

Testimony to the Oregon Investment Council
Carole Romm
March 8, 2023

Thank you, Chair Samples, and members of the Oregon Investment Council, for the opportunity to speak to you today. For the record, my name is Carole Romm.

I am a PERS retiree, so I am naturally concerned about the viability of OPERF. Like almost 400,000 Oregon PERS members, my retirement is critical to my future and my family's.

I have spoken here before about the environmental impact of OPERF investments.

That my retirement funds are doing damage to our climate is bad enough. But now I have learned that these investments are a risk to the very viability of my retirement funds.

As the 2021 [report](#) by Ortec Finance revealed, the Treasury's fossil fuel investments are a threat to the fiscal health of OPERF. A follow-up [report](#) by Ortec outlined recommendations for reduction in these investments in order to avoid the deep losses predicted in its first report. **Both of these reports were hidden and seemingly ignored by the Treasury.**

And if we needed any more proof of the threat to the portfolio that these investments create, take a look at the Treasury's own report, [2022 PERS By the Numbers](#). On page 23 it projects that OPERF's **funded status will decrease from 86% to 79%**, and the **unfunded actuarial liability will increase from 20% to 27%**.

Divest Oregon has tried to get information about PERS investments. The Treasury has used a combination of stonewalling, redactions, and slow-walking to keep the information from the public. Divest Oregon has had to resort to filing public records requests, filing a transparency bill in last year's legislative session, and the threat of public records mediation to pry the information from the Treasury. **Other states' pension funds freely publish this information on their websites or provide it immediately when asked because that's their fiduciary duty.**

As a PERS retiree, I find this information frightening. The iceberg is looming and the ship is steering straight towards it.

From: [Charlotte Maloney](#)
To: [OIC Public Comments](#)
Subject: Comment for April 19th Public Meeting
Date: Wednesday, April 12, 2023 11:24:48 AM

This email is from a party external to Treasury. Use care with links and attachments.

Dear Treasurer Tobias and Commission Members,

I am a retired occupational therapist, whose household receives PERS pension through my husband's pre-retirement employment. We are shocked that you have been so unresponsive to the issue of removing fossil fuel investments from Oregon's portfolio.

With the fact that fossil fuel investments are bringing less return recently and projected to continue to decrease, as documented in the study your Commission funded, it makes no sense to us that you continue to begin new investments in the industry. Why don't you attempt to combine your fiduciary responsibility with our common need to replace fossil fuels for the good of future generations?

New York and California systems have accomplished this. Please stop dragging your feet.

You could be part of the solution instead of risking our pension funds to support an industry which needs to be curtailed for the health of our planet.

Sincerely
Charlotte Maloney
Eugene

Voice Through Divestment

Finance Working Paper N° 900/2023

March 2023

Marco Becht

Solvay Brussels School of Economics and
Management, Université libre de Bruxelles, CEPR
and ECGI

Anete Pajuste

Stockholm School of Economics, Riga, Harvard
Law School and ECGI

Anna Toniolo

Harvard University

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Abstract

A common argument against divestment is that it jettisons voting power and that it has a small effect on stock prices. We argue that divestment is a form of voice that changes social preferences. We show that the Go Fossil Free divestment movement has had a disproportionate impact on share prices by changing the economic narrative. By stigmatising target companies, it has increased stranded asset risk. Divestment pledges that went viral have depressed share prices of all high carbon emitters, including those with no significant divestment. Peak virality coincides with an increase in the carbon premium and precedes netzero commitments from countries, regions, cities, and business. By altering the social and regulatory environment, divestment induces risk averse investors to decarbonise their portfolios, further reinforcing the narrative.

Keywords: Divestment, fossil free, carbon budget, shareholder engagement, responsible investment, climate change, carbon premium, economic narratives, net-zero commitments, social preferences, tweets as data

JEL Classifications: D23, K22, G32, G34

Marco Becht*

Goldschmidt Professor of Corporate Governance
Université Libre de Bruxelles



Anete Pajuste

Professor

Stockholm School of Economics in Riga, Department of Economics
Strelnieku iela 4a



Anna Toniolo

Researcher

Harvard University



*Corresponding Author

Voice Through Divestment

Marco Becht¹

Solvay Brussels School of Economics and Management, Université libre de Bruxelles, CEPR
and ECGI

Anete Pajuste²

Stockholm School of Economics in Riga and ECGI

Anna Toniolo³

Harvard Law School, Harvard University

9 March 2023⁴

Abstract

A common argument against divestment is that it jettisons voting power and that it has a small effect on stock prices. We argue that divestment is a form of voice that changes social preferences. We show that the Go Fossil Free divestment movement has had a disproportionate impact on share prices by changing the economic narrative. By stigmatising target companies, it has increased stranded asset risk. Divestment pledges that went viral have depressed share prices of all high carbon emitters, including those with no significant divestment. Peak virality coincides with an increase in the carbon premium and precedes net-zero commitments from countries, regions, cities, and business. By altering the social and regulatory environment, divestment induces risk averse investors to decarbonise their portfolios, further reinforcing the narrative.

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¹ ECARES, Solvay Brussels School of Economics and Management, Université libre de Bruxelles, 42 Avenue F. D. Roosevelt, 1050 Brussels, Belgium, e-mail: marco.becht@ulb.be.

² Stockholm School of Economics Riga, Strelnieku iela 4a, Riga, LV 1010, Latvia, e-mail: anete.pajuste@sseriga.edu.

³ Program on Corporate Governance, Harvard Law School, 1563 Massachusetts Avenue, Cambridge, MA 02138, e-mail: atoniolo@law.harvard.edu.

⁴ We are grateful to Patrick Bolton, William Cheung, Koyu Furusawa, Beni Lauterbach, Ailsa Röell, David Thesmar and participants at the RIETI Brownbag Lunch Seminar in Tokyo for helpful comments. We are grateful to David Root at FFI Solutions for providing us with Carbon Underground 200 data and to Twitter for providing academic research access to its API. Vasilisa Kotova, Martyna Lacyte and Lotte Vahellan provided excellent research assistance. We acknowledge financial support from the Goldschmidt Chair at the Solvay Brussels School of Economics and Management, Université libre de Bruxelles.

1 Introduction

It has been argued that the financial impact of divestment is small because there are too many willing buyers on the other side of the trade, and that therefore engagement is a better approach to addressing environmental, social and governance (ESG) issues (Broccardo, Hart, and Zingales 2020; Heinkel, Kraus, and Zechner 2001). Yet, divestment is the preferred tactic of climate campaigners and responsible investors (Global Sustainable Investment Review 2020), with *go fossil free* becoming the fastest-growing divestment movement in history (The Guardian 2015). This paper argues that there is no opposition between divestment and engagement when divestment pledges contribute to changing social preferences. Go fossil free is part of a wider movement that seeks to denounce coal, oil and gas companies. Its impact is reflected in the net-zero commitments of many countries, regions, cities, and companies. Divestment has a much larger impact than is reflected in the reduction in shares held by responsible investors because it increases reputation and regulatory risk for fossil fuel companies and high carbon emitters; its effect goes far beyond the negative price pressure on the stock. Divestment pledges are statements of disapproval echoed through social media and the press, which is heard by policy makers, customers, employees, and boards. Through its impact on social preferences and policy, the divestment movement begets further divestment by rational risk averse investors, even those who have no ethical imperative against coal, oil, gas, carbon emissions and climate change. Net-zero commitments from governments have made it riskier to invest in high-carbon emitters, making it rational to decarbonize portfolios.

We show how the fossil fuel divestment campaign has achieved mass-media coverage. The movement has deliberately targeted university endowments, religious groups, foundations, and other renowned institutions with a stock portfolio. Pledges from pension funds and asset managers followed. The number of institutions that have joined the movement grew from 181 in 2014 to 1559 in 2023 (Global Divestment Commitments Database). In many instances, divestment pledges became viral and preceded net-zero commitments by countries, regions or cities where the divesting institutions have social influence, or came from state and private entities that had divested. Moreover, the impact of these divestments is not confined to fossil fuel companies but extends to all high-level carbon emitters, for example the cement industry.

To illustrate this broader significance of divestments, consider the case of Ireland. The Republic of Ireland was one of the first countries to divest from fossil fuel companies in 2018. In April 2016, Trócaire, a humanitarian organization established by the Bishops of Ireland and actively involved in ending apartheid, launched a “Burning Question” campaign urging the Irish Strategic Investment Fund (ISIF) to divest (CatholicIreland.net 2016). Trinity College Dublin, Ireland’s most prestigious university, pledged to divest in December of the same year. On January 26, 2017, the Irish parliament voted in favor of passing a Fossil Fuel

Divestment Act. The Act was adopted on July 12, 2018, and instructed the ISIF to fully divest from companies that derive more than 20% of their revenue from the exploration, extraction and/or refinement of fossil fuels. On 16 July there was a report that ISIF would pull out from carbon-producing companies (Peters 2018). At the time, ISIF had positions in 38 fossil fuel companies with a portfolio value of Euro 72 million. The shares were sold in December 2018 and in early January 2019 (ISIF Annual Report 2018, pg. 26). The two announcements went viral on Twitter, with the number of retweets vastly exceeding the number of tweets. On 12/13 July there were over 21,000 tweets and retweets that were seen by up to 264 million followers (Figure 1).

The divested amounts were negligible when compared to the market capitalization of fossil fuel majors.⁵ For example, at the end of 2017 the fund only held 21,350 shares in Exxon Mobil valued at 1.5 million Euro million (1.25 million \$); Exxon had 4.256 billion shares issued and outstanding with a market capitalization of 354 billion dollars. Yet, there were negative abnormal returns of -3.4% and -4.1% for the 40 U.S. companies with the largest coal, oil, and gas reserves summing up to losses of 31 billion and 21 billion dollars over a seven-day window around the events (Table 1).⁶ It is inconceivable that the anticipation of ISIF's sale caused this price reaction, especially since ISIF only held 16 of these 40 stocks. On the second (viral) day of Ireland's divestment announcement there were negative abnormal returns for fossil fuel companies more generally (-2.7%) and for all high carbon emitters (-1.7%). This is not consistent with a pure price pressure effect because cement stocks, for example, were not divested; it is consistent, however, with the market changing its estimate of stranded asset risk. In sum, the Irish divestment pledge was a lead indicator of social and political change.

In 2019 Ireland published a comprehensive report of its path to net-zero. In 2020 the country passed a law committing to net-zero by 2050 (Government of Ireland 2020) and signed a Climate Act into law in July 2021. *Inter alia* the law contained a commitment to end the issuing of new licenses for the exploration and extraction of oil and gas. The Act commits the Irish government to “adopt carbon budgets that are consistent with the Paris agreement and other international obligations” and to “determine [...] how to apply the carbon budget across the relevant sectors”.⁷ The initial reduction will be 51% by 2030 relative to a baseline of 2018. Crucially, the Act will affect all carbon emitters, not just fossil fuel companies.

⁵ The number of shares held was also very small in terms of voting; engagement and voting were outsourced to Hermes EOS, an equity ownership service (ISIF RI Transparency Report filed with PRI, 2018). Hermes continued to engage, also on behalf of ISIF, with fossil fuel companies.

⁶ Cumulative abnormal returns over a seven-day window around the two announcement dates using a market model based on the MSCI AC World US\$ index. Over a narrower three-day window, the losses were 11 and 14 billion dollars respectively. For the second event the window was constructed around 12 July.

