Do Domestic Climate Rulings Make Paris Treaty Commitments More Credible? Evidence from Stock Market Returns

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Abstract

The absence of legal enforcement mechanisms undermines the credibility of global climate mitigation commitments. Recently, various domestic courts have held governments accountable for their failures to reduce carbon emissions in accordance with their share of the global responsibility. Can such national litigation transform the global climate regime from "soft law" to "hard law" and make mitigation commitments more credible? This paper offers evidence by examining stock market returns in Europe (EU, EFTA, and the UK). If investors update their beliefs about the credibility of mitigation commitments following climate judgments regarding national mitigation targets, then such judgments should affect the valuation of assets most affected by mitigation policies. Consistent with this, I find that judicial decisions aligned with climate goals have modest but economically significant positive effects on firms that are primarily active in the renewable energy sector and similarly sized negative effects on the stock market returns of firms that are heavily invested in coal assets. These effects are stronger for firms located in the country where litigation takes place and for the first ruling in a country. The climate judgments have no significant effect on "green" firms or major oil and gas producers. Court judgments that reject climate claims have no significant effect on asset prices. These findings highlight both the potential and limits of climate litigation as a global governance tool.

1 Introduction

The Paris Agreement suffers from a well-known credibility problem. Governments have committed to undertake ambitious efforts to keep the global average temperature to well below 2°C above pre-industrial levels. Yet, the Agreement does not specify what governments must do to achieve this objective and it lacks legal enforcement mechanisms. Recently, domestic courts in Germany, France, the Netherlands, Ireland, and other countries have stepped in to hold governments accountable for their failure to reduce carbon emissions in accordance with their share of the global responsibility. This raises the question whether national level litigation can transform the global climate regime from "soft law" to "hard law" and thereby make government commitments to climate mitigation more credible?

Stock markets offer a setting to empirically examine the possibility that domestic court rulings increase the credibility of climate mitigation commitments. The energy transition has large theoretical effects on asset values (e.g. Colgan et al., 2021). If governments follow through on their Paris commitments, then we should expect policies that benefit the profitability of renewable firms and that hurt firms who are heavily invested in fossil fuels, especially coal, which 23 European countries have promised to phase out as part of their climate mitigation commitments. Yet, current market valuations of fossil fuel companies are inconsistent with beliefs that governments will follow through on their Paris commitments. Thus, if domestic court rulings about national mitigation targets increase investor beliefs about the credibility of these targets, then such rulings should positively affect the returns on renewable stocks and negatively affect fossil fuel stocks.

I examine this hypothesis using an event study on stock market returns on major European firms in the renewables sector, other "green" firms from the Clean200 list, and coal and oil/gas firms listed on the Carbon Underground 200 from 2015-2021. I examine the effects of rulings that are about national mitigation targets rather than litigation that could directly affect the profitability of firms, for example because firms are involved as (indirect) parties.

On average, a positive ruling has a modest but statistically significant effect on renewables and a negative effect on coal. Both effects are similarly sized: a climate judgment on average increases/decreases cumulative returns by a little more than .5 percentage points for renewables/coal intensive firms. This effect is larger for firms that are in the judgment's home country, although the effect on coal intensive firms is based on a small sample. Most of this effect is due to the first ruling in a country rather than subsequent appeals. Positive rulings do not, however, have a negative effect on oil and gas stocks nor do they affect "green" firms that are not primarily active in renewable energy. Moreover, court judgments that reject a claim do not move markets, which suggests that, at least in this period, investors

expect courts to remain on the sidelines. Thus, overall, the evidence is consistent with a view that investors modestly update their priors over stronger mitigation policies following the first pro-climate judgment in a country. These updated beliefs are primarily about the profitability of firms that produce renewables and that are heavily invested in coal.

The next section offers background on domestic litigation in Europe that seeks to hold governments accountable for their global mitigation targets. The next section offers a simple theory that relies on three propositions that are individually well established but rarely connected: that climate mitigation commitments face a credibility problem, that courts can enhance the credibility of government commitments, and that events that shift beliefs over mitigation commitments affect market valuations of climate sensitive assets. A news analysis then shows that pro-climate rulings attract considerable international attention and that these rulings are described in ways that suggests that updating of beliefs about likely policy changes is at least plausible. The remainder of the paper introduce data and methods and interpret the findings.

2 Litigation Holding Governments Accountable for Mitigation Targets

The number of lawsuits that raised issues of law or fact regarding climate change increased sharply after 2015[1] This paper focuses on a small but important subset: cases brought against national governments seeking to enforce or enhance global mitigation commitments. The Grantham Research Institute on Climate Change and the Environment (LSE) and the Sabin Center for Climate Change Law (Columbia University) maintain a database of all known global climate litigation cases and their judgments.[2] Table 1 lists all judgments that challenge national mitigation plans against national governments in the EU, EFTA, and the UK. This group of countries represent a highly integrated market, commonalities in energy policies (especially in the EU), and many shared legal obligations. Yet, these countries also differ in their legal systems, including the role courts play in reviewing government policy and the extent to which international law is embedded in domestic legal systems (Verdier and Versteeg, 2015). Moreover, energy policy continues to have important national dimensions.

The list only includes cases that have at least one judgment before January 31st 2021, including admissibility decisions that provide material information about a case's outcome.[3]

[1]For reviews, see: (Eskander, Fankhauser, and Setzer 2021; Setzer and Vanhala 2019; Peel and Osofsky 2020; Setzer and Higham 2021).

[2]Climate Change Laws of the World database, Grantham Research Institute on Climate Change and the Environment and Sabin Center for Climate Change Law. Available at climate-laws.org

[3]For example, I exclude decisions in Client Earth v Poland that appear to be mostly about which court

Admissibility is often a key hurdle in climate litigation. Plaintiffs often face challenges demonstrating that they have suffered or are likely to suffer damages from climate change and that a particular country's emissions contribute materially to that harm.

