pretax income, taxes paid, and employees and assets in each country in which they operate. These rules were implemented to make companies' international tax planning strategies more transparent. De Simone and Olbert (2022b) and Joshi (2020) discuss the CbC Reporting regime in detail. The OECD collects these reports from tax authorities around the world and aggregates the data at the country-pair level for each reporting year, where a country pair is an MNC's home jurisdiction (where the company is incorporated) and a given reporting jurisdiction (all countries where a company has operations through at least one legal entity). We aggregate these data by reporting jurisdiction. This procedure allows us to observe the total amount of, for example, revenues, pretax income, and taxes paid of all globally operating companies reported in a given country and the number of legal entities of these companies in a given country.

this country's total household consumption. This measure aims to capture the misalignment between a country's size of its consumer market (i.e., where profits will be taxed under the reform) and tax bases of global companies allocated to a country under the current rules. Thus, this measure comprehensively captures the overarching goal of the global tax reform, namely, to align corporate profit taxation with the location of real activities and combat the artificial allocation of tax bases to tax-favorable countries. To showcase the misalignment for specific countries, we illustrate selected values of this proxy in Figure 7. Countries typically labelled as tax havens exhibit values far above one. For instance, in the financial centers and alleged tax havens Luxembourg and Singapore, global companies report that they generate external sales that exceed these countries' domestic household consumption by approximately 350%. In Ireland, a famous host country for global technology companies' intellectual property, and the Bahamas, a so-called dot haven without much of a real economy, global companies' reported revenues exceed domestic household consumption by approximately 200%-250%. In European countries with relatively large economies, like the United Kingdom and Germany, the ratio of global companies' reported revenues to household consumption is approximately 50%. In the emerging markets of India and China, which have very large consumer markets, the ratios are below 50%. For countries other than the United States, the *MNC revenues to market size* measure is conceptually aligned with the company-level exposure measure *Foreign earnings ratio*, because the latter proxies for companies having relatively large tax bases in countries *outside* the United States and the former captures the aggregate tax bases of MNCs reported in a given country.

Our second country-level exposure variable extends our main measure by accounting for the extent to which a country's corporate tax rate is below the proposed minimum rate of 15%. Specifically, we define *MNC revenues to market size (minimum tax-weighted)*_k as *MNC revenues to market size*, our first measure, multiplied by the tax rate differential between a country's 2020 statutory corporate income tax rate and the proposed minimum tax rate of 15%. In line with our approach for the company-level measure *Foreign tax differential to minimum tax*, a country's tax differential is based on a max operator and thus equal to zero for a country with a tax rate of 15% and above. Table A.2 in the Internet Appendix lists the distribution of tax rates across sample countries. This second exposure measure effectively weights a potential misalignment between MNCs' reported tax bases and the domestic economy's size by a country's tax rate distance to the 15% minimum tax rate. We follow this approach because the effect of the reform crucially depends on how much of the tax bases MNCs currently allocate to

Figure 7
MNC Revenues to Market Size: Selected countries



This figure plots the relationship between MNCs' revenues reported in a given country and the country's consumer market size of selected sample countries. The y-axis shows a country's value of our variable of interest, *MNC revenues to market size*. The x-axis shows a country's market size (the denominator in our variable of interest *MNC revenues to market size*). MNC revenues is the sum of revenues reported by MNCs in the CbC files. Consumer market size is defined as household consumption in billions (purchasing power parity-adjusted in current national currency per USD).

a given country they will likely not allocate to it after the reform (Johannesen 2022; Keen and Hebous 2021). Our measure accounts for this feature, as it relates a country's attraction of MNCs' tax bases to the country's tax rate policy and thus captures countries' specific exposure to the effect of the new global minimum tax rate.