⁷ Irish Government, Department of the Environment, Climate and Communications, Press Release, 23 July 2021 “Ireland’s ambitious Climate Act signed into law” (<https://www.gov.ie/en/press-release/9336b-irelands-ambitious-climate-act-signed-into-law/>).

Accordingly, ISIF has committed to decarbonize its portfolio by 50% by 2025 and will ensure that “investee companies and third-party managers are considering potential climate risks and opportunities”.⁸ The fossil fuel divestment decision was a principle-based decision and gave impetus to Ireland’s net-zero commitment. The decarbonization decision was a risk-based decision and reflects the new social and political environment. This Irish example illustrates how voice through divestment has been an effective strategy significantly affecting the valuations of all high carbon emitters.

The framing of divestment by finance scholars and practitioners has been as an exclusionary investment strategy aimed at screening out socially irresponsible investments (Heinkel, Kraus, and Zechner 2001). Selling the stock of dirty companies would lower the market value of these companies, raise the cost of capital and induce value-maximizing corporate leaders to switch to “pro-social” strategies. In equilibrium, the price impact of divestments is mitigated by value-oriented agents with weaker “pro-social” preferences who will take advantage of lower prices to purchase more shares, bonds or goods; or to supply more labour. Therefore, the impact on stock price is limited and the incentive for management to change strategy is small.⁹ The effect on the cost of capital is also predicted to be small (e.g., Berk and van Binsbergen 2021).¹⁰ According to this view, the small amount divested by Ireland would have no measurable impact on the share price of target companies or their cost of capital. The argument can be taken even further to argue that the impact on the divested companies is negligible, but the impact on portfolio returns of the divesting institutions would be large. This argument was actively used by the fossil fuel industry to lobby against divestment, especially by university endowments.¹¹

Divestment is also criticised because it prevents responsible investors from engaging with the company (using “voice”), pursuing an active communication and voting policy, which has been shown to be effective in influencing corporate decisions (Dimson, Karakaş, and Li 2015; Krueger, Sautner, and Starks 2020).¹² Comparing the relative strengths of divestment

⁸ ISIF Press Release, “ISIF publishes first-ever Annual Climate Report”, 25 November 2021 (<https://isif.ie/news/isif-publishes-first-ever-annual-climate-report>).

⁹ This view is also echoed by leading practitioners. For example, in 2019 Bill Gates said: “Divestment, to date, probably has reduced about zero tonnes of emissions. It’s not like you’ve capital-starved [the] people making steel and gasoline.” Larry Fink, the chief executive officer of BlackRock put forward a similar argument in his 2022 letter to CEOs: “Divesting from entire sectors – or simply passing carbon-intensive assets from public markets to private markets – will not get the world to net zero. And BlackRock does not pursue divestment from oil and gas companies as a policy.”

¹⁰ The application of exclusionary screening is also predicted to result in lower returns for pro-social shareholders (Heinkel, Kraus, and Zechner 2001; Luo and Balvers 2017; Zerbib 2020).

¹¹ A leading example is the “Divestment Facts” campaign of the Independent Petroleum Association of America (IPAA). See *infra*, Section 3.3.

¹² Edmans, Levit, and Schneemeier (2022) argue that divestment is inferior to “tilting” or “best in class” strategies; they argue that once divestment has occurred the target company no longer has a financial incentive to change behaviour.

and engagement, Broccardo, Hart, and Zingales (2020) thus conclude that voice is the preferable strategy to push firms to act in a socially responsible manner.¹³ The argument is also used by some of the largest and most engaged responsible investors to justify why they oppose divestment (Stausboll 2015), but it was also co-opted by the fossil fuel industry, including the Independent Petroleum Association of America (IPAA), suggesting that the industry prefers engagement to divestment.¹⁴

On the other hand there is growing evidence that markets have started to price in carbon emissions and demand higher returns from firms with higher total CO₂ emissions (Bolton and Kacperczyk 2021).¹⁵ This finding is not consistent with the traditional view of divestment and downward sloping demand curves for stocks, since the carbon premium is not limited to the divestment targets in the fossil fuel sector, but is proportional to carbon emissions across all industries. Bolton and Kacperczyk (2021) also find that the carbon premium has increased significantly around 2015. Our view of divestment is consistent with this pricing evidence because the divestment narrative potentially affects all carbon emitters. We also provide a rationale for the observed timing: the initial peaks in virality around divestment pledges coincide with the observed increases in the carbon premium.

We argue in this paper that the financial impact of the divestment movement is best understood through the lens of an economic narrative, even if narratives are not always easy to delineate empirically (Shiller 2017). We overcome this empirical challenge by using Twitter data.

Narratives have been defined as “stories people tell themselves, and each other, to make sense of human experience that is, to organize, explain, justify, predict and sometimes influence its course” (Bénabou, Falk, and Tirole 2018). They are central to our cultures and social science has long recognized their role in shaping public opinion. Economists, however,

¹³ The authors acknowledge the potential impact of divestment campaigns on raising awareness about an issue and social preferences. Divestments (“exits”) are a continuous source of news while shareholder votes tend to be singular events. They also acknowledge peer pressure inciting institutions to divest because they want to be part of a “growing and potentially successful movement (Thaler and Sunstein 2008).” The authors question the legitimacy of the divestment campaigns: “There is no guarantee that the ability of an exit strategy to succeed is linked to the social desirability of its goal. Thus, extending the model to incorporate information and social pressure is unlikely to change the fundamental result that voice is more aligned to social incentives than exit.” In the case of fossil free it is likely that the movement is more aligned with social incentives than shareholder voting; we shall return to this question below.

¹⁴ See DivestmentFacts.com blog-post, “Experts say company engagement drives change. Will divestment groups get the memo?”, 22 January 2022. The argument also overlooks that engagement is a parallel activity to voting and beneficial owners like ISIF pay equity ownership services with multiple clients to engage (Becht et al. 2021); engagement continues after divestment.

¹⁵ A recent paper found a contradictory result, identifying a “greenium” – a premium on stocks of green companies – rather than a carbon premium (Pástor, Stambaugh, and Taylor 2022). Yet, the authors caution that the outperformance of “sin” stocks by “clean” stocks is likely to reflect an unanticipated increase in environmental concerns, representing an ex-post realization rather than being indicative of the true expected return.

have only recently turned to the study of narratives: traditionally economic theory has focused on individual decision making subject to constraints and beliefs (Akerlof and Snower, 2016). However, individual aspirations are often shaped by the stories people tell themselves, in other words social and economic narratives (Bénabou, Falk, and Tirole 2018).

“Narrative economics” seeks to understand how popular narratives spread and can influence economic fluctuations (Shiller 2017). The form of the narrative can vary greatly, but the ones that are successful share a critical social-contagion element, and when they “go viral” they affect economic behavior and have economic consequences (Shiller 2019).¹⁶ More specifically Shiller (2017, at 968) defines “the term narrative to mean a simple story or easily expressed explanation of events that many people want to bring up in conversation or on news or social media because it can be used to stimulate the concerns or emotions of others, and/ or because it appears to advance self-interest. To be stimulating, it usually has some human interest either direct or implied.”

We show that *go fossil free* closely fits this economic narrative definition. Its declared goal goes beyond exclusionary screening. Indeed, the movement has been described as “a transnational advocacy network that uses a range of strategies to shame, pressure, facilitate, and encourage investors in general, and large institutional investors in particular, to relinquish their holdings of fossil fuel stocks in favour of climate-friendly alternatives” (Ayling and Gunningham 2017). It calls into question the social license to operate dirty businesses: “Cut off the social license and financing for fossil fuel companies — divest.”¹⁷ Moreover, the Fossil Free campaign explicitly sees itself as creating a “story”: “Campaigns aren’t just about winning a “yes” on divestment. They’re about telling the story of people power against the fossil fuel industry. Getting a “yes” on divestment is a big part of that, but creating tension around a city pension system that might be reluctant to divest tells that story, too.”¹⁸ In this broader view, the main goal of the movement is to target dirty companies’ reputation and standing in society. Because it is a story aiming at teaching a moral,¹⁹ the divestment movement might be defined not just as a narrative, but as a finance “parable.”²⁰

We show that widely publicized divestment commitments (that are part of a broader campaign) put pressure on companies that goes well beyond stock prices, the cost of equity and the loss of shareholder voting power. Our results reveal that Ireland is no isolated case.

¹⁶ For example, Roe and Shapira (2021) have argued that “stock-market-driven short-termism damages the economy” is a narrative that had a substantial impact on law-making, although the supporting empirical evidence is inconclusive and contested.

¹⁷ 350.org, About 350, <https://350.org/about/>.

¹⁸ Fossil Free, About, <https://gofossilfree.org/about/>.

¹⁹ The Oxford English Dictionary define “parable”: “A (usually realistic) story or narrative told to convey a moral or spiritual lesson or insight.”

²⁰ As pointed out by Eliot in *Middlemarch*: “[W]hatever has been or is to be narrated ... may be ennobled by being considered a parable” (Eliot 1930).

When media coverage raises the salience of a fossil fuel divestment campaign in public opinion, there are negative abnormal returns for all high-carbon emitters; markets correctly anticipate that cities, regions, and countries are more likely to make net-zero commitments. The divestment campaign made it rational for managers to act, for example by making net-zero commitments. This, in turn, makes it rational for risk averse investors to contemplate decarbonizing their portfolios.

Our paper builds on the theoretical work on narrative economics (Shiller 2017; 2019) and more broadly on the importance of “stories” in the formation of economic behavior (Akerlof and Snower 2016; Bénabou, Falk, and Tirole 2018; Akerlof 2020). Our work relates to a large literature investigating green-versus-brown returns, generally for stocks. Examples include Litterman (2011), Bansal, Ochoa, and Kiku (2016), Daniel, Litterman, and Wagner (2016), Painter (2020), Hsu, Li, and Tsou (2020), Bolton and Kacperczyk (2021), Aswani, Raghunandan, and Rajgopal (2021), Ilhan, Sautner, and Vilkov (2021), Ramelli et al. (2021), and Pástor, Stambaugh, and Taylor (2022). Finally, our empirical evidence adds to the literature on the role of the media in affecting corporate governance (Dyck and Zingales 2002; Burke 2022) and social media in finance (Campbell et al. 2022).

2 The Go Fossil Free Narrative

2.1 The Carbon Budget

For decades climate experts have been alerting about the catastrophic climate consequences that would come if carbon dioxide (CO₂) emissions are not slashed. In 2008, a group of NASA scientists guided by James Hansen identified 350 parts per million (ppm) CO₂ as the safe upper bound for atmospheric concentration of carbon dioxide (Hansen et al. 2008): “If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO₂ will need to be reduced ... to at most 350 ppm.” Today, the level of CO₂ in the atmosphere is 419 ppm and projected to reach 450 ppm by 2040, with average temperatures rising to over 1.5°C above pre-industrial levels (Intergovernmental Panel on Climate Change (IPCC), 2022).

The IPCC estimates that the total carbon budget we have left (the total amount of CO₂ that can still be accumulated in the atmosphere while keeping temperatures from rising by more than 1.5°C) is around 300Gt of CO₂ as of 2020. Under any scenario the carbon budget is almost depleted and emitting the carbon from all known fossil fuel reserves would vastly exceed the allowable CO₂ emission budget for staying below 1.5°C.