The table excludes at least two important sets of cases that likely influence asset prices but that are less informative about the perceived credibility of government commitments. First, there are a growing number of cases against private companies. Most notably, in *Mileudefensie v. Shell* a Dutch court held that Royal Dutch Shell should "reduce its emissions in line with the objective of the Paris Agreement."[4] Most analysts would expect that this type of litigation should negatively affect Shell's market valuation, although it is less clear if it also affects the valuation of fossil fuel companies that may share litigation risk. News reports suggest that the ruling influenced Shell's decision to move its headquarters from the Netherlands and to sell 10 billion dollars' worth of fossil fuel holdings.[5] This is anecdotal evidence for a court effect on Shell but not on the credibility of climate mitigation.

Second, lawsuits against governments over permits or specific policies often directly affect corporations as third parties. NGOs often sue governments for ignoring the climate implications of authorizations for fossil fuel exploration,[6] airport expansions,[7] and corporate bailouts.[8] The outcomes of this litigation directly affect the profitability of specific firms and thus should affect their stock market valuations. Yet, the interest in this paper is not about direct effects on corporations but indirect effects through updating of priors that national governments have to uphold their mitigation commitments. It is possible that these lawsuits do have a cumulative effect on mitigation policies, for instance if governments come to anticipate that they must take the climate implications of policy choices more seriously. Yet, this paper focuses on direct attempts to hold national[9] governments accountable for their mitigation commitments.

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has jurisdiction.

[4]https://uitspraken.rechtspraak.nl/inziendocument?id=ECLI:NL:RBDHA:2021:5339

[5]Royal Dutch Shell Sells Permian Basin Oil Holdings for $9.5 Billion, The New York Times, September 21, 2021.

[6]E.g. Greenpeace Norway v. Government of Norway regarding arctic oil.

[7]E.g. Plan B v Secretary of State for Transport regarding Heathrow.

[8]E.g. GreenPeace Netherlands v. State of the Netherlands regarding KLM bailout

[9]I also set aside litigation against subnational governments. Again, this litigation can be important but subnational governments are not signatories of the Paris Agreement.

Table 1: Judgments on national mitigation targets

Case	**Date**	**Court**	**Plaintiff Win**[10]
Urgenda v The Netherlands	6/24/2015	Hague district court	Yes
	10/9/2018	Hague Court of Appeal	Yes
	12/20/2019	Supreme Court	Yes
Friends of the Irish Environment v Ireland	9/19/2019	High Court	No
	7/31/2020	Supreme Court	Yes
Family Farmers and Greenpeace v. Germany	10/31/2019	Administrative Court of Berlin	No
Neubauer et al. v. Germany	4/29/2021	Federal Constitutional Court	Yes
group of parliamentarians v. France	8/13/2021	Constitutional Council	No
Notre Affaire à Tous and Others v. France	2/3/2021	Administrative Court Paris	Yes
	10/14/2021	Administrative Court Paris	Yes
Commune de Grande-Synthe v. France	11/19/2020	Constitutional Council	Yes
	7/1/2021	Constitutional Council	Yes
Klimaatzaak v. Belgium	6/17/2021	Brussels Court of First instance	Yes
Plan B Earth and Others v. Prime Minister (UK)	12/21/2021	High Court	No
Plan B Earth and Others v. The Secretary of State for Business, Energy, and Industrial Strategy (UK)	07/20/2018	High Court	No
	01/25/2019	Court of Appeal	No
Greenpeace v. Spain	06/14/2021	Supreme Court	Y (admissibility)
	09/15/2021	Supreme Court	Y (admissibility)
Greenpeace v. Spain 2	07/21/2021	Supreme Court	Y (admissibility)
Association of Swiss Senior Women for Climate Protection v Switzerland	11/27/2018	Federal Administrative Court	No
	5/20/2020	Supreme Court	No

The landmark case that inspired much subsequent litigation is *Urgenda v The Netherlands.*[11] In 2015, the Hague District Court ruled that the government's existing mitigation pledges were insufficient to meet UN goals to keep global temperature increases to within two degrees Celsius. The Court ordered the government to limit GHG emissions to 25% below 1990 levels by 2020. The initial ruling was based on international commitments and on the government's duty of care to its own citizens under the Dutch constitution. In 2018, the Court of Appeal not only upheld the decision but also granted Urgenda's appeal that failing to enact stronger mitigation policies violates government obligations under Articles 2 (right to life) and 8 (right to private and family life) of the European Convention on Human Rights (ECHR). This has legal relevance beyond the Netherlands because all European governments have both implemented the ECHR into national law and have ratified the Paris Agreement. In 2019, the Supreme Court upheld both the verdict and the legal reasoning.

Neubauer et al v Germany is another major human rights based case. The plaintiffs allege that the Federal Climate Protection Act sets an insufficiently ambitious target to meet global climate goals.[12] The judgment references the Paris Agreement 38 times and explicitly recognizes the commitment problem that motivates this paper:

> "It is precisely because the state is dependent on international cooperation in order to effectively carry out its obligation to take climate action under Art. 20a GG that it must avoid creating incentives for other states to undermine this cooperation. Its own activities should serve to strengthen international confidence in the fact that climate action – particularly the pursuit of treaty-based climate targets – can be successful. [..] The Paris Agreement very much relies on mutual trust as a precondition for effectiveness. [..] the Parties agreed on a climate target (well below 2°C and preferably 1.5°C) without committing themselves to any specific reduction measures. In this respect, the Paris Agreement establishes a voluntary mechanism by which the Parties determine their own measures for reaching the agreed temperature target. These measures must, however, be made transparent. The purpose of the transparency provisions is to ensure that all states are able to trust that other states will act in conformity with the target ([...]).This is significant from the constitutional law perspective to the extent that the route signposted by Art. 20a GG towards globally effective climate action is largely directed through this Agreement."[13]

[12]https://www.bundesverfassungsgericht.de/SharedDocs/Pressemitteilungen/EN/2021/bvg21-031.html (April 29, 2021).

[13]http://climatecasechart.com/wp-content/uploads/sites/16/non-us-case-documents/2021/20210324_11817_order-1.pdf. paragraph 203 (official English translation).