Our third country-level exposure variable is *MNC taxable income margin_k*, which we define as the sum of all MNCs' pretax earnings reported in the CbC files for a given country *k* scaled by all global companies' external revenues reported in the same CbC files. This measure aims to capture the aggregate effects of companies' profit shifting in the spirit of Tørsløv, Wier, and Zucman (2022). The intuition is that companies have a greater incentive to allocate pretax income to a given country in which it reports revenues if this country offers a preferential tax regime under the current system. Thus a disproportionately high pretax income to revenues figure is another proxy for a country's exposure to the global tax reform. This measure is conceptually aligned with the company-level exposure measures *Foreign low tax benefit* and *Foreign tax differential to minimum tax* because the latter two proxy for a company's income tax-motivated profit shifting, and the former captures the consequence of MNCs reporting large income tax bases in a given country.

Table 6 provides summary statistics for these three variables. We show statistics for the full sample of countries and separately for nontax-havens and tax havens using the tax haven classifications of Bennedsen

Table 6
Summary statistics for country-level exposure variables

<i>A. MNC revenues to market size</i>								
	Count	Mean	SD	p5	p25	p50	p75	p95
Total	131	0.32	0.67	0.0002	0.014	0.06	0.23	1.31
Nontax haven	119	0.21	0.34	0.0004	0.014	0.05	0.21	0.96
Tax haven	12	1.46	1.60	0.0063	0.09	0.73	2.66	3.73
<i>B. MNC revenues to market size (minimum tax-weighted)</i>								
	Count	Mean	SD	p5	p25	p50	p75	p95
Total	120	2.04	16.71	0.00	0.00	0.00	0.00	0.61
Nontax haven	107	0.03	0.11	0.00	0.00	0.00	0.00	0.17
Tax haven	13	18.61	49.34	0.00	0.00	0.00	8.77	93.16
<i>C. MNC taxable income margin</i>								
	Count	Mean	SD	p5	p25	p50	p75	p95
Total	122	0.12	0.22	-0.11	0.05	0.10	0.16	0.35
Nontax haven	113	0.10	0.18	-0.11	0.04	0.10	0.16	0.33
Tax haven	9	0.36	0.48	0.02	0.08	0.17	0.28	1.21

Notes: This table reports summary statistics for the main country-level variables for the full sample of countries and the subsamples of nontax-havens and tax havens. panel A presents values for the reported revenues to market size ratio. panel B presents values for the reported revenues to market size ratio weighted by the tax rate differential between a country's 2020 statutory corporate income tax rate and the proposed minimum tax rate of 15%. panel C presents values for the reported taxable income margin. Variable definitions are provided in Table A.1 in the Internet Appendix.

and Zeume (2018) and De Simone and Olbert (2022b). Consistent with our measures capturing global companies' tax base allocations and a misalignment between actual market sizes and tax bases under the current system, we observe substantially higher means in all measures of the subsample of tax havens. Specifically, the reported revenues-to-market size ratio, weighted by a country's tax rate wedge relative to the minimum tax rate of 15%, is skewed toward tax havens (panel B).

In the Internet Appendix, we use three additional country-level variables for supplementary tests. Specifically, these are *MNC taxable income to market size* $_k$, *MNC taxes paid to market size* $_k$, and *MNC entities to population* $_k$. The construction of these variables follows the same intuition in that these variables capture the misalignment between companies' tax base allocations and their consumer market sizes under the current system. Tables A.1 and A.5 in the Internet Appendix provide variable definitions and summary statistics.

3.2.2 Asset prices: Sovereign debt CDS spreads. To measure investors' expected impact of the reform on countries' public finances,

we use the prices of credit derivatives that measure the credit risk of countries. Specifically, we use CDS spreads for countries' sovereign debt. Sovereign debt CDS have several advantages for our setting. First, they are frequently traded and thus allow us to observe market expectations with respect to the outcomes of an entire country in a short time window (Augustin et al. 2014; Lando 2020). Second, they are distinct from corporate CDS in that the event triggering the contingent default insurance payment is not necessarily a country's bankruptcy. Instead, insurance payments are triggered if the reference entity repudiates one or more debts or declares a moratorium relating to these debts (Augustin et al. 2014; Cruces and Trebesch 2013). For example, Greece's default in 2012 was mostly due to the majority of bond holders agreeing on a voluntary debt restructuring, rather than Greece actually being bankrupt. Therefore higher CDS spreads should capture investors' expectation of a country facing greater difficulties in fulfilling its obligations and do not necessarily only reflect whether investors think a country is actually more likely to go bankrupt (Salomao 2017).