In 2011, the Carbon Tracker Initiative (CTI) – an NGO formed by a group of financial analysts and environmentalists – translated the carbon budget constraint into financial terms,

applying the concept to listed companies. The CTI's first "Carbon Bubble" report identified a balloon in the valuation of oil and gas companies tied to stranded fossil fuel proven reserves of listed firms, the extraction of which is incompatible with a 2°C global carbon budget (Campanale, Leggett, and Leaton 2011). Their analysis estimated that the remaining global carbon budget until 2050 is 565Gt, while known fossil fuel reserves amount to 2795Gt, which is equivalent to nearly 5 times the carbon budget for the next 40 years. The report refers to the difference between the carbon budget and the amount of fossil fuels reserves as "unburnable carbon." The analysis implies that these known reserves will need to remain in the ground to stay below 2°C. This means that fossil fuel companies should drastically reduce production and immediately stop the expansion of existing projects and exploration.

The CTI report also pointed out that the fossil fuel reserves held by the top 100 listed coal companies and the top 100 listed oil and gas companies represented potential emissions of 745Gt, while the rest were owned by governments or state energy firms. If the 20% use limit is applied uniformly, then only 149Gt of the 745Gt held by listed companies could be used unabated, implying that 80% of declared reserves owned by the world's largest coal, oil and gas firms would be subject to impairment as these assets become "stranded." Yet, valuations of the oil and gas sector still assumed that all known reserves could be taken out of the ground and sold. If the assumption is wrong, the report argued, there is a "carbon bubble" in financial markets.

This science-backed financial analysis provided a new conceptual foundation to the climate justice movement. The "carbon budget" and "carbon bubble" concepts were used by climate activists to shape a new strategy: divestment from the fossil fuel industry. The thinking was that if the movement was able to persuade policy makers to force fossil fuel companies to "keep it in the ground," the carbon bubble would burst. If enough market participants believed in the implosion of the bubble, carbon divestment would be transformed from a statement of principle to a rational investment decision. The same logic applied to other industries that would be affected by restrictions on carbon emissions or taxation. Thus, the fossil free divestment movement viewed itself as a catalyst for a broader reassessment of stranded asset and other risks associated with fossil fuel-based companies.

A key breakthrough for the go fossil free movement was the publication of an article by climate activist Bill McKibben's in Rolling Stone Magazine 2012 edition called "Global Warming's Terrifying New Math", in which he advocated cutting the supply of financial capital to fossil fuel companies. The article prominently refers the "carbon budget" and "carbon bubble" notions, asking readers "to do a little math" and focusing on "three simple numbers" (McKibben 2012).²¹ Carbon reserves that would take us past two degrees had to

²¹ The argument was picked up subsequently by mainstream publications (e.g. (The Economist 2013).

stay in the ground. The article further argued that “working through the political system had proved ineffective to achieve this goal, but the moral outrage arising from this terrifying math could lead to a transformative challenge to fossil fuel. There is one example in recent corporate history when anger was effectively able to force an industry to make changes: the South Africa divestment movement of the 1980s” (McKibben 2012).

The Rolling Stone article was heavily promoted on social media by 350.org, an organization co-founded in 2008 by McKibben and named after the Hansen et al. (2008) 350 ppm paper (Hestres 2014). The main goal of 350.org was to build a global grassroots movement using internet-enabled organizing strategies to increase the intensity of political activism among the segment of the public already alarmed about climate change (Nisbet 2015). The organization sought to generate headlines and to draw media attention, and it was able to obtain more than 170,000 online comments on the Rolling Stone article and social media posts, making it the most widely read in the magazine’s history at the time (Hestres 2014).

Along with this article, McKibben and 350.org organized a university campus “Do the Math Tour,” traveling around the country to explain the math behind climate change and carbon emissions; they also produced a movie. The tour then led to the launch of a global “Go Fossil Free: divest from fossil fuels” campaign. This is the genesis of the fossil free divestment movement (Hopke and Hestres 2017).

2.2 *The Fossil Free Divestment Movement*

Fossil Free (also “FF”) is a campaign of 350.org started in 2012 to push institutions to divest from fossil fuels.²² FF later developed into a loosely affiliated network of independent grassroots campaigns. FF considers fossil fuel companies a crucial target for its campaign to stay within the limits of the carbon budget. By calling on leading institutions to divest from the fossil fuel industry, the aim is to turn public opinion against the fossil fuel sector and to hold it accountable. In short, the goal of FF is to strip the veneer of fossil fuel companies’ social acceptability, which is essential for the industry to continue to benefit from government subsidies.

FF records divestment pledges in a Global Divestment Commitments Database (GD CD), which collects fossil fuel divestment commitments made by institutions globally. The first Go Fossil Free campaign was launched in November 2012. In keeping with the “unburnable carbon” narrative, the campaign focused on divestment from 100 listed companies with the largest coal reserves and 100 companies with the largest oil and gas reserves. The names of the companies had been published by Carbon Tracker (2011) in its report. In 2014 the list

²² The first fossil fuel divestment campaign begun on the campus of Swarthmore College in Pennsylvania in 2011, but the movement started to gather force only after the first Go Fossil Free campaign was launched by 350.org in November 2012.

became the Carbon Underground 200™ compiled by Fossil Free IndexesSM (today, FFI Solutions), ranking companies by carbon emissions embedded in their reported reserves.

The divestment targets were the Carbon Underground 200, but the campaign was directed at investors. In 2012 the campaigns recruited college students in the U.S. and the U.K. to press universities to divest endowment assets (Nisbet, 2015). In November 2012, Unity College (Maine) became the first institute of higher learning to commit to fossil fuel divestment supported by the FF movement (350.org 2018). Between 2012 and 2014, student movements at more than two hundred universities pressured their institutions to divest from fossil fuel companies.

On September 21, 2014, the People's Climate March called by the global advocacy human rights group Avaaz and 350.org gathered more than three hundred thousand people in New York City, becoming the largest climate change march in history (The New York Times 2014b). Following the March, the Divest-Invest Philanthropy organization – a coalition of endowments and individuals committed to divesting from fossil fuels and investing in clean energy – announced that 70 organizations were divesting \$50 billion from the fossil fuel sector (Philanthropy News Digest 2014). Remarkably, among the new signatories was the Rockefeller Brothers Fund, heirs of Standard Oil founder John D. Rockefeller (The New York Times 2014a). At the same time, Naomi Klein – writer and member of the board of 350.org – published her best-selling book, “This Changes Everything: Capitalism Versus the Climate”, advocating for divestment from fossil fuel companies. The book debuted on the New York Times bestseller list at number five on 5 October 2014, and it appeared on the best-seller list for several weeks, generating considerable media attention (Nisbet 2015).

By 2015 thousands of divestment campaigns were underway, earning support well beyond college campuses, with 436 institutions and 2,040 people committed to divesting from fossil fuels companies (Arabella 2015). In March 2015, the Guardian (in partnership with 350.org and its Go Fossil Free Campaign) launched a “Keep It in the Ground” campaign, at the behest of outgoing editor-in-chief Alan Rusbridger. Within its first year, the digital campaign garnered support from more than a quarter million online petitioners and won the “campaign of the year” at the Press Gazette's British Journalism Awards (Press Gazette 2015). On December 15, 2015, 196 parties signed the Paris Agreement at the UN Climate Change Conference. This was followed by a new cascade of divestment pledges, providing further impetus to the campaign (Arabella 2016).

The movement spread beyond universities, and by 2016 the largest share of divestment commitments had been made by faith-based organizations. In 2014, the University of Dayton was the first Catholic institution to divest. In June 2015 Pope Francis published an encyclical letter called *Laudato Si': On Care for Our Common Home*. He explicitly called world leaders to action, underscoring that “highly polluting fossil fuels – especially coal, but also oil and, to

a lesser degree, gas – needs to be progressively replaced without delay” (Vatican City State 2015). The next month the World Council of Churches – which includes more than 350 denominations comprising more than 500 million Christians worldwide – made divestment pledges and encouraged its members to do the same (World Council of Churches 2014). In August 2015, Islamic leaders from 20 countries announced the Islamic Declaration on Global Climate Change, which not only calls on the 1.6 billion Muslims around the world to phase out greenhouse-gas emissions but also specifically calls “upon corporations, finance, and the business sector to (...) [assist] in the divestment from the fossil fuel driven economy” (Islamic Declaration on Global Climate Change 2015). The faith community support is important to understand how the divestment movement makes a strong case for the moral responsibility to act on climate change divesting from the fossil fuel industry (Arabella 2016). Yet the divestment pledges were relatively small in monetary terms and unlikely to have any direct price impact.

By 2018, the FF divestment movement extended its reach to private companies and major pension, sovereign wealth, and insurance funds. Many high profile individuals such as Archbishop Desmond Tutu (“Press Release” 2015) – the Nobel Peace Prize who worked to liberate South Africa from Apartheid –, the former secretary-general of the United Nations Ban Ki Moon, and actor Leonardo DiCaprio (Reuters 2015) also started supporting the FF divestment movement.

From early 2018 FF entered a new phase of the campaign, “expanding beyond divestment”, and introduced new tactics and tools with “the goal of stopping all new fossil fuel projects by 2020.” But the divestment movement continued to grow, and the total number of recorded investment pledges now stands at 1559.

2.3 Is Fossil Free Divest a Narrative?

As the description in the previous section shows, the FF divestment movement has some critical features of an economic narrative. Narratives usually have an ethical dimension that trumps hard-nosed economic calculations (Bénabou, Falk, and Tirole 2018). In its early days the FF divestment movement was not primarily focused on the financial implications of shifting money away from the fossil fuel industry, but rather on “highlighting the moral dimensions of climate change”. Divestment was seen as a way of ending fossil fuel companies’ social license to operate and of breaking their hold over economy and governments at a global level.

Second, popular narratives have an underlying “us versus them” theme, a Manichaeian tone of clear right and wrong, black or white behavior (Shiller 2019). The FF movement identifies the fossil fuel industry as the enemy of a sustainable planet, painting the whole sector with a broad brush. Klein advanced the idea that to avoid a climate catastrophe “It’s them or us”

(Klein 2014). McKibben in his influential article is even clearer, explaining that “enemies are what climate change has lacked. But what all these climate numbers make painfully, usefully clear is that the planet does indeed have an enemy (...). Climate change operates on a geological scale and time frame, but it's not an impersonal force of nature; the more carefully you do the math, the more thoroughly you realize that this is, at bottom, a moral issue; we have met the enemy and they is Shell” (McKibben 2012).

Third, stories can have a core contagious element that makes them go viral and cause economic changes. The viral elements of the FF divestment campaign were the underlying science, 350 ppm, and the carbon budget. In the empirical section we list the main hashtags used by the campaign and show how they propagated. We also establish which elements went viral.

Finally, economic narratives mutate, and mutations might change their contagiousness. Mutations in a narrative can renew its economic message by tying it better to economic decisions (Shiller 2017). In the next sections we will show how the FF divestment narrative has morphed from a “moral outrage” narrative to a more mainstream risk-management issue supported by a shift in the narrative towards more financial considerations related to stranded assets risk and the “carbon bubble”.²³ There are signs that the narrative might be shifting from fossil fuel divestment to the decarbonization of portfolios.

3 The Fossil Free Movement on Twitter

This section documents the growth of the Fossil Free movement and its accompanying narrative on social media. Section 3.1 reports the Twitter handles associated with the movement and descriptive statistics on tweets, hashtags, and followers. Section 3.2 details network analysis that treats the movement’s Twitter handles as nodes. Section 3.3 presents a time series of the movement’s Tweet volumes.

3.1 Data and Methodology

FF has its dedicated website (gofossilfree.org) which provides information about the campaigns and makes material available to activists. Local movements can register with 350.org to get listed on the gofossilfree.org website. We accessed the Twitter archive through its API and created a dataset containing all handles associated with the 350.org and the Fossil Free Project, including tweets, hashtags, followers, and users.