The Constitutional Court holds that the government has a constitutional obligation to fight climate change and that the only way to effectively do so is through international cooperation. Since the national law explicitly implements the Paris targets, the government is not free to design a policy that is inconsistent with those targets. Unlike the *Urgenda* judgment, the *Neubauer* judgment is based on the undue burdens that would fall upon future generations to cut emissions if the government does not act more quickly: "one generation must not be allowed to consume large portions of the CO2 budget while bearing a relatively minor share of the reduction effort, if this would involve leaving subsequent generations with a drastic reduction burden and expose their lives to serious losses of freedom."[14] The new German government, which for the first time included the Green Party, responded quickly and adopted a more ambitious climate plan.

Not all litigation in all countries has resulted in rulings that are consistent with climate goals or that specify specific mitigation targets. An Irish court initially rejected a claim by Friends of the Irish Environment that the government's mitigation plan violated Ireland's mitigation and human rights obligations, although the Supreme Court later partially reversed that decision. Like in the Irish case, the Belgian *Klimaatzaak* judgment granted only partial victory to the plaintiff in that the court invalidated existing policies without setting specific new binding targets. In France, an administrative court ordered the State to take immediate and concrete actions to comply with its mitigation commitments but fell short in requiring specific commitments or in demanding financial compensation for delaying action.[15] In a case filed by a local community threatened by climate change (*Commune de Grande-Synthe*), the Constitutional Council similarly ruled that France's mitigation efforts were inadequate but the Court did not specify what the government should do. In the UK and Switzerland, courts have ruled that plaintiffs lack standing.

3 Domestic Court Enforcement of Climate Mitigation Commitments

A recent review concludes that the literature on climate litigation "has not yet engaged deeply with questions about the effectiveness of climate litigation as a governance tool."[16] The absence of a robust social science literature on climate litigation is understandable. This is a rapidly evolving area of law and it is impossible to evaluate the causal impact

[14]Ibid.

[15]This is Notre Affaire à Tous and Others v. France. In France, administrative courts can adjudicate whether the government owes civil damages to plaintiffs.

[16](Peel and Osofsky 2020)

of these judgments on policies and emission reductions. What we can examine is whether court judgments have affected the beliefs of consumers, voters, investors, and other relevant actors. Influencing beliefs is exceptionally important. The efficacy of climate commitments depends on whether investors, consumers, and voters believe these promises.

The theory that domestic climate rulings affect asset valuations relies on three propositions that are individually well established but rarely connected. First, climate mitigation commitments face a credibility problem. Second, courts can enhance the credibility of government commitments. Third, events that result in an increased credibility of mitigation commitments affect market valuations of climate sensitive assets.

Both government commitments to the Paris Agreement and their more specific NDC commitments face credibility problems. There is no shortage of reasons why governments have incentives to renege. Democracies typically have difficulties committing to policies for the long term (Jacobs, 2016). Many mitigation policies generate short-term costs in exchange for uncertain long-term benefits that are conditional on other governments also implementing costly policies. Governments may defect from their mitigation commitments due to fears of free-riding, capture by special interests, shifts in public opinion, distributive conflicts, and/or changes in preferences over intertemporal trade-offs (e.g. Barrett, 2007 Aklin and Mildenberger, 2020).

Whether and why governments will actually renege is an empirical question. There are strong pro-compliance domestic and international forces. Yet, doubts about the credibility of mitigation targets influences firms and investors. If market actors lack confidence that governments will follow through on their mitigation commitments, then they will underinvest in carbon reducing technology, overinvest in carbon-intensive assets, and assume a business-as-usual approach until they see evidence to the contrary (e.g. Brunner et al., 2012). These credibility issues are widely recognized. The report of the high level commission on carbon prices highlights that: "The efficiency of carbon-price signals in changing behaviors and driving investments depends on the long-term credibility and predictability of those signals" (Stiglitz et al., 2017, 22).

Consistent with the credibility gap, stock markets do not value climate sensitive assets 'as-if' governments are committed to Paris Agreement goals. For example, a recent study estimates that about 60 per cent of oil and gas and 90 per cent of coal must remain unextracted by 2050 to meet Paris Agreement goals (Welsby et al., 2021). The risk of such stranded assets is barely priced into the valuation of firms whose primary assets are coal, oil, or gas reserves (Shimbar, 2021).

Climate mitigation policies include market-based and non-market based policies that differentially affect the profitability of firms. Market-based mechanisms set carbon prices

through taxes or cap-and-trade schemes. Such policies should incentivize firms to invest in less carbon intensive means of production and favor renewable energy. However, in practice, industries often pressure governments to set prices so low that evidence for their effects on emissions is inconsistent at best Green, 2021). The IMF estimates that governments would have to raise fossil fuel prices by about $4.3 trillion a year in order to meet Paris climate goals (Parry et al., 2021). Non-market-based mechanisms include regulation, subsidies for renewable energy, and investments in technology development. For example, regulation to reduce methane emissions during fossil fuel extraction (and transport) could increase cost for some firms and make alternative energy sources more attractive. Thus, in theory, any news that makes such mitigation policies more or less likely could influence the market valuation of carbon intensive industries and renewable energy firms.

Several studies have investigated whether asset prices are responsive to new information about likely mitigation policies, yielding mixed findings (for a review, see Venturini, 2022). For example, one study found that after the Paris Agreement, the systemic risk for low-carbon indices decreases while the weight of low carbon indices in portfolios increases but there is only a mild reaction for most carbon-intensive indices (Monasterolo and De Luca, 2020). The unexpected success of the first Global Climate Strike on March 15, 2019 caused a decrease in stock prices of carbon intensive firms in Europe (Ramelli et al., 2021). Announcements about the outcome of global climate negotiations had modest effects on just the stock prices of green firms until the Paris Agreement but have also affected brown (carbon intensive) firms since (Schuetze et al., 2020). Announcements related to the Paris Agreement negatively affected polluting industries in the German stock market (Pham et al. 2019). Negative news may also matter. The 2016 election of President Trump and the subsequent U.S. withdrawal from the Paris Agreement appears to have benefited the stock market returns of carbon intensive firms (the 2020 election had the reverse effects) (Alessi et al., 2021; Ramelli et al., 2021).