The ability to pay debts is a key aspect of a country's public finances, and tax revenues are the key income source for a country's public finances (e.g., Eaton and Fernandez 1995). Therefore we argue that the global tax reform should affect countries' CDS if investors expect the reform to affect countries' tax revenues, either directly or in a broader sense through the allocation of MNCs' real resources (see Section 3.1 for a discussion). Thus, we interpret higher CDS spreads as a proxy for investors' more negative outlook for a country's public finances.

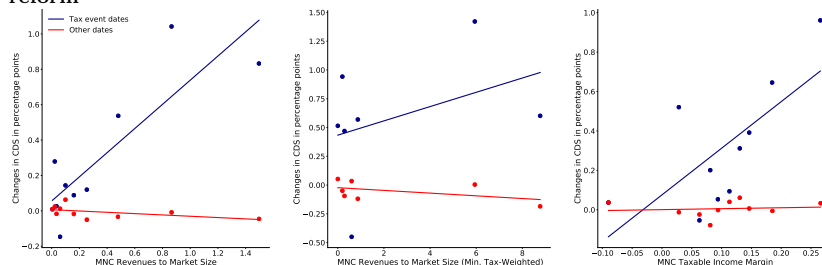
We use 5-year CDS spreads on sovereign bonds for 87 countries. The data come from IHS Markit and Bloomberg and is available at daily frequency. We download data for all trading days in 2021. Table A.6 in the Internet Appendix provides summary statistics on our CDS variable. The level of the CDS spreads vary significantly across countries. For instance, the United States, Germany, Mexico, Ireland, India, and Hong Kong had average CDS spreads of 25, 26, 121, 162, 120, and 44 basis points in our sample period, respectively. However, the daily percentage change in CDS spreads is close to zero for the average country-day observation in 2021.

3.3 Empirical strategy and results

3.3.1 Effects on daily CDS spreads. We predict that the reform will affect countries' public finances through the reallocation of global companies' tax bases. To test this, we estimate the following regression:

$$\begin{aligned} \Delta CDS_{k,d} = & a + b \cdot TaxEvent_d + c \cdot CountryExposure_k \\ & + d \cdot (CountryExposure_k \times TaxEvent_d) + \epsilon_{k,d}, \end{aligned} \quad (5)$$

Figure 8
Changes in sovereign CDS spreads and countries' exposure to the global tax reform



We first sort countries into bins based on their $CountryExposure_k$ measure. We then compute both average $CountryExposure_k$ and average CDSs' percentage changes for each of the 10 ordered bins. The blue circles represent CDS changes that occurred during tax event dates, while the red circles represent nontax event dates. The lines represent the regression fit lines. The left panel uses MNCs' reported revenues scaled by a country's market size as the sorting variable. The middle panel uses MNC revenues to market size weighted by a country's tax rate differential to the minimum tax rate. The right panel uses MNCs' reported pretax earnings scaled by revenues as the sorting variable. These variables are described in Section 3.2.1 and in Table A.1 in the Internet Appendix.

where $\Delta CDS_{k,d}$ refers to the percentage change in CDS spreads for country k on day d and $TaxEvent_d$ is a dummy variable equal to one if day d happens to be on the day of a tax event and zero otherwise. $CountryExposure_k$ denotes the exposure of country k to the tax event (i.e., $CountryExposure$ is measured either as MNC revenues to market size, MNC revenues to market size (minimum tax-weighted), or as MNC taxable income margin in the main tests). To run this regression, we use all trading days for 2021. Standard errors are clustered at the country and date levels. We predict that $d > 0$, that is, the credit risk protection becomes more expensive for countries with a higher exposure to the global tax reform.