²³ Consistently, Krueger, Sautner, and Starks (2020) shows how institutional investors strongly agree that the two most important motives for incorporating climate risk into investment decisions are: the protection of their reputation; and a moral/ethical obligation to consider climate risks.

The main Twitter account is run by 350.org in the United States with the handle @350. Local campaigns typically use handles that are composed of @350 plus the country, city, or region, for example @350Australia, @350Montana, @350Sacramento, @350Deutschland or @350Canada. However, it is also possible that 350 is used at the end of the handle or in the descriptor, for example @SanDiego350. There are also individuals who affiliate themselves with the movement and use #350.org or 350.org in their profile text, for example @GreenGregDennis²⁴ or the @350 founder, @billmckibben.²⁵

The FF project has its own Twitter handle (@gofossilfree), but it was only created in February 2020, has few followers (116 in November 2022), and only one tweet. The local campaigns typically use @FossilFree and a location, for example @FossilFreeCA for California or @FossilFreeYale. They also use @Divest plus the target institution, for example @DivestHarvard, @DivestMIT or @DivestEast, a campaign to divest the East Sussex Pension Fund.

We identified the handles associated with both networks 350 and FF. For 350 we required the handle to contain the substring “350” and the description to contain “fossil” or “climate”. We also selected accounts that mentioned “350.org” in the description. For FF we required the handle to contain “fossilfree” or “divest” in combination with “fossil” in the description. Through the latter, we excluded the handles of unrelated divestment campaigns. We combined the two sets of handles into one list and eliminated duplicates; the result is a combined dataset containing 504 handles.

3.2 *Network Analysis*

We performed basic network analysis to assess the overall integration of the movement (Grund 2015). We found that the network is directional, and that the nodes are well connected. There are 4,842 singular and 2,741 mutual connections, meaning that followership of these nodes is reciprocal. Transitivity is a high 40%, meaning that almost half the nodes are connected directly or through one other node. The nodes are also relatively close to each other: the length of the longest shortest path between two nodes is 5; the average length of the shortest path is 2.8.

We further identify the most connected nodes, those with the highest network centrality. We calculate degree centrality of a node by the number of its connections, and betweenness centrality by “the number of shortest paths among all other nodes that pass through this node”

²⁴ Greg Dennis’s Twitter biography reads “Writer, Vermonter, #ClimateChange activist, #ThirdAct, son of USAF colonel. #350.org #vtpoli #Skiing. Life is a carnival.” See @GreenGregDennis, TWITTER, <https://twitter.com/GreenGregDennis>.

²⁵ Bill McKibben’s Twitter biography reads “Author, Educator, Environmentalist and founder of <http://350.org> and <http://ThirdAct.org>.” See @billmckibben, TWITTER, <https://twitter.com/billmckibben>.

(Grund 2015). Since the absolute number is hard to interpret, it is customary to standardize the betweenness measure with the length of the shortest path. We use the standardized betweenness measure to rank nodes (Table 2).

The nodes with the highest degree of centrality are @nyudivest, @DivestHarvard, @350 itself, @FossilFreeMIT and @divesthackney. These nodes were created around campaigns at specific institutions (NYU, Harvard, MIT, and the London Borough of Hackney) but morphed into central connectors in the movement; @DivestUK, @DivestDE (divest Germany) and @350Australia are not linked to an institution specific campaign but seek to influence policy in a country.

3.3 *FF Hashtags and Tweets*

We extracted all tweets and retweets from each of the 504 handles. Not surprisingly, the most frequently used hashtags by fossil free nodes were #divest and #divestment, while #keepitintheground is used by both movements (Table 3). Also, 350.org often used hashtags with some variations on climate, consistent with its broader scope. In addition to fossil free, 350 also participates in campaigns targeted at specific pipeline or mining projects.²⁶

Table 4 reports the evolution of the Fossil Free movement over time. In 2008, when 350.org was founded, there was only one tweet, which did not receive any kind of attention or interaction on the platform. In 2012, McKibben's article went viral and after the first FF campaign was launched in 2013 the number of tweets, retweets and replies grew exponentially. Not surprisingly in 2015, the year of the adoption of the Paris Agreement and of the related "Keep It in the Ground" campaign, the Twitter interaction about the FF movement reached its peak. In the following years, the number of tweets, replies, retweets, and quotes remained steadily high, in line with the overall growth of the movement (Table 4, Panel A).

The size and the relevance on Twitter of the Fossil Free movement can be better appreciated through a comparison with "Divestment Facts," a counter campaign launched by the Independent Petroleum Association of America (IPAA) with the goal "to educating the public and institutions alike on the facts about divestment".²⁷ IPAA members would be hardest hit from a ban on exploration and production restrictions. The IPAA employed the economic consultancy Compass Lexecon to calculate the alleged cost of divesting for university endowments, created a dedicated website (<https://divestmentfacts.com>), a Twitter

²⁶ For instance, #nokxl refers to the Keystone XL Pipeline project in the United States, while #StopAdani seeks to stop the Indian Adani Group from expanding its coal operations.

²⁷ In its website, the association is described as the "voice for the exploration and production segment of the industry" representing independent producers that "develop 91 percent of the nation's oil and natural gas wells" in the United States (<https://www.ipaa.org/about/>).

account (@DivestmentFacts) and promoted the hashtag #divestmentpenalty (DivestmentFacts.com 2022). As Panel C of Table 4 shows, the campaign was never able to garner media attention, and by 2021 its activity on Twitter has almost completely disappeared. Ironically, the tweet from Divestment Facts with the highest level of engagement – reporting a study commissioned by the IPAA that shows the negative effects of divestment – received essentially only critical comments and quote retweets, underlining the conflict of interests behind the study and the importance of fighting climate change.²⁸

4 The Divestment Campaign

This section tracks the pledges from divesting institutions and divestment campaigns, and measures their broader impact using Twitter data. Section 4.1 and 4.2 present the dataset and sample descriptive statistics for divesting institutions and divestment campaigns respectively. Section 4.3 measures the virality of the divestment pledges.

4.1 *Divesting Institutions and Divestment Pledges*

The FF divestment campaigns targeted institutions with investment portfolios and asked them to divest from fossil fuel companies. Because the main objective of the movement was to remove the social license of the fossil fuel industry, the ideal targets were prestigious and high reputation institutions. If successful, a divestment pledge would publicize that the institution distances itself from the fossil fuel industry; if unsuccessful on divestment, the campaign might still be a success because it raises awareness. An example of the latter is the FF divestment campaign aimed at the Nobel Foundation in Sweden, that awards the Nobel Prizes. The campaign is explicitly motivated by the fact that the Foundation “is seen by the public, and politicians (and us!), as a guiding light, showing the way forward for humanity.”²⁹ Likewise, both Go Fossil Free website display the logos of “Notable Divestment Commitments,” a selection of pledges from a Global Divestment Commitments Database (GDGD) with 1,556 individual entries. The selected logos are government sponsored financial institutions (La Banque Postale, the Norwegian Sovereign Wealth Fund, the New York City Pension Fund), leading Universities (Harvard, Oxford), the State of Maine, the Ford Foundation, the Rockefeller Brothers Fund, the UK Royal Family, and the Vatican. The selection criteria are not the size of the divestment but the perceived social influence of the institution, or its proximity to governments and policy makers.

²⁸ Divestment Facts (@DivestmentFacts), TWITTER (Aug. 8, 2018, 10:34 AM), <https://twitter.com/DivestmentFacts/status/1027201476899291136>.

²⁹ Fossil Free, #DivestNobel, <https://gofossilfree.org/se/divest-nobel/#blog>.

To estimate the power of the divestment campaigns that involved these divesting institutions, we construct a database that draws on the 1,556 entries in the FF Global Divestment Commitments Database (GD CD). For each pledge we record the name of the divesting institution, the institution type, the country, a link to the institution's website, the type of divestment (full, partial, coal only, coal and tar sand etc.) and a link to the information source that led to inclusion. In the background, the GD CD also tracks the total assets under management by the divesting institution (i.e., the market value of its portfolio). The value of the fossil fuel divestment is not reported, and often not available.

We have downloaded the publicly available data in July 2021 and again in December 2021. We further augmented the database by adding a field with the information source (press release, Twitter post, news article), the date of the first announcement, the value of the divestment pledge (when available) and the Twitter handle of the divesting institution. For the latter we first performed a Google search for the respective institution's name and the word "twitter" (for example, "Archdiocese of Malta AND twitter"). We verified the description to ensure that we had found the correct institution. We found 845 unique handles in our sample of 1,477 institutions (after duplicate removal).

Table 5 – which lists the first ten divesting institutions who committed to divest from fossil fuel companies – demonstrates how at the beginning of the movement the pledges came mainly from educational and faith-based organizations.

4.2 Fossil Free Divestment Campaigns

We also collected tweets from divesting institutions or tweets that mention the divesting institutions in the context of the fossil free campaign. To retrieve all relevant tweets, we employed the Twitter Academic Research application programming interface (API) v2³⁰ that we accessed through Twarc2.³¹ We ran three queries. The first query contains tweets from divesting institutions with reference to fossil fuel; the second query are tweets about the divesting institutions; the third query searched for all tweets that mention fossil fuel divestment.

For the first query we extracted the tweet history of the 845 divesting institutions with a Twitter handle if they contained the words divest, divestment, fossilfree, fossilfuel, fossilfuels or the hashtag KeepitintheGround.³²

³⁰ Twitter Development Platform, Getting Started with the Twitter API, <https://developer.twitter.com/en/docs/twitter-api/getting-started/about-twitter-api>.

³¹ Twarc Project, twarc2, https://twarc-project.readthedocs.io/en/latest/twarc2_en_us/.

³² The exact search expression was "from:username (divest OR divestment OR fossilfree OR fossilfuel OR fossilfuels OR KeepitintheGround OR fossil)".

For the second query we searched the text of all tweets in the Twitter archive for mentions of one or more of the 845 divesting institution handles.³³ Multiple mentions were fairly common and we eliminated the resulting duplicates. Since we wanted to track the mention of institutions *targeted* by 350 and not made by 350 itself, we also eliminated tweets mentioning @350 and @350Australia. After these exclusions, we retained 127,929 fossil fuel divestment tweets mentioning at least one of the divesting institutions. The strategy underestimates the total impact of the divestment pledges, because we could not search for mentions of 714 divesting institutions that have no twitter handle.³⁴ However, we could be certain that the bulk of the tweets we retained were directly related to the divestment pledges of institutions in the fossil free divestment database.

The third query captured all fossil free divestment related tweets, retweets, replies and quotes.³⁵ It is more general than the previous queries and captured the full impact of the fossil free divestment movement. We retained 418,901 tweets and 945,016 retweets; there were also 40,927 replies and 33,557 quotes (Table 4, Panel B). Figure 2 Panel A shows cumulative count of tweets and retweets from the beginning to the end of the sample period.

For the third query we also computed an upper bound for the number of views. To obtain this estimate we multiplied the number of tweets and retweets with the number of follows of the author. This provides an upper bound for the number of views because not all tweets or retweets are viewed, and the number of followers changes over time.³⁶ Our estimate of the upper bound for the cumulative number of views of the fossil fuel divestment campaign on Twitter is approximately 20 billion (Figure 2, Panel B). Figure 3 shows the monthly intensity of the number of tweets, retweets, and views. The greatest intensity was around the time of the Paris agreement in 2015, but there are distinct peaks in later years. We use these peaks to find days when tweets went viral.