This literature has not yet considered litigation over mitigation targets as a source of belief updating. The theoretical idea that independent courts can lock-in government policies is foundational in the study of both domestic and international courts in democratic politics (e.g. North and Weingast, 1989 Moravcsik, 2000). Scholars have also long recognized the centrality of domestic courts in implementing international human rights treaties (e.g. Simmons, 2009) and international legal obligations more generally (Verdier and Versteeg, 2015). Thus, although the role of domestic courts in enforcing global mitigation targets is relatively new, the role of domestic courts in enforcing international legal commitments is reasonably well understood.

It is not obvious that domestic courts will be a strong pro-compliance force on climate

issues. Climate litigation is a two-way street (Peel and Osofsky, 2020 Savaresi and Setzer, 2021). Energy markets, especially in natural gas and coal, often operate with long-term contracts due to large-scale up front investments. Policies that affect the value of such contracts are subject to litigation. Property rights are strongly protected in international human rights and investment law as well as in many constitutions. People and communities regularly challenge large scale wind or solar farms based on procedural issues, indigenous rights, or other legal claims (Savaresi and Setzer, 2021). Courts may hold the government accountable for mitigation promises but they can also limit policy options and protect firms from the negative consequences of such policies. For example, the German (coal) utility giant RWE filed an investment arbitration disputed based on the Energy Charter following the Dutch government's decision to phase out coal, which was partially to implement the Urgenda ruling (Setzer and Higham, 2021).

This paper is not about whether (or which) courts are likely to come down with strong pro-climate judgments. Instead, the question is whether mitigation targets become more credible following such a ruling. In liberal democracies with strong independent courts we typically expect governments to implement court judgments. Yet, there may still be some doubts about the effectiveness of these rulings. Courts may well be reluctant to overstep their authority and order relatively vague remedies. For example, in the *Klimaatzaak* case the Belgian Court of First Instance found that the government's unambitious mitigation policies had breached its duty of care but it also left specific targets to legislative and executive bodies. Even if courts adopt specific targets, as in Urgenda, GHG emissions fluctuate based on numerous non-policy related factors, such as economic cycles. Holding governments accountable for meeting these targets likely requires subsequent costly and slow legal proceedings.

Moreover, not all climate rulings should be expected to have the same effect. First, some judgments could update investor beliefs about mitigation policies more than others. The aforementioned positive rulings were largely surprises. This was most obviously true of the first *Urgenda* judgment. Yet, even Luisa Neubauer, the plaintiff in the 2021 German case, called the ruling "so, so unexpected."[17] It would not seem unreasonable to think that most investors would expect courts to stay relatively deferential to governments. If this is so, then we should expect stronger updating following positive climate rulings than negative ones, at least initially. Moreover, the strongest updating should take place following the first ruling in a country as investors may expect that appeals courts tend to uphold prior rulings.

Second, not all firms should be equally affected by court rulings. The effect of mitigation policies on renewable energy producers is the most straightforward, as these firms are direct

[17]https://www.cnn.com/2021/05/09/europe/climate-lawsuits-governments-intl-cmd/index.html

beneficiaries of subsidies and indirect beneficiaries of carbon pricing. The effect on brown firms is more complicated. Strong mitigation policies may most clearly affect European firms that are heavily invested in coal. Burning coal leads to the largest GHG emissions. As a result, most European governments are committed to phasing out coal. By contrast, natural gas is widely seen as a key transitory fossil fuel and has received a "green" designation by the EU for at least the coming decade. European governments do have plans to reduce the extraction of of and dependence on oil. Yet, oil companies operate in a global market. Court rulings could lead to greater shares of fossil fuel assets controlled by private firms or firms headquartered in countries with looser domestic regimes (as illustrated by the Shell examples mentioned earlier).

A third question concerns geographic bounds. The EFTA and EU countries are a relatively highly integrated markets. Yet, it may still be that investors expect firms headquartered in the country of litigation to benefit more from an increased commitment. Not all firms (can) operate in all countries. Yet, court rulings could alter beliefs not just about mitigation policies in a specific country but they may also raise expectations that other courts will follow suit. Thus, whether these litigation outcomes affect asset prices in just home country firms or also other European firms is an empirical question worth testing.

4 News about Climate and Climate Litigation

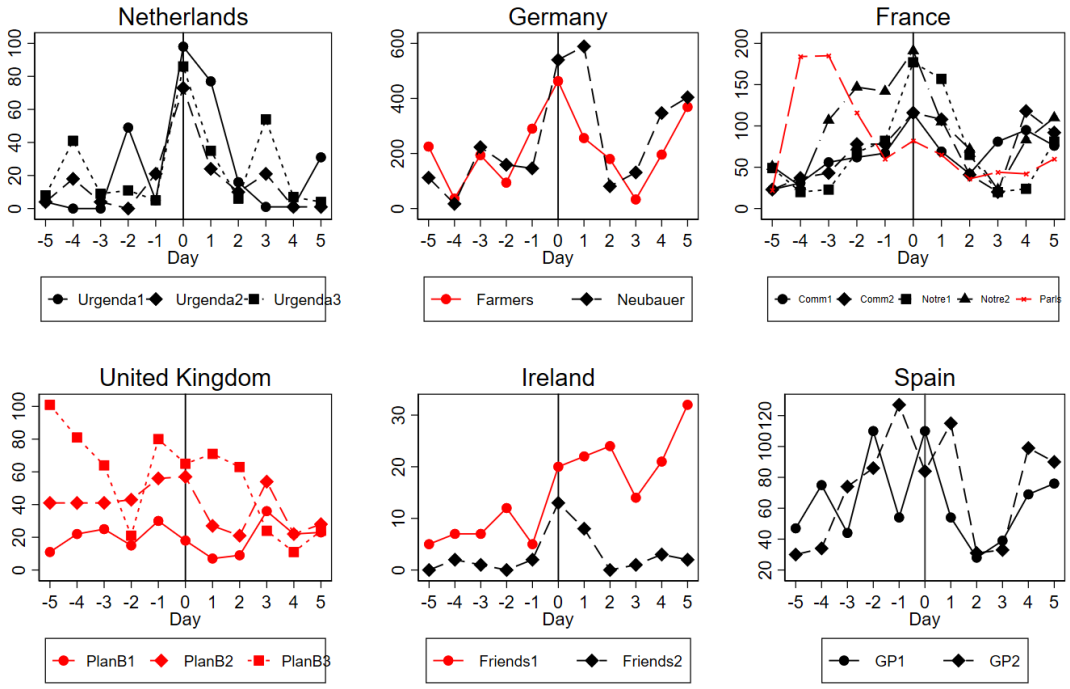
A news analysis serves as a preliminary assessment of the theory's plausibility. The theory suggests that court judgments can update investor beliefs on whether governments will strengthen their mitigation commitments. This is only plausible if litigation outcomes provide new evidence on the day of their announcements. If investors anticipate a ruling's direction with great certainty, then they should have already priced in the ruling before the public announcement. Moreover, if court judgments are sufficiently significant events to move stock market prices, then they should get a fair bit of attention. Finally, a news analysis can help reveal if other relevant events could be responsible for moving markets on any given day.