We first illustrate our results in Figure 8. We sort countries into 10 bins based on their $CountryExposure_k$ measure. We then compute both average $CountryExposure_k$ and average CDSs' percentage changes for each of the 10 bins. The blue circles represent CDS spreads changes occurred during tax event dates, while the red circles represent nontax event dates. The lines represent the regression fit lines. The left panel shows results for the ratio of reported MNC revenues to market size, the panel in the middle for the MNC revenues to market size weighted by a country's tax rate differential to the minimum tax rate, and the right panel for the MNCs' reported taxable income margin as the exposure measure $CountryExposure_k$, respectively. Figure 8 shows that the relation between $CountryExposure_k$ and CDS spreads changes is positive on tax event days but zero on any other date across all three exposure measures.

Table 7 presents regression estimates of Equation (2). To facilitate an interpretation, we standardize the $CountryExposure_k$ measure in all regressions below. Column 1 uses our main country-level exposure measure, MNCs' aggregate reported revenues scaled by the consumer market size in country k . Consistent with our prediction, the coefficient for the interaction term $CountryExposure \times TaxEvent$ is positive (27.99) and significant (t -statistic = 2.10), indicating that countries currently attracting a relatively high volume of reported revenues from MNCs' global operations experienced an increase in sovereign bond credit risk on the tax reform event dates. In terms of economic magnitude, the coefficient \hat{d} indicates a 28 basis point higher change in CDS spreads on tax-event days if countries have a one-standard-deviation higher value in $MNC\ revenues\ to\ market\ size$. This result represents a 19% increase, relative to the CDS spreads mean in our sample. For Hong Kong, a country acting as a tax-favorable jurisdiction under the current regime and with a mean CDS spread of 44.4 basis points in 2021, this effect would constitute a 63% increase in investors' perceived credit risk. Notably, the coefficient for $CountryExposure$ alone, \hat{c} , is small and statistically insignificant, suggesting that countries with a relatively high $CountryExposure_k$ do not exhibit differential trends in CDS spreads, relative to other countries on nontax event dates.

Column 2 shows results for the second exposure measure, which weights a country's potentially disproportionate attraction of MNC tax bases by the country's tax rate distance to the 15% minimum tax rate. Again we document a significantly positive coefficient for the interaction term $CountryExposure \times TaxEvent$. The coefficient of 8.74 (t -statistic = 2.77) indicates a 9 basis point higher change in CDS spreads on tax-event days if countries have a one-standard-deviation higher value of $MNC\ revenues\ to\ market\ size\ (minimum\ tax-weighted)$. This estimate is economically meaningful, given that the variation in $MNC\ revenues\ to\ market\ size\ (minimum\ tax-weighted)$ is concentrated among countries with currently low tax rates (predominantly tax havens). Some of these countries exhibit very large values in the $MNC\ revenues\ to\ market\ size\ (minimum\ tax-weighted)$ measure as of 2020 (see Table 6). Therefore these results suggest that countries attracting a disproportionately large share of MNCs' tax bases *and* offering a tax rate below 15% under the current system experienced the most pronounced increase in sovereign bond credit risk on the tax reform event dates.

Column 3 shows results for when we use MNCs' aggregate pretax earnings scaled by revenues as our measure for $CountryExposure$. Countries in which MNCs report a higher profitability for tax purposes experience a substantial increase in their CDS spreads on tax event dates, as implied by the positive coefficient \hat{d} equal to 27.91 (t -statistic = 3.31). In terms of economic magnitude, CDS spreads change by

Table 7
Countries' CDS spread responses to the global tax reform

Country exposure	<i>MNC revenues to market size</i> (1)	<i>MNC revenues to market size (min. tw)</i> (2)	<i>MNC taxable income margin</i> (3)
<i>CountryExp.</i> × <i>TaxEvent</i>	27.99 [2.10]	8.74 [2.77]	27.91 [3.31]
<i>CountryExp.</i>	-2.36 [-0.88]	-2.68 [-1.44]	-1.14 [-1.60]
<i>TaxEvent</i>	47.80 [3.08]	47.80 [3.03]	45.67 [2.89]
Constant	4.31 [0.62]	4.31 [0.62]	5.22 [0.74]
<i>R</i> -squared (%)	0.08	0.06	0.07
Observations	19,228	19,228	20,493

The table reports the regression estimates for the following equation.