Table 6 lists the thirty authors that made the largest contribution to the campaign when ranked by the potential number of views. The total is the product of the number of times an author tweeted or retweeted and the number of followers in March 2023. The most important contributor has been The Guardian newspaper tweeted 143 times and had almost 11 million followers in March 2023 making it the top contributor with up to 1.5 billion views. The New

³³ The exact expression was "*@username (divest OR divestment OR fossilfree OR fossilfuel OR fossilfuels OR KeepitintheGround)*".

³⁴ We also tried a string search using the names of these institutions but without success; there were too many duplicates and it was not possible to narrow down the search with accuracy.

³⁵ The exact search query was: *twar2 search --archive --start-time --end-time '(divest OR divestment OR divesting OR divestnow) (fossil OR fossils OR fossilfree OR fossilfuel OR fossilfuels OR keepitintheGround OR climate OR climatechange OR actonclimate OR climatestrike OR climateaction OR climateemergency OR coal OR greennewdeal OR 350ppm OR fridaysforfuture OR cop21 OR cop26)'*.

³⁶ The Twitter archive does not contain the number of followers of the author at the time of the tweet, but with an archive search writes out the number of followers at the time the query was run. The number of followers can go up or down.

York Times tweeted less often but has more followers, putting it in second place. Potential views provide an approximate measure of how many people were made aware about the fossil fuel divestment narrative and the key contributors play a central role in fostering viral divestment pledges on twitter.

4.3 *FF Divestment Virality*

We next examine the propagation of the divestment campaigns on Twitter, define “virality”, and identify the points in time when divestment-related tweets “went viral”.³⁷ The term “viral marketing” goes back to the late 1990s and refers to a marketing technique where users help to spread the advertiser’s message to other users; more recently the virality concept has been applied to the spread of information among social media users (Campbell et al. 2022). The term is also used to characterize the strength of contagion in economic narratives (Shiller 2017).

We construct two time-specific measures of divestment campaign virality. The first measure captures the potential number of users who view the tweets (Campbell et al. 2022). It combines the number of tweets (including retweets)³⁸ (*#tweets*) per day and the number of followers (in thousands) for users that tweeted about divesting institutions (*#followers*). Concretely, we define a *Virality Dummy* taking the value one in days when both variables *#tweets* and *#followers* are in the top decile, and zero otherwise.³⁹ The *Virality Dummy* identifies important days at any point in the campaign but is not directly related to the announcement day of an investment pledge. In contrast, the second measure, the *Combined Virality Dummy*, is explicitly tied to the investment pledges. It is only set equal to one if a tweet-based viral day was preceded by at least one divestment announcement in the previous 30 days. There were 323 such “viral” days.

Table 7 reports the top-20 most viral dates for all fossil fuel related divestment tweets from the third query. As the table shows, the divestment campaigns that went viral on Twitter had different scopes. While the majority announced or reported a divestment pledge, others aimed at drawing attention to eminent organizations to pressure them into divesting from fossil fuels, for example Harvard, Oxford and the Bill & Melinda Gates Foundation. Harvard University went viral several times. Significantly, two of the most viral days out of 20 involved the Irish divestment law that we documented in the introduction.

³⁷ We focus on Twitter because it has the largest impact on journalists, politicians, and senior decision makers.

³⁸ Campbell et al. (2022) at 15: “the concept of retweeting, or resharing in general, is part of what fuels the speed and depth of dissemination on social media.”

³⁹ Campbell et al. (2022) use a similar approach for their *Viral Earnings* variable.

5 Event Study: Impact on Stock Prices

In this section we test if viral tweets associated with divestment campaigns and pledges had an impact on stock returns. We consider three different groups of companies: (1) the Carbon Underground 200 that were specifically targeted by the FF divestment movement; (2) fossil fuel companies not included in the CU 200 list; and (3) high carbon emitting companies in other sectors, such as cement or airline companies. If the impact of divestment is primarily driven by selling pressure and downward sloping demand curves for stocks, then we would expect to see the largest impact on the first group, the FF movement's declared divestment targets. We would also expect some impact on the second group because many institutions pledged to divest from all fossil fuel companies.

Note that the events we identify mark divestment announcements, not actual sales, that could follow much later.⁴⁰ If the market expects the sale to be delayed or uncertain we would observe no impact on prices, even for the first group. In any case, we would expect an insignificant impact on the third group because the divestment pledges do not cover cement companies or airlines.

In contrast, if the FF movement is an economic narrative reaching companies that fit the narrative even if they are not directly targeted for divestment, then viral carbon divestment pledges should have a much broader impact. The effect of stigmatization of some fossil-fuel companies is not limited to those companies but may extend to all high-carbon emitters, if the narrative shifts social preferences, and if transition risk increases for all high-carbon emitters. In this case we expect to observe negative abnormal returns for all three groups.

5.1 Data and Methodology

To perform the event study, we identify potential targets of the FF movement and classify them into the three groups described above: (1) the Carbon Underground 200 (CU 200); (2) other coal, oil and gas companies; (3) other high carbon emitters (Scope 1, 2 and 3).

We combine two datasets for the time-series variable of the CU 200 sample. First, we use the original list of Top 200 listed companies by estimated carbon reserves – 100 coal companies and 100 oil & gas companies - published by Carbon Tracker in 2011 (Carbon Tracker 2011). We update this list with a seven-year history of CU 200 companies (Q4 2014-Q4 2020), provided by FFI Solutions. The result is a list with 1200 observations. There were 27 duplicates and 113 companies with only one or two years of data; we excluded these observations. The resulting CU 200 unbalanced panel contained 1060 firm-year observations for 218 unique firms. We have annual observations between 2011 and 2014, and quarterly

⁴⁰ In the case of Harvard, for example, the Harvard Crimson note that “Fossil fuels make up less than 2 percent of the University’s endowment — but they won’t disappear overnight” (Goodman and Griffin 2021).

observations between 2014 and 2020. For the events we study we require daily observations, so that we define a daily dummy set to one if a company was on the CU 200 at the beginning of the year or quarter and zero otherwise. There were 113 firms that were on the CU 200 list on all days during the observation period.

To identify the second group, we used the Global Industry Classification Standard (GICS) industry group 101020 “Oil, Gas & Consumable Fuels”, an industry taxonomy developed by MSCI and S&P and widely used by the global financial community. We retrieved the relevant companies and excluded those that were already on the combined CU 200 list.

Finally, the third group includes companies in other high carbon emission sectors. We used the top ten industries in terms of average Scope 1, 2 and 3 emissions as reported by Bolton and Kacperczyk (2021). Companies already included in the CU 200 or “Oil, Gas & Consumable Fuels” industry group were excluded.

We calculate cumulative average abnormal returns for the three different groups around viral days. We use the MSCI AC World US\$ Price Index for the baseline model. As a robustness test, we also calculate abnormal returns for each of the countries with the largest number of sample companies, namely Australia, Canada, China, and the US, using local market indices.⁴¹ We use two short event windows, (-1, +1) and (-3, +3), to limit potential confounding effects. The cumulative average abnormal returns (CAAR) are tested for significance using a simple t test. All results are qualitatively similar if we use alternative parametric and non-parametric tests.

The initial set of dates to consider are the 323 viral days (with the *Combined Virality Dummy* equal to one) described in Section 4.3. We restrict this further to most viral divestment campaign dates. In particular, we select only the top 1 percentile of dates according to the number of daily tweets and retweets and exclude the dates that overlap with other (earlier) viral days within the (-3, +3) interval. The final sample consists of 25 viral divestment campaign dates between 2014 and 2021.⁴²

As a placebo test, we use a similar approach to determine the days with the lowest number of mentions of the divestment campaign on Twitter. We select the dates in the bottom 10th percentile according to the daily number of tweets and followers, and without any divestment pledge made in the previous 7 days. On these days there were less than three tweets and retweets a day. After excluding weekends and dates that overlap within the (-3, +3) interval, we get a sample of 18 low Twitter activity days.

⁴¹ This robustness test is done using the event study tool in WRDS.

⁴² Two viral dates were public holidays. In these cases, we chose the next trading day.

We extract stock price data for Canadian and US companies from Compustat North America and for all other countries – from Compustat Global. MSCI AC World US\$ Index returns, and daily currency rates are obtained from Refinitiv.

5.2 Results

Tables 8 and 9 present our main results. Table 8 shows the CAARs around viral divestment pledges for US companies for the subsample groups. Table 9 presents the same analysis for non-US (and Canadian) companies and three individual countries with the largest number of sample companies (besides the US), namely, Australia, Canada, and China.

Panel A of Table 8 reports significant negative cumulative average abnormal returns for all the three groups. We find the largest negative CAARs for group (1), the carbon underground companies targeted by the FF movement. For the narrower three-day window $[-1,+1]$ there is a -0.9% loss that is significant at the one percent level; in terms of market value this sums up to losses of 3.5 billion dollars on average and 87 billion dollars in total. For the wider window $[-3,+3]$ the losses are larger; 4.8 billion on average and 121 billion dollars in total. This finding is consistent with the negative price pressure and stigmatization hypothesis.⁴³

For group 2, coal, oil and gas companies that are not included in group (1) we also find negative CAARs, -0.4% in a three-day event window; again this finding is consistent with the price pressure and stigmatization hypothesis because some divesting institutions do not distinguish between the Carbon Underground 200 and fossil fuel companies in general. However, we further observe negative and significant CAARs (-0.2% in a three-day event window) for group (3) (albeit significantly smaller than for group 1), which suggests a broader effect from the divestment campaign. A similar pattern holds for a sample of global firms (excluding Canada and US) in Panel A of Table 9 and a sample of Canadian and Chinese firms in Panels C and D of Table 9.

In Panel B of Table 8, we perform a placebo test using days with hardly any Twitter activity as event days. None of the CAARs, except for those of group (2) in the $[-3,+3]$ event window, are significant, and there is no significant difference between the returns of groups (1) and (3). The results are consistent across countries except for Australia (in Panel B of Table 9). We do not observe any negative effect from divestment campaigns on Australian companies in all three samples. On the contrary, results show a positive effect for group (2) and (3) companies.

⁴³ Price pressure would require relatively large amounts to be divested or expected to be divested; many of the institutions in our sample have relatively small holdings in Carbon Underground 200 companies, but we do not have systematic data on this point across all divesting institutions.

It is conceivable that in Australia divestment pledges have had no impact because of the unique political context driven by the powerful Australian fossil fuel lobby (Wright, Nyberg, and Bowden 2021; Crowley 2021). If investors expect the power of this lobby to persist, they may price in an Australian exception for fossil fuel companies. The sample is too small to draw definite conclusions, but this Australian exception is striking.

Overall, the general finding – negative CAARs in all the three sample groups (in all countries except Australia) – suggests that there is more to the prevalent finance hypothesis that divestment primarily operates through selling pressure on stock prices. The effects of divestment are far broader than simply through selling pressure; they also work by shifting social preferences. To be sure, our results are consistent with the hypothesis that the FF divestment movement influences public opinion in general through its economic narrative. It has a broader impact that goes beyond the fossil fuel industry and affects all the high carbon emitters. Our findings are also consistent with the temporal and cross-section distribution of the “carbon premium” documented by Bolton and Kacperczyk (2021). They rationalise their finding with increased investor awareness since the signing of the Paris agreement in 2015. Our findings are consistent with this general explanation, but we highlight the special role of a particularly powerful social agent raising awareness, the Carbon Underground 200 divestment movement.