Figure 1 plots daily counts of Factiva news stories about climate change concerning the country of the ruling five days before and after each judgment.[18] This search helps establish whether the ruling increases reporting on climate change and whether there were other simultaneous stories about climate change that could differentially affect the relative valuation of renewable and fossil fuel stocks. A supplemental search looks for mentions of

[18]Based on Factiva's subject category for climate change.

the judgment. However, this search is less reliable as news stories differ in how they report on judgments. I also read news stories about judgments in major news sources widely read by investors, such as the *Financial Times*, for indications of whether the judgment could be seen as a surprising event.

Figure 1: Factiva News Stories about Climate Change in Days Before and After Climate Judgments



Note:Red lines are plaintiff losses

As expected, the canonical Urgenda rulings received considerable attention on the day of each ruling (day 0) and the day thereafter. There were about ten times as many climate change stories about the Netherlands on Urgenda day rulings compared to other days in the same year. This attention was international. On the day of the 2015 ruling, Dutch was only the fourth common language of a Factiva news story (after English, Spanish, and French, equal with German). Many news stories use adjectives like "historic" or "landmark" to describe the ruling and mention that it opens the door to similar lawsuits in other countries.[19] The appeals rulings in 2018 and 2019 also attracted international attention but the news stories did not express the same sense of a seismic shift.

[19]For example: "Hague court orders cut in Dutch emissions" By Duncan Robinson and Pilita Clark in Financial Times. 25 June 2015.

European news sources also reported extensively on the *Neubauer* judgment, again using terms like "groundbreaking" and "historic" to describe its potential impact.[20] There are also upticks in news stories about climate change on the days of pro-climate rulings in France, with English language stories outnumbering French ones. For example, *The New York Times* labels the first *Notre Affaire à Tous* ruling "pivotal."[21] There was less attention for the follow-up judgments. The *Friends of the Irish Environment* judgment mostly drew attention in Ireland and the United Kingdom where it was considered a major event. As the *Irish Times* put it: "Those within the Government pressing for legally binding specifics to be included in a new statutory plan, can now argue that further international embarrassment, and the Four Courts, await any failure to adequately do so."[22]

There are a handful of news reports that anticipate a ruling's timing but none that made any prediction regarding the outcome of a case. The 2019 *Family Farmers and Greenpeace v Germany* judgment is the only negative ruling to attract considerable media attention, although mostly in Germany. The *Associated Press* and *Agence France Press* picked up the story but few newspapers outside of Germany did so. The red lines in figure 1 show that other negative rulings do not result in major increases in reporting about climate; suggesting that these are not (yet) seen as major events by journalists. There was some domestic reporting on the *Plan B* judgments in the UK and very few stories on the Swiss rulings. The negative judgment on the first *Friends of the Irish Environment* ruling coincides with reporting about the upcoming 2019 UN Climate summit, which is responsible for the temporary increase in news reports about climate.

The main conclusion from the (preliminary) media analysis is that the pro-climate rulings on the merits attract considerable international attention and that these rulings are described with adjectives that suggests that updating of beliefs about likely policy changes is at least plausible. The evidence is consistent with a view that negative rulings were not seen as major news events, at least by the media.

[20]For example: "Constitutional court strikes down German climate law" 29 April 2021, Guy Chazan in the Financial Times.

[21]"Pivotal Ruling On Emissions Faults France Over Damage" Constant Méheut, 4 February 2021, The New York Times

[22]"Ruling a cause for international embarrassment" Colm Keena, 1 August 2020, The Irish Times

5 Data and Method

5.1 Data on Firms and Stock Prices

A first important data issue concerns the selection of firms. The Carbon Underground 200 is a list of the top 100 coal and top 100 oil and gas companies worldwide, ranked by the carbon emissions content of their reported reserves. I select all firms that are headquartered in Europe (meaning EFTA/EU/UK) or firms listed on a European stock exchange. For example, Gazprom and Tata Steel are not incorporated in EFTA countries but they do have considerable economic activity there and are thus listed on the London/Frankfurt stock exchange. This yields 19 Oil and Gas firms, and 14 Coal firms; reflecting that this region is not a global center of activity for the fossil fuel industry. A future version will check the robustness of the findings using the Global Coal Exit List produced by the German NGO Urgewald.

The list of green companies comes from the *Clean200*, which is intended as the clean energy inverse of the Carbon Underground 200 Heaps, 2018. It includes firms with a market capitalization of at least 1 billion and a minimum of 10% in green revenue. Some of the major renewable energy firms like Nordex and Vestas are also included on the Green list, but the Green list includes many firms that are not primarily about renewable energy, like Philips and Akzo/Nobel. Excluding the firms whose main business purpose is renewable energy, this yields 60 firms, reflecting that Europe is a hotbed for "green" firms. Both the *Clean 200* and the *Carbon Underground 200* lists are widely used in event studies (e.g. Dordi and Weber, 2019 Schuetze et al., 2020.

There is no similarly widely used list of firms that specialize in the production and deployment of renewable energy. I searched the S&P business description of all European incorporated firms with a market valuation over 1 billion dollars for terms related to solar, wind, and biofuels. I only included firms whose main business activity is renewable energy firms, thus excluding many energy firms who produce some solar or wind energy as part of their activities. I also consulted the WilderHill New Energy Global Innovation Index, which was established in 2006. This is an index comprised of companies who focus on generation and use of cleaner energy, conservation, efficiency and advancing renewable energy. This yielded a total of 43 European renewable energy firms. The appendix lists all firms included in the analysis.