$$\Delta CDS_{k,d} = a + b \cdot TaxEvent_d + c \cdot CountryExposure_k + d \cdot (CountryExposure_k \times TaxEvent_d) + \epsilon_{k,d},$$

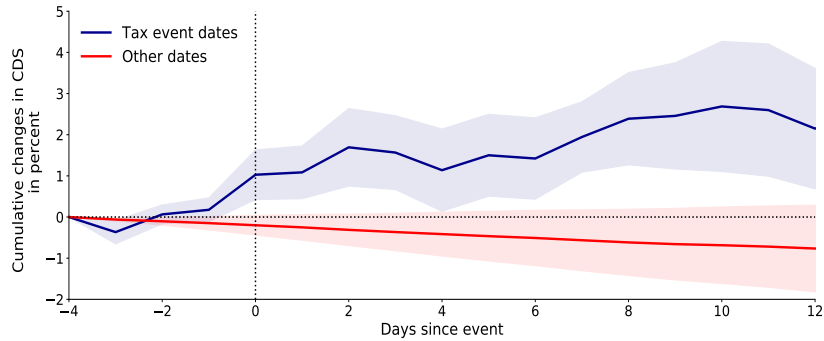
where $\Delta CDS_{k,d}$ refers to the change in CDS spreads for country k on day d (in basis points); $TaxEvent_d$ is a dummy variable equal to one if day d happens to be on the day of a tax event (shown in Figure 2) and zero otherwise; $CountryExposure_k$ denotes the standardized exposure of country k to the tax event. In column 1, $CountryExposure_k$ is the MNCs' aggregate reported revenues scaled by the consumer market size in country k (*MNC Revenues to Market Size*). In column 2, *MNC revenues to market size* is weighted by the tax rate differential between the proposed minimum tax rate of 15% and a country's 2020 statutory corporate income tax rate (*MNC revenues to market size (minimum tax weighted)*). In column 3, $CountryExposure_k$ is MNCs' aggregate pretax earnings scaled by external revenues in country k *MNC taxable income margin*. We use all trading days during 2021. Standard errors are clustered at the country and date levels. t -statistics are in brackets.

around 28 basis points more for a one-standard-deviation higher value in countries' taxable income margin. This finding further suggests that countries that attract inward profit shifting by MNCs under the current system will likely lose out from the reform.

Table C.13 in the Internet Appendix presents consistent results when using alternative measures of country exposure. Specifically, we document that countries in which MNCs currently report more taxable income and pay more taxes, relative to a country's market size, experience significantly positive changes in CDS. We also document these effects for countries in which MNCs have incorporated a disproportionately high number of legal entities, likely for tax planning purposes, relative to a country's population.

3.3.2 Persistence of effects. We then ask whether the effects on CDS persist by extending the analysis to the days surrounding the tax events. For each country, we compute the cumulative change in

Figure 9
Event-time cumulative CDS spread



This figure shows differences in cumulative CDS changes between countries highly exposed to the tax reform and those with less exposure. We first sort countries into 10 bins based on their reported taxable income margin. Countries in the first (last) decile have a low (high) exposure. The blue line represents the average difference in cumulative CDS changes from 4 days before the tax event to 12 business days afterward. The red line represents cumulative changes in CDS during any other day not overlapping with the tax event dates. The shaded areas represent the 95% error bands.

CDS from 4 days before the tax event and expand the window to 12 business days afterward. We then sort countries into 10 groups based on $CountryExposure_k$, that is, their ex ante exposure to the global tax reform. We then form a CDS spread by taking the difference in cumulative CDS changes between the countries sorted in the last decile (i.e., high values of $CountryExposure_k$) and the countries sorted in the first decile (i.e., low values of $CountryExposure_k$).

Figure 9 shows the CDS spread, where we use the reported taxable income margin as a sorting variable. The shaded areas represent the 95% error bands. After the tax event days, the CDS spread (blue line) significantly drifts upward for the next 2 to 8 days and then flattens. Consistent with our company-level results presented in Section 2, we do not observe a preannouncement drift in the days leading up to the tax event days: the CDS spread from day $t-4$ to day $t-1$ is close to zero and statistically insignificant. Finally, as represented by the red line, the CDS spread is close to zero on nontax event dates. Based on these results, we conclude that the effects of the global tax reform do persist and increase in the days following the tax reform announcement events.