6 Divestment Pledges and Net-Zero Commitments

One of the most viral divestment pledges in our sample is the 2018 divestment pledge of Ireland. In the introduction we indicated how Ireland’s principle-based divestment pledge preceded its broader net-zero commitment and the subsequent announcement of the decarbonization of the Irish strategic investment fund. In this section we explore whether the effects of this net zero commitment extend to the full sample of viral pledges. In this view markets interpret viral divestment pledges as a lead indicator for credible net-zero commitments tied to the carbon budget. These commitments from cities, regions, companies, and countries increase the risk of investing in high-level carbon emitters.⁴⁴

To test the lead indicator hypothesis, we constructed a database of net-zero commitments using data from Net Zero Tracker (NZT). NZT tracks all commitments from United Nations Framework Convention on Climate Change (UNFCCC) member states, regions in the 25 highest emitting countries, cities with population greater than 500,000, and the 2,000 largest publicly-listed companies (Lang et al. 2022). Table 10 Panel A shows the earliest pledges from entire countries and Panel B the most important pledges when in terms of real GDP. The earliest commitment from a high-GDP country enshrined in law was from Sweden in 2018. The commitments from the largest 20 economies date to 2020/21. We matched this

⁴⁴ Net-zero refers to “cutting greenhouse gas emissions to as close to zero as possible”.

data to our divestment pledges database using the geographic location of the divesting institutions.

If divestment pledges are lead indicators for net-zero commitments, we expect to find a correlation between the geographic location of the divesting institutions and net zero-commitments from entities in the same jurisdiction.⁴⁵ Table 11 compares the mean number of divestment pledges for countries that had made net-zero commitment by the end of 2021 with those that had not. The difference is large and statistically significant.

For the United States we conduct a more detailed analysis considering all the net-zero commitments by states, cities and companies and match these to the divestment pledges from U.S. institutions that went viral between 2010 and 2021. Figure 4 shows a clear temporal pattern. The number of viral divestment pledges increased sharply from 2014 onwards, while net-zero commitments only started in 2017. Viral divestment campaigns preceded and likely pushed the net-zero commitments. The political mechanism that links divestment pledges to net-zero commitment could be explored in future research, for example by investigating the influence of divesting institutions on voter opinion and the campaign on political careers.⁴⁶

7 Conclusion

In conclusion, the Go Fossil Free divestment movement has been able to contribute to a change in social preferences through its mass-media coverage and targeting of prominent institutions. The paper presents evidence that viral divestment pledges have preceded net-zero commitments from divested entities and countries where the divesting institutions have social influence. Voice through divestment had an impact beyond fossil fuel companies and increased the carbon premium for all high-level emitters such as cement companies. The divestment movement is a finance parable that was able to convey a moral principle in a simple story that people could understand. The narrative might mutate blurring its moral component, and there could be a new campaign to pressure any risk averse investor to decarbonize portfolios. Overall, the paper argues that divestment is an effective form of "voice" in driving change in the context of net-zero. Voice through divestment could be effective for other environmental, social or governance issues as well, but only if it is linked to a broader social movement around a compelling economic narrative.

⁴⁵ We are assuming that the prominence of the divesting institutions is greatest in the city, region, or country where the institutions is located. This is not unreasonable even for institutions with global influence like the Holy See because divestment pledges usually came from local churches, not from the Vatican itself.

⁴⁶ There is anecdotal evidence that some participants in the fossil free movement successfully transitioned into politics (Murray 2022).

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Table 1

Abnormal Returns Around Ireland's Divestment Announcements

The table shows abnormal returns around Ireland's divestment announcements on 26 January 2017 and 12 July 2018 for US companies. The two announcements went viral on Twitter, but the degree of virality was significantly higher for the latter. The Ireland Strategic Investment Fund (ISIF) divested from 38 global fossil fuel companies in December 2018 and January 2019; the total value of the divestment was €72m. The cumulative abnormal returns (CARs) are relative to the MSCI AC World US\$ index and they are reported for three groups: The Carbon Underground 200 targeted by the fossil free divestment movement [1]; other fossil fuel companies [2] and a third group of high-carbon emitters that are not fossil fuel companies (e.g. cement) [3]. Fossil Fuel companies are from GIC Industry 101020 (Oil, Gas & Consumable Fuels). High Carbon Emitters are from GIC Industries 551050, 551010, 203020, 551030, 151040, 203010, 151020, 151050, and 151010, as in Bolton and Kacperczyk (2021). CARs are winsorized at the 99th percentile. We also report inflation-adjusted (base January 2023) dollar returns in millions calculated by multiplying the market capitalization of the sample firm the day before the respective event window with the cumulative abnormal returns in the three (and seven) days around the announcement. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. CARs for US companies on 26 January 2017

		[1]	[2]	[3]	(1)-(2)	(1)-(3)	(2)-(3)
CAR (-1,+1)	Mean	-1.02%*	-0.44%	-0.53%***	0.577	0.472	0.868
	Median	-1.48%*	-0.53%	-0.72%***	0.211	0.267	0.311
Dollar returns (\$ millions)	Mean	-289.7*	3.4	-13.7	0.000	0.000	0.422
	Median	-50.1***	-0.2	-6.3***	0.000	0.016	0.000
<i>Sum of values (\$ millions)</i>		-10,718	638	-3,158			
CAR (-3,+3)	Mean	-3.37%***	-1.39%***	0.24%***	0.130	0.000	0.012
	Median	-3.65%***	-0.67%**	0.12%	0.001	0.000	0.016
Dollar returns (\$ millions)	Mean	-840.0**	4.7	-8.4	0.000	0.000	0.695
	Median	-305.0***	-1.0	0.6*	0.000	0.000	0.055
<i>Sum of values (\$ millions)</i>		-31,077	879	-1,938			
Number of unique firms		40	177	214			

Panel B. CARs for US companies on 12 July 2018

		[1] Carbon Underground 200	[2] Fossil Fuel Companies	[3] High Carbon Emitters	(1)-(2)	(1)-(3)	(2)-(3)
CAR (-1,+1)	Mean	-3.11%***	-0.94%***	-0.38%*	0.001	0.000	0.093
	Median	-2.37%***	-0.56%***	-0.26%***	0.000	0.000	0.223
Dollar returns (\$ millions)	Mean	-352.6**	-10.6	-20.4	0.000	0.000	0.638
	Median	-125.0***	-1.0**	-2.3**	0.000	0.000	0.651
<i>Sum of values (\$ millions)</i>		-14,104	-1,883	-4,360			
CAR (-3,+3)	Mean	-4.06%***	-2.66%***	-1.74%***	0.214	0.000	0.122
	Median	-3.11%***	-2.36%***	-1.71%***	0.103	0.008	0.233
Dollar returns (\$ millions)	Mean	-521.2***	-56.0***	-86.8***	0.000	0.000	0.249
	Median	-171.1***	-5.6***	-18.7***	0.000	0.000	0.079
<i>Sum of values (\$ millions)</i>		-20,849	-9,990	-18,490			
Number of unique firms		40	177	214			

Table 2**Nodes with Highest Degree of Centrality**

The table shows the twenty nodes that are most central to the 350/Go Fossil Free Twitter network when ranked by their normalized “between” factor. The between factor is calculated by dividing the number of shortest paths that pass through a node by the total number of shortest paths. Shortest path is the shortest path between any two nodes. The table also reports the “in” and “out” connections for any one node.

RANK	@HANDLE	OUT	IN	BETWEEN	RANK	@HANDLE	OUT	IN	BETWEEN
1	nyudivest	171	144	4.4%	11	BestToDivest	50	132	1.2%
2	DivestHarvard	91	119	3.2%	12	FossilFreeSWK	56	94	1.1%
3	350	99	92	2.1%	13	divestumass	84	101	1.0%
4	FossilFreeMIT	155	89	2.1%	14	DivestVU	103	82	1.0%
5	divesthackney	81	131	2.0%	15	350Australia	60	60	0.9%
6	DivestDE	30	139	2.0%	16	massdivest	50	61	0.9%
7	DivestFund	93	98	1.9%	17	350Vermont	73	62	0.9%
8	divestinvestorg	88	72	1.6%	18	DivestMcGill	137	82	0.8%
9	DivestSmith	113	76	1.5%	19	DivestNobel	34	57	0.8%
10	UKDivest	31	55	1.4%	20	MPDivest	55	46	0.7%

Table 3**Main Hashtags**

The table shows the hashtags that were used most frequently by 350.org and the Go Fossil Free project. They were extracted from the collection of tweets from all 504 nodes. Some hashtags are not completely self-explanatory: #auspol refers to Australian Politics; #nokxl is the collective term use by the opposition movement to the Keystone Oil Pipeline in the United States; #StopAdani is the hashtag of the @stopadani campaign in Australia that opposes the expansion of coal mines controlled by the Adani Group; #NoDAPL opposition to the Dakota Access Pipeline; #StopLine3 opposition to the Line 3 Pipeline; #MAPoli refers to Massachusetts politics.

Rank	350.org		Go Fossil Free	
	Hashtag #	Obs.	Hashtag #	Obs.
1	climate	19,105	divest	10,867
2	climatechange	18,191	divestment	7,095
3	actonclimate	8,620	fossilfree	5,741
4	keepitintheground	7,267	climatechange	3,339
5	climatestrike	6,916	climate	3,327
6	auspol	6,619	fossilfuels	2,133
7	fossilfree	6,602	fossilfuel	1,946
8	nokxl	6,502	keepitintheground	1,893
9	coal	5,992	divestnow	1,730
10	divest	5,871	mapoli	1,230
11	stopadani	5,294	actonclimate	1,121
12	climateaction	4,569	fracking	910
13	greennewdeal	4,106	coal	902
14	divestment	4,041	cop21	853
15	nodapl	3,956	climateemergency	809
16	stopline3	3,797	nodapl	797

Table 4**Tweets and Retweets by Year**

The table shows the number of fossil fuel divestment tweets, replies, retweets and quotes. Panel A shows the tweets associated with the 350.org and the go fossil free movement between 2008 and 2021; Panel B shows the number of tweets mentioning divestment in the context of fossil fuels and climate change; Panel C shows the number of tweets from the @DivestmentFacts handle sponsored by the Independent Petroleum Association of America (IPAA).

Panel A. Number of Tweets from 350 and the Go Fossil Free Campaign

Year	Total	Retweets	Tweets	of which:	
				Replies	Quotes
2008	1	0	1	0	0
2009	0	0	0	0	0
2010	127	19	108	1	0
2011	285	109	176	1	0
2012	591	144	447	14	0
2013	10,880	3,556	7324	665	0
2014	14,856	6,311	8545	821	1
2015	28,312	12,923	15,389	1,298	929
2016	27,324	14,330	12994	767	2,138
2017	18,283	9,438	8845	594	1,757
2018	14,734	7,421	7313	696	1,399
2019	15,977	8,314	7,663	1,387	1,620
2020	17,255	8,209	9,046	2,140	2,039
2021	26,861	11,655	15,206	5,750	2,853
Total	175,486	82,429	93,057	14,134	12,736

Panel B. Number of Tweets mentioning Divestment from Fossil Fuels

Year	Total	Retweets	Tweets	of which:	
				Replies	Quotes
2008	1	0	1	0	0
2009	27	0	27	2	0
2010	300	4	296	5	0
2011	134	9	125	2	0
2012	8887	3882	5005	85	0
2013	54,605	23,189	31416	1,318	2
2014	137,090	70,948	66142	2970	27
2015	293,506	162,077	131,429	5,704	2808
2016	149,248	100,272	48976	1,507	2,620
2017	163,773	123,804	39969	2,539	3,513
2018	173,683	129,889	43794	3,717	4,270
2019	151,289	111,786	39,503	8,084	6,869
2020	164,689	118,939	45,750	7,228	6,727
2021	140,706	100,217	40,489	7,766	6,721
Total	1,437,938	945,016	492,922	40,927	33,557

Panel C. Number of Tweet from the @DivestmentFacts handle sponsored by the Fossil Fuel Industry

Year	Total	Retweets	Tweets	of which:	
				Replies	Quotes
2015	412	103	309	26	10
2016	523	50	473	12	7
2017	177	16	161	3	6
2018	198	17	181	1	6
2019	284	1	283	2	0
2020	116	5	111	29	0
2021	21	1	20	6	1
Total	1,731	193	1,538	79	30

Table 5**Earliest Divestment Pledges**

The table shows the first ten of 1,555 pledges recorded in the global divestment database. They came from educational institutions, cities and faith institutions.