Second, I downloaded daily stock prices from Compustat, Capital IQ global from January 1, 2015 until December 31 2021. The core dependent variable in this study $R_{it}$is the return (percentage increase) of daily close price of stock i on day t adjusted for stock splits (AJEXDI) and the current total return factor (TRFD), which help adjust daily stock prices dividends,

and cash equivalent distributions.

Table 2 provides the summary statistics. The average daily returns for renewable firms is higher (.08 percentage points) than for green (.06), oil (.05) and especially coal firms (02). This reflects well known overall trends that renewable stocks have outperformed fossil fuel stocks during this period. The analysis asks to what extent days where plaintiffs win litigation challenging national mitigation targets offer unusually high returns for renewables stocks, thus contributing to the overall market adjustments. The summary stats also show that the fossil fuel firms in this analysis are on average larger and attract a higher daily trading volume. The analysis will assess the robustness of the results for only including the largest renewable firms.

Table 2: Summary table

	Renewables mean	Green mean	Oil/Gas mean	Coal mean
Daily Returns	0.08	0.06	0.05	0.02
Market Value	1.3e+10	6.9e+10	7.2e+11	1.6e+12
Daily Trading Volume	9.4e+05	2.0e+06	4.9e+06	2.8e+07
Frankfurt	0.18	0.24	0.05	0.07
London	0.11	0.10	0.53	0.57
Paris	0.05	0.21	0.05	0.00
Amsterdam	0.08	0.13	0.05	0.00

There are also notable geographical differences. The fossil fuel firms are more likely to be traded on the London Stocj Exchange whereas renewable energy and Green firms are more likely registered on the Frankfurt Stock Exchange. This is especially important to keep in mind when evaluating whether home country firms are more affected by court judgments.

5.2 Event Studies Method

Event studies are well-established in the finance literature, including studies that examine the effects of corporate litigation outcomes on market valuations Bhagat and Romano, 2002. The typical approach is to compare the actual returns (daily percentage increase) of a firm during the event window to the expected returns. The abnormal returns can then be ascribed to the event and statistical inference can reveal how unusual these abnormal returns are.

The simplest event studies examine the influence of one event, such as an adverse litigation outcome, on the market valuation of one firm.

This paper asks a more complicated question about the effect of a series of events (court judgments) on the stock prices of a portfolio of firms (renewables, green, oil and gas firms, and coal). I use the following basic estimating equation, where $R_{it}$is the return (percentage increase) of stock i on day t.:

$$R_{it} = \alpha_i + \beta 1_i RM_t + \beta 2_i SMB_t + \beta 3_i HML_t + \beta 4_i BRENT_t + \partial 1 Win_t + \partial 2 Loss_t + \varepsilon_{it} (1)$$

The first part of the equation estimates expected returns. α_i is the average daily rate of return for a stock. In robustness checks, this average return is allowed to vary by year. The simplest model for expected returns is the capital asset pricing model, which estimates expected returns based overall market returns. The Fama-French 3-factor model more adequately estimates expected returns (Fama and French, 1993). This model expands on the capital asset pricing model by accounting for the excess risk that value and small-cap stocks face as a result of their higher cost of capital and greater business risk. Although the data include mostly large firms, I do estimate the model with (and without) these extra factors. The Fama/French European 3 Factors [Daily] come from Kenneth French website.[23] RM_t is the market rate of return, SMB_t is the size premium (small vs big), HML_t is the value premium (high minus low).

The equation takes into account that energy stock prices may be influenced by fluctuations in crude oil prices. Event studies do not always include these prices because the events that influence the valuations of oil companies may also shape price fluctuations. This could suppress the estimation of event effects. Litigation is unlikely to have this type of effect so I estimate the model both with and without crude oil prices. European crude oil prices come from the St Louis Federal Reserve.[24]

The β parameters are estimated separately for each stock, allowing each stock to have a different responsiveness to market and oil price fluctuations. Thus for each stock the model estimates five parameters to establish expected returns: the average return (α), the stock return's responsiveness to the market, the size premium, the value premium, and crude oil prices. The standard errors ε_{it} are clustered on stocks (firms).

The ∂ parameters are the coefficients of interest. Win_t equals 1 on the day of a court ruling in favor of a plaintiff and the day after. Two days seems about the length of the media attention in the previous section.[25] The expectation is that $\partial 1$ is positive for renewable

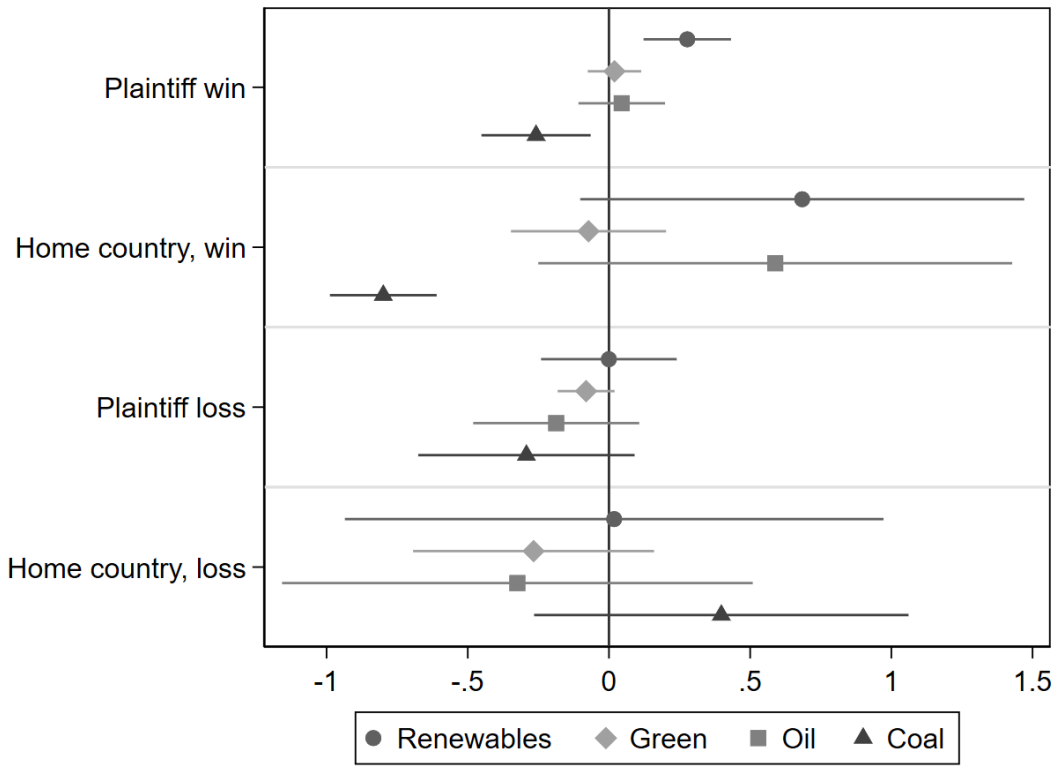
[23]http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#International
[24]https://fred.stlouisfed.org/series/DCOILBRENTEU
[25]I did experiment with longer event windows.