3.3.3 Discussion of country-level effects. Collectively, these macro-level results show that countries that attract large tax bases and operations of global companies under the current tax regime exhibit significant increases in their sovereign CDS spreads. This evidence suggests that the information events during the negotiations of the

global tax reform changed market participants' expectations regarding the outlook for countries' public finances, proxied by the credit risk of sovereign bonds.

The results are consistent with investors expecting a decrease in governments' revenues, which could impair their ability to service their debts after the global tax reform takes effect in 2023 and beyond. These expectations can be due to investors anticipating that governments will collect less corporate income tax, relative to the current regime. Investors might also anticipate that multinationals would allocate fewer resources to these countries, resulting in less economic activity and reductions in government revenues through indirect channels, like fees, payroll and other non-corporate-income taxes, and economic growth in the professional services sectors.

We acknowledge that it is challenging to empirically benchmark the estimates from our analysis using sovereign debt CDS with tax revenue projections. The OECD estimates that investment hub countries that act as favorable tax jurisdictions but still levy corporate income taxes (e.g., Singapore, Luxembourg, or Ireland) will lose around 6% in tax revenues to due the reallocation of revenues under Pillar 1 (OECD 2020). In contrast, the effect of the global minimum tax rate (Pillar 2) is ambiguous, and projections for tax haven countries that levy tax rates of (nearly) 0% do not exist. However, to the best of our knowledge, our results provide the first macroeconomic evidence on potential effects on tax revenue reallocation and, more broadly, on the allocation of multinationals' real resources induced by a global tax reform. Specifically, our results indicate that the global tax reform will benefit emerging markets with large consumer markets and hurt countries that operate as favorable tax jurisdictions under the current regime of international company taxation.

4. Concluding Remarks

Our paper provides novel evidence on the expected impact of the global tax reform on affected U.S. companies' shareholder values and countries' public finances. In 2021, more than 140 countries agreed to overhaul the system of taxing global companies' profits by allocating tax bases to countries where final consumers reside and applying a global minimum tax rate of 15%. We exploit the reform's negotiations in 2021 and high-frequency asset pricing data to estimate the market participant's expectations of its effects. To measure companies' exposure to the reform, we combine several data sources to proxy for companies' current international tax planning strategies through foreign-sourced income, the allocation of income to low-tax countries, and the use of tax havens. To measure countries' exposure, we devise a novel approach by

combining macroeconomic data on countries' market sizes and publicly available aggregate data from global companies' tax returns, which allows us to observe companies' tax bases and resource allocations to specific countries under the current regime.

We show that companies that can minimize their global taxes under the current system exhibit significant decreases in firm value after the announcement of the global tax reform. Further, our results suggest that investors expect the reform to have significant macroeconomic effects through the reallocation of tax revenues across countries. Specifically, countries currently attracting a large portion of global companies' tax bases but having relatively small domestic economies experience increases in CDS spreads on their sovereign bonds, suggesting investors expect that their public finances to deteriorate after the reform becomes effective. In contrast, our results suggest that emerging countries with large consumer markets that currently do not have a large share of global companies' tax bases will likely benefit through higher tax revenues under the new rules.

To the best of our knowledge, our study is the first to investigate the economic effects of the recent global tax reform. We show how the reform affects firm values both in the cross-section depending on companies' characteristics and in terms of the aggregate loss in shareholder value. Furthermore, we provide the first evidence on potential corporate income tax revenue effects and MNCs' resource reallocations induced by the reform. One limitation of our study is that our company-level results only speak to the expected effects on publicly listed U.S. companies. A natural question is how investors perceive the reform's impact on non-U.S. companies, which might exhibit heterogeneous responses, given that they compete with U.S. peers and might have different tax planning strategies. We look forward to future research exploring this question. Our results have important policy implications, as regulators are working to implement rules for the reform and policy makers are considering domestic policy changes to counteract the potential impact on their tax revenues. Our results also inform future research on the real effects of companies' responses to the reform.

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