Divesting institution	Type of organization	Announcement date
Hampshire College	Educational Institution	01-Dec-11
City of Oakland, CA	Government	14-Jun-12
Unity College	Educational Institution	01-Nov-12
Massachusetts United Church of Christ	Faith-based Organization	10-Dec-12
City of Santa Monica, CA	Government	26-Feb-13
United Church of Christ, Minnesota Conference	Faith-based Organization	05-Mar-13
Trinitarian Congregational United Church of Christ, Warwick, MA	Faith-based Organization	10-Mar-13
Uniting Church, New South Wales & ACT, Australia	Faith-based Organization	16-Apr-13
City of Richmond, CA	Government	07-May-13
First Parish Church UU, MA	Faith-based Organization	02-Jun-13

Table 6

Tweet and Retweet Authors with Most Potential Views

The table ranks institutions or individuals who tweeted or retweeted about fossil fuel divestment between January 2008 and December 2021 by an upper bound estimate of the potential number of views. Column 1 shows the rank, Column 2 the potential number of views, Column 3 the sum of tweets and retweets and Column 5 the number of followers the author had during the latest Twitter archive search (March 2023). Column 6 shows the authors Twitter handle. The list is dominated by newspapers and new services like The Guardian, The New York Times, Bloomberg, CNN, Reuters, HuffPost, CNBC, ABC News, The Wall Street Journal, The Financial Times (with three handles), The Independent, and magazines like The Nation, The New Yorker and TIME. From the movement itself, 350.org and Bill McKibben were the most visible authors. The most visible external contributor is the American actor Mark Ruffalo; Leonardo DiCaprio has more followers but tweeted less often. @climatehawk1 and @johnlundin are climate activists. @YourAnonNews is part of nerdculture.de, a decentralized social network. Greenpeace and the Sierra Club environmental NGOs. @democracynow is the handle of an independent news service. @mashable is a blog platform. @ClimateReality is a project set up by former U.S. Vice-president Al Gore.


Rank	Potential Views Total	Tweets and Retweets Total	Name	Number of Followers	Handle (@)
1	1,677,677,386	154	The Guardian	10,894,009	guardian
2	769,909,560	14	The New York Times	54,993,540	nytimes
3	731,772,238	1,913	350 dot org	382,526	350
4	636,204,512	76	Mark Ruffalo	8,371,112	MarkRuffalo
5	597,487,410	65	Bloomberg	9,192,114	business
6	438,488,928	1,104	Bill McKibben	397,182	billmckibben
7	386,153,705	203	Greenpeace International	1,902,235	Greenpeace
8	384,366,910	6,445	climatehawk1	59,638	climatehawk1
9	334,969,392	4,724	John Lundin 	70,908	johnlundin
10	306,289,360	5	CNN	61,257,872	CNN
11	231,752,808	9	Reuters	25,750,312	Reuters
12	214,147,604	11	TIME	19,467,964	TIME
13	212,906,400	19	HuffPost	11,205,600	HuffPost
14	179,133,812	143	CNBC-TV18	1,252,684	CNBCTV18Live
15	169,892,832	136	The Nation	1,249,212	thenation
16	158,952,784	304	Guardian Environment	522,871	guardianeco
17	158,386,608	41	Guardian news	3,863,088	guardiannews
18	150,817,953	19	Anonymous	7,937,787	YourAnonNews
19	148,807,890	394	Sierra Club	377,685	SierraClub
20	125,633,312	14	The New Yorker	8,973,808	NewYorker
21	124,745,096	7	ABC News	17,820,728	ABC
22	123,060,240	6	The Wall Street Journal	20,510,040	WSJ
23	112,975,800	15	Financial Times	7,531,720	FinancialTimes
24	106,448,260	19	Financial Times	5,602,540	FT
25	102,549,402	162	Climate Reality	633,021	ClimateReality
26	102,281,960	11	Mashable	9,298,360	mashable
27	100,225,140	5	The Washington Post	20,045,028	washingtonpost
28	97,606,440	5	Leonardo DiCaprio	19,521,288	LeoDiCaprio
29	95,613,600	120	Democracy Now!	796,780	democracynow
30	94,331,380	26	The Independent	3,628,130	Independent

Table 7
Top-20 Fossil Fuel Divestment Viral Dates

The table lists the 20 most viral dates, which identify the days when tweets mentioning fossil fuel divestment reached the highest virality. Most of the tweets refer to divestment campaigns and coincide with the more restrictive sample that required specific reference to a divesting institution. The table confirms that the raw counts for the restrictive sample vastly understate their visibility. The viral tweets in this table capture the impact of the pledges but also the impact of the campaigns, for example the Harvard and Yale campaigns that were central to the movement. The last column shows a selection of the most viral tweets on the day.

Viral Date	Tweets and Retweets per Day	Views per Day (Upper Bound)	Type of Campaign	Example of Divestment/Campaign Tweet
Jan 11, 2018	13,367	121,212,192	Divestment Pledge	@thenation: "Flanked by Nation contributors Naomi Klein and Bill McKibben, Bill de Blasio just announced that New York City would divest from and sue fossil fuel companies"
Jul. 12, 2018	11,060	114,591,624	Divestment Pledge	@guardian: "Ireland becomes world's first country to divest from fossil fuels"
Jul. 13, 2018	10,301	149,153,664	Divestment Pledge	@Davos: "Ireland becomes the 'world's first' country to commit to divesting from fossil fuels"
Nov. 24, 2019	9,509	89,922,920	Push to divest	@billmckibben: "Not just Harvard--Here's one of Yale footballs leaders with the same message: Climate is an emergency. Divest now."
Jan. 10, 2018	9,286	148,385,664	Divestment Pledge	@MarkRuffalo: "NYC's move to sue and divest from Big Oil is a huge step in curbing the impact of climate change and creating a more responsible financial future for the city. #stopfundingfossils"
Sep. 22, 2014	8,937	324,948,032	Divestment Pledge	@MSNBC: "Rockefellers announce plans to divest fossil fuel assets following largest climate march in history"
Nov. 23, 2019	8,193	139,887,712	Push to divest	@nytimes: "Climate change activists stormed the field at the Yale-Harvard football game on Saturday afternoon, disrupting the game at halftime to call for the universities to divest their investments in fossil fuels"
Apr. 1, 2015	7,303	103,977,312	Divestment Pledge	@guardian: "Guardian Media Group to divest its £800m fund from fossil fuels"
Feb. 13, 2015	7,220	203,305,360	Push to divest	@MarkRuffalo: "Today is Global Divestment from Fossil Fuel day. I will be sending out tweets today on that topic. Please RT"
Sep. 10, 2021	5,533	150,992,912	Divestment Pledge	@algore: "After years of activism from students, faculty & alums, Harvard is finally divesting from fossil fuels. Thank you to @DivestHarvard and all those who pushed to make this happen. Let this be a strong signal to other institutions that the era of fossil fuels is coming to a close."
Sep. 23, 2014	5,044	192,843,136	Divestment Pledge	@Slate: "The Rockefeller Family made billions from oil. Now they're divesting over climate change"
Jun. 5, 2015	4,903	166,872,976	Divestment Pledge	@thinkprogress: "Norway will divest from coal"
Feb. 14, 2015	4,716	73,720,992	Push to divest	@ClimateReality: "For Valentine's Day, break up with fossil fuels & fall in love with renewables http://gofossilfree.org/#divest "
Jan. 23, 2020	4,524	150,847,344	Push to divest	@AP: "U.S. Treasury chief says it's 'a joke' when asked about climate activist Greta Thunberg's recommendation that the public and private sectors should divest from fossil fuels. He says she can't give economic advice until she gets a college degree."
Mar. 16, 2015	4,479	94,914,800	Push to divest	@tveitdal: "Oxford University Fossil Free Divestment Campaign: Group of Oxford alums in occupation!"; @guardian: "'The argument for divesting from fossil fuels is becoming overwhelming' – @arusbringer"
Apr. 16, 2015	4,111	95,375,728	Push to divest	@democracynow: "Harvard Students Expand Blockade Calling for School to Divest from Fossil Fuels"; @guardianeco: "Dear @gatesfoundation @wellcometrust : here's 180,000 reasons why you shd #divest #fossilfuels"
Dec. 13, 2016	4,025	62,746,928	Push to divest	@LeoDiCaprio: "As the hottest year in history concludes it's time for NY to act on climate & divest from fossil fuels http://divestny.org/#DivestInvest "
Dec. 9, 2020	3,843	64,258,032	Divestment Pledge	@billmckibben: "Truly staggering win in New York this a.m.: the state will divest its \$226 billion pension fund from fossil fuels. That's the biggest pension fund yet, it comes after a decade of great activism, and it underlines the weakening power of Big Oil"
Dec. 27, 2021	3,834	13,481,942	Push to divest	@FastCoImpact: "Was 2021 the tipping point for fossil fuel divestment?"
Dec. 20, 2017	3,715	50,638,452	Divestment Pledge	@350: "NY state and city are moving to divest their pension funds from fossil fuels. With combined assets over \$390 billion, these are the largest ever pension fund commitments to freeze and divest from oil, gas and coal in the world."