stocks and $\partial 2$ for fossil fuel stocks. In addition, I also estimate separate ∂ parameters for companies that are headquartered in the country in which the litigation takes place.

6 Regression Findings

Figure 2 shows the findings from a model that aggregates all positive judgments and negative judgments. Moreover, the model includes an additional parameter for when a ruling occurs in the country where the firm is incorporated. An alternative model that defines a home country as any country where the company is listed on the stock market has very similar estimates.

Figure 2: Average Effect of Climate Litigation Outcomes on Stock Market Returns of European Renewable, Green, Oil/Gas, and Coal Firms



The figure only shows the event coefficients, thus eliminating the many coefficients that help estimate expected returns. A plaintiff win has a significant positive effect on the returns of renewables. The average effect is .27 percentage points, which is considerable given that the average daily returns are .08 percentage points. Over the two day event window, a positive ruling thus contributes to a liitle more than half a percentage point unusual returns

for renewables. There is an additional positive effects on renewable firms with headquarters in the country where the litigation took place. The effect is very large (.69) but imprecisely estimated (although significant at the 10 percent level).

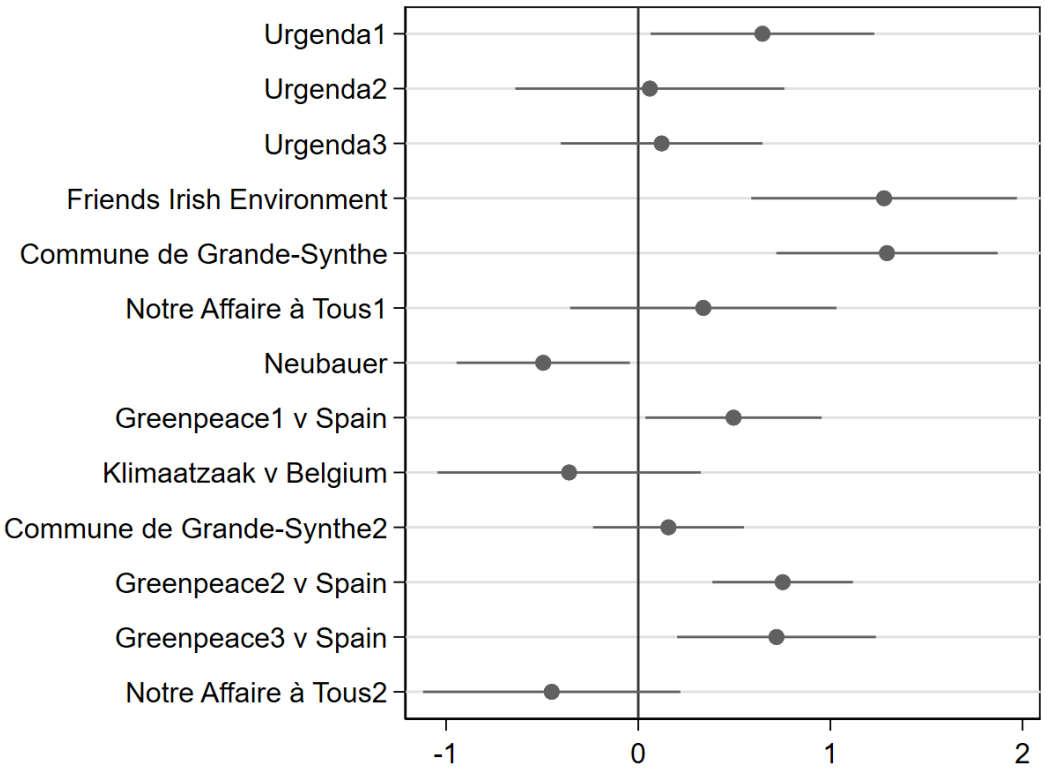
There are no significant effects on green or oil and gas stocks. However, the negative effect on coal stocks mirrors the positive effect on renewables (-.27 significant at the .01 level). Moreover, there is a very large negative effect on coal stocks when the ruling is in a company's home country: a daily decline of 3.3 percentage points! However, this effect is entirely driven by the German firm RWE following the Neubauer ruling. RWE was the only "domestic" coal firm on the Carbon Underground list that experienced a climate litigation judgment. RWE is also the firm that is suing the Dutch government for its decision to phase out coal. While it is thus credible that this firm's market valuation is sensitive to climate litigation, it would not be prudent to draw generalizable conclusions from this very small sample. In future iterations, I will include tests that have more coal companies and/or code which coal-intensive companies are most important economically in the various European countries.

Plaintiff losses did not have significant effects on the stock market returns of any group of firms. This is consistent with the notion that the market anticipates that courts will, for the most part, defer to legislatures and executives on mitigation targets. Thus, when a court throws out a climate suit, investors do not significantly update their beliefs about the credibility of mitigation targets.

Figure 3 plots the effect of individual positive rulings on renewables. The first positive ruling in each country typically has the largest positive effects on daily returns for renewable firms. This is consistent with an updating of priors mechanism. That is: the first Urgenda ruling had a strong positive effect on renewables returns but the upholding of that ruling on appeal did not move the markets much, presumably because it was more expected. The main anomaly is that renewable firms did not have higher returns on the days following the Neubauer ruling. This was driven by large losses among the major renewable companies, like Ørsted, Siemens Gamesa, and Powercell. Danish giant Ørsted's losses are likely due to a company announcement on April 30 (the day after Neubauer) regarding severe damage to seabed cables for its offshore UK windfarms, which led to a 6 percentage point drop in stock prices. The sensitivity of the findings to individual stocks warrants further scrutiny.

These results are preliminary. The findings are robust to some alternative model specifications, such as including lags for returns, excluding the crude oil prices, excluding the two additional Fama/French factors, allowing fixed firm effects to vary by year, estimating the model only with renewable firms with a market value over 1 billion dollar, and estimating the model on the post 2018 period (when most rulings occur). The effects on coal firms are less

Figure 3: Effect of Individual Litigation Outcomes on Stock Market Returns of European Renewable Firms



stable than the effects on renewables, which may well be due to the smaller sample. In the post 2018 period, the negative effect of climate judgments on coal stocks is only significant at the 10 percent level but there is now a positive home effect of a negative ruling, driven again by German firm RWE. This again suggests the need to examine the sample of coal firms and the sensitivity of the findings to individual firms.

By contrast, the effects on renewables are stable across specifications. In some models the positive effect of judgments on home country renewables is significant at the 5 percent level. Otherwise, both size and coefficients are very stable across model specifications and estimation periods.

7 Conclusion

The initial findings in this study are consistent with the idea that domestic court judgments that hold governments accountable for their contribution to global mitigation goals increase beliefs among investors that governments will adopt policies that favorably affect the prof-

itability of renewables and adversely affect coal-intensive firms. The effects are modest in size but economically significant: about a .5 percentage point abnormal returns following a positive judgment. There are no effects on green firms and oil/gas firms, who are less directly affected by a shift in mitigation policies. Moreover, there is no evidence that investors update their beliefs following a ruling that defers to the government, which is consistent with the idea that prior beliefs do not expect domestic court interventionism.

If these findings withstand further scrutiny, then this is at least suggestive that domestic court rulings can make climate mitigation commitments more credible. Future studies can examine how these rulings affect public opinion or whether climate judgments had similar effects on investors in other parts of the world. Studies can also expand the scope to different types of climate litigation, including litigation that directly or indirectly includes firms. Yet, the evidence in this paper is partially interesting because these judgments should not affect stock prices other than through the effects they have on investor beliefs about future mitigation policies. Given the centrality of asset valuation in climate politics Colgan et al., 2021, this is an important finding.

The overall effect of climate litigation on mitigation will depend on whether domestic courts will increasingly rule in ways that are consistent with climate goals. If so, then there will be an increasing number of countries where governments are constrained by their own courts when they design mitigation policies. As the Bundesverfassungsgericht alluded to in the Neubauer judgment, trust that other governments will meet their mitigation targets is essential for effective mitigation policies. Within Europe, the European Court of Human Rights could eventually apply consensus analysis to effectively pull up laggard countries. Whether courts will indeed go this route is an open question. There are now cases in many European countries as well as countries in other continents and it is much too early to detect a uniform trend in either direction.

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8 Appendix

Renewables	Green	Oil/Gas	Coal
ACCIONA SA	AALBERTS NV	AKER BP ASA	ANGLO AMERICAN PLC
AFC ENERGY PLC	ABB LTD	BP PLC	BHP GROUP LTD
AKER OFFSHORE WIND AS	ACCENTURE PLC	CABOT ENERGY PLC	BUMI RESOURCES TBK PT
ALFEN NV	ADIDAS AG	DNO ASA	EVRAZ PLC
CADELER A/S	AKZO NOBEL NV	ENERGEAN PLC	GLENCORE PLC
CERES POWER HLDGS PLC	ALSTOM SA	ENI SPA	JASTRZEBSKA SPOLKA WEGLOWA
CLOUDBERRY CLEAN ENERGY ASA	ANDRITZ AG	EQUINOR ASA	LUBELSKI WEGIEL BOGDANKA SA
CROPENERGIES AG	ASML HOLDING NV	GALP ENERGIA SGPS SA	MC MINING LTD
EDP RENOVAVEIS SA	ATLAS COPCO AB	GAZPROM NEFT PJSC	PUBLIC POWER CORP SA
ELIA GROUP SA/NV	BIOMERIEUX	GAZPROM PJSC	RWE AG
ENCAVIS AG	BT GROUP PLC	LUNDIN ENERGY AB PUBL	SEVERSTAL PJSC
EOLUS VIND AB	CHR.HANSEN HOLDINGS AS	NOVATEK JSC	SOUTH32 LTD
FASTNED BV	CLARIANT AG	OMV AG	TATA STEEL LTD
GRENERGY RENOVABLES SA	COMPAGNIE DE SAINT GOBAIN	POLISH OIL AND GAS CO	
GURIT HOLDING AG	DASSAULT SYSTEMS SA	REPSOL SA	
HEXAGON COMPOSITES ASA	DSV A/S	ROSNEFT OIL COMPANY	
ITM POWER PLC	ELECTROLUX AB	SHELL PLC	
KINGSPAN GROUP PLC	ESSITY AKTIEBOLAG	TATNEFT PJSC	
LANDIS & GYR AG	FIRSTGROUP PLC	TOTALENERGIES SE	
MAGNORA ASA	GEA GROUP AG		
MCPHY ENERGY SA	HENNES & MAURITZ AB		
NEL ASA	IBERDROLA SA		
NEOEN SA	KERLINK SA		
NKT A/S	KONE OYJ		
NORDEX SE	KONINKLIJKE DSM NV		
NOVOZYMES A/S	KONINKLIJKE KPN NV		
ORSTED A/S	KONINKLIJKE PHILIPS NV		
POWERCELL SWEDEN AB	L'AIR LIQUIDE SA		