Table 8

Abnormal Returns around Viral Divestment Pledges for U.S. Companies

The table shows cumulative abnormal returns around the announcement dates of divestment pledges that went viral on Twitter. The sample is confined to U.S. companies. The cumulative abnormal returns (CARs) are relative to the MSCI AC World US\$ index and they are reported for three groups: Carbon Underground 200 companies targeted directly by the divestment movement [1]; other fossil fuel companies [2] and other high carbon emitters that are not directly targeted by the divestment movement (e.g. cement companies) [3]. Panel A reports abnormal returns around the top viral days. We also report inflation-adjusted (base January 2023) dollar returns in millions calculated by multiplying the market capitalization of the sample firm the day before the respective event window with the cumulative abnormal returns in the three (and seven) days around the announcement. Panel B reports results around low Twitter activity dates. Fossil Fuel companies are from GIC Industry 101020 (Oil, Gas & Consumable Fuels). High Carbon Emitters are from GIC Industries 551050, 551010, 203020, 551030, 151040, 203010, 151020, 151050, and 151010, as in Bolton and Kacperczyk (2021). CARs are winsorized at the 99th percentile. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. CAARs for US companies during top viral days (25 event days)

		[1] Carbon Underground 200	[2] Fossil Fuel Companies	[3] High Carbon Emitters	[1]-[2]	[1]-[3]	[2]-[3]
CAAR [-1,+1]	Mean	-0.94%***	-0.41%***	-0.18%***	0.014	0.000	0.029
	Median	-0.85%***	-0.37%***	-0.25%***	0.004	0.000	0.094
Dollar returns (\$ millions)	Mean	-92.7***	-4.6	-15.1***	0.000	0.000	0.078
	Median	-11.4***	-0.2***	-0.6***	0.000	0.000	0.214
Sum of values (\$ millions)		-86,963	-19,643	-82,881			
Sum of values average over days		-3,479	-786	-3,315			
CAAR [-3,+3]	Mean	-1.03%***	-1.01%***	-0.24%***	0.927	0.001	0.000
	Median	-0.99%***	-0.88%***	-0.44%***	0.960	0.001	0.000
Dollar returns (\$ millions)	Mean	-128.7***	-10.9***	-24.2***	0.000	0.000	0.106
	Median	-9.0***	-0.8***	-0.9***	0.000	0.002	0.945
Sum of values (\$ millions)		-120,550	-46,976	-132,772			
Sum of values average over days		-4,822	-1,879	-5,311			
N		937	4,294	4,497			
Number of unique firms		60	257	288			

Panel B. CAARs for US companies during low activity days (18 event days)

Sample	CAAR [-1,+1]	Significance	CAAR [-3,+3]	Significance	Number of firms
Carbon Underground 200 [1]	0.09%		-0.16%		53
Fossil Fuel Companies [2]	-0.08%		-1.03%	***	228
High Carbon Emitters [3]	0.09%		-0.05%		260
[1] vs. [2] (p-value)	0.561		0.004		
[1] vs. [3] (p-value)	0.985		0.515		
[2] vs. [3] (p-value)	0.270		0.000		

Table 9

Abnormal Returns Around Viral Divestment Pledges for Global Companies

The table reports similar result to Table 7 but for global companies. The cumulative abnormal returns (CARs) for global companies are relative to the MSCI AC World US\$ index. Panel A includes all global companies, excluding Canada and the United States. Panel B show results for Australia, a country with a large number of fossil fuel companies and governments that were considered firmly in the hand of the fossil fuel industry. Panel C and D shows the same results for Canada and China. Fossil Fuel companies are from GIC Industry 101020 (Oil, Gas & Consumable Fuels). High Carbon Emitters are from GIC Industries 551050, 551010, 203020, 551030, 151040, 203010, 151020, 151050, and 151010, as in Bolton and Kacperczyk (2021). CARs are winsorized at the 99th percentile. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. CAARs for Global companies (excluding Canada and US) during top viral days (25 event days)

Sample	CAAR [-1,+1]	Significance	CAAR [-3,+3]	Significance	Number of firms
Carbon Underground 200 [1]	-0.16%	***	-0.63%	***	82
Fossil Fuel Companies [2]	-0.21%	***	-0.80%	***	395
High Carbon Emitters [3]	0.15%	***	-0.38%	***	2699
[1] vs. [2] (p-value)	<i>0.714</i>		<i>0.413</i>		
[1] vs. [3] (p-value)	<i>0.009</i>		<i>0.193</i>		
[2] vs. [3] (p-value)	<i>0.000</i>		<i>0.000</i>		

Panel B. CAARs for Australian companies during top viral days (25 event days)

Sample	CAAR [-1,+1]	Significance	CAAR [-3,+3]	Significance	Number of firms
Carbon Underground 200 [1]	-0.36%		0.27%		8
Fossil Fuel Companies [2]	0.22%		1.19%	***	27
High Carbon Emitters [3]	0.28%	***	1.54%	***	144
[1] vs. [2] (p-value)	<i>0.368</i>		<i>0.316</i>		
[1] vs. [3] (p-value)	<i>0.289</i>		<i>0.158</i>		
[2] vs. [3] (p-value)	<i>0.842</i>		<i>0.487</i>		

Table 9 (continued)

Panel C. CAARs for Canadian companies during top viral days (25 event days)

Sample	CAAR [-1,+1]	Significance	CAAR [-3,+3]	Significance	Number of firms
Carbon Underground 200 [1]	-0.85%	***	-1.31%	***	25
Fossil Fuel Companies [2]	-0.48%	***	-1.03%	***	85
High Carbon Emitters [3]	0.01%		-0.14%		174
[1] vs. [2] (p-value)	<i>0.285</i>		<i>0.579</i>		
[1] vs. [3] (p-value)	<i>0.010</i>		<i>0.023</i>		
[2] vs. [3] (p-value)	<i>0.006</i>		<i>0.001</i>		

Panel D. CAARs for Chinese companies during top viral days (25 event days)

Sample	CAAR [-1,+1]	Significance	CAAR [-3,+3]	Significance	Number of firms
Carbon Underground 200 [1]	-0.21%	*	-1.62%	***	18
Fossil Fuel Companies [2]	0.65%	***	-1.90%	***	35
High Carbon Emitters [3]	0.49%	***	-0.64%	***	811
[1] vs. [2] (p-value)	<i>0.001</i>		<i>0.490</i>		
[1] vs. [3] (p-value)	<i>0.002</i>		<i>0.012</i>		
[2] vs. [3] (p-value)	<i>0.299</i>		<i>0.000</i>		

Table 10

Country Net Zero Commitments

The table shows net-zero commitments by country, the end target, the target year, the target status at the end of 2022 and the country's real GDP in billion U.S. dollars. Panel A shows the earliest net-zero commitments; Panel B ranks the countries that have made a commitment by real GDP. The data comes from Net Zero Tracker (<https://zerotracker.net>); see Lang et al. (2022). Net-zero (emissions) and climate neutral implies that all greenhouse gases released by human activity are absorbed or removed; carbon neutral is similar but confined to carbon; reduction v. BAU means a reduction against a “business as usual” scenario.

Panel A - Earliest Net-Zero Commitments by Countries

Status Year	ISO	Country Name	End Target	Target Year	Target Status	Real GDP
2014	SUR	Suriname	Net zero		Achieved (self-declared)	10B
2015	LIE	Liechtenstein	Emissions reduction target	2030		
2015	FIN	Finland	Climate neutral	2035	In policy document	305B
2015	VEN	Venezuela	Emissions reduction target	2030	In policy document	
2015	KGZ	Kyrgyzstan	Other	2050	In policy document	35B
2015	FSM	Micronesia	Net zero	2050	Proposed / in discussion	less than 1B
2015	SMR	San Marino	Emissions reduction target	2030	In policy document	2B
2015	TKM	Turkmenistan	Other	2030	In policy document	76B
2016	DMA	Dominica	Emissions reduction target	2030	In policy document	1B
2016	DJI	Djibouti	Reduction v. BAU	2030	In policy document	6B
2016	BWA	Botswana	Emissions reduction target	2030	In policy document	42B
2017	EGY	Egypt	Other	2030	In policy document	1,388B
2017	SRB	Serbia	Emissions reduction target	2030	In policy document	117B
2017	AZE	Azerbaijan	Emissions reduction target	2030	In policy document	161B
2018	GNQ	Equatorial Guinea	Emissions reduction target	2050	In policy document	26B
2018	ERI	Eritrea	Net zero	2050	Proposed / in discussion	
2018	SWE	Sweden	Net zero	2045	In law	618B

Panel B – Top-20 Net-Zero Commitments by Countries by GDP

Status Year	ISO	Country Name	End Target	Target Year	Target Status	Real GDP
2020	CHN	China	Carbon neutral(ity)	2060	In policy document	27.3E+12
2021	USA	United States of America	Net zero	2050	In policy document	23.0E+12
2020	XXX	European Union	Climate neutral	2050	In law	21.7E+12
2021	IND	India	Net zero	2070	Declaration / pledge	10.2E+12
2021	JPN	Japan	Net zero	2050	In law	5.4E+12
2021	RUS	Russian Federation	Carbon neutral(ity)	2060	In law	4.8E+12
2021	DEU	Germany	Climate neutral	2045	In law	4.6E+12
2021	IDN	Indonesia	Net zero	2060	Proposed / in discussion	3.6E+12
2020	BRA	Brazil	Carbon neutral(ity)	2050	Declaration / pledge	3.4E+12
2020	FRA	France	Net zero	2050	In law	3.4E+12
2020	GBR	United Kingdom	Net zero	2050	In law	3.3E+12
2021	ITA	Italy	Climate neutral	2050	In policy document	2.7E+12
	MEX	Mexico	Carbon neutral(ity)	2050	Proposed / in discussion	2.6E+12
2021	TUR	Turkey	Net zero	2053	In policy document	2.6E+12
2021	KOR	South Korea	Net zero	2050	In law	2.3E+12
2021	CAN	Canada	Net zero	2050	In law	2.0E+12
2021	ESP	Spain	Climate neutral	2050	In law	1.9E+12
2021	SAU	Saudi Arabia	Net zero	2060	In policy document	1.8E+12
2021	AUS	Australia	Net zero	2050	In policy document	1.4E+12
	POL	Poland	Emissions reduction target	2030	In policy document	1.4E+12

Table 11**Divestment Pledges and Country Net Zero Commitments**

The table test the mean difference in the number of divestment pledges between countries that have made a net-zero commitment by the end of 2021 and countries that have not. Note that the sample only includes countries with at least one divestment pledge. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

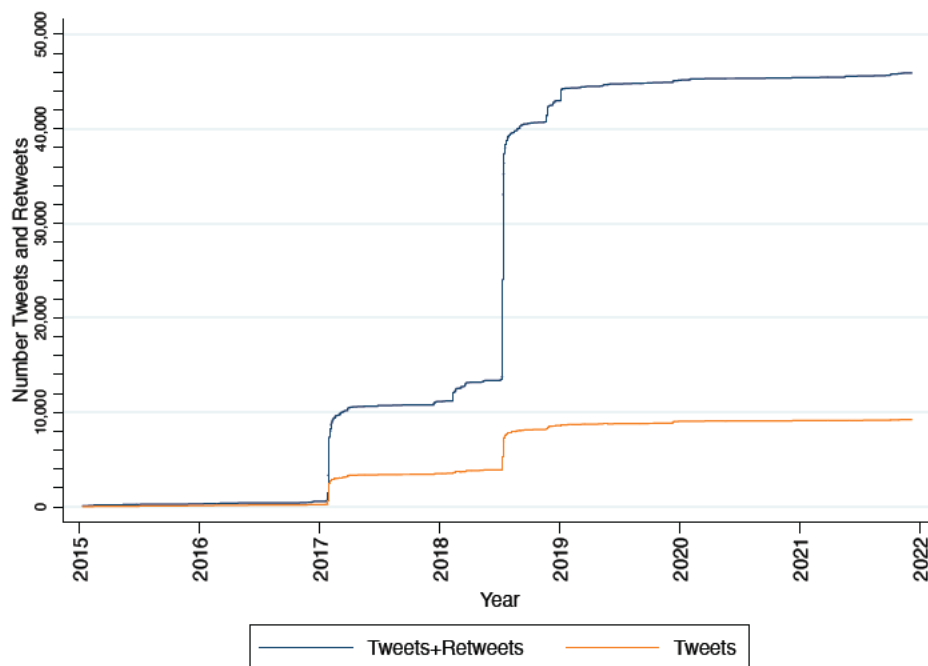
	Countries WITH Net Zero pledges	Countries WITHOUT Net Zero pledges	Difference (p-value)	Significance
Divestment pledges (mean)	36.91	5.40	.0736	*
Number of countries	23	15		

Figure 1

Number of Tweets and Retweets around Ireland's Divestment Announcements

The figure shows the number of tweets and retweets containing the word "Ireland" in tweets and retweets mentioning fossil fuel divestment. To be included the tweet needs to contain the words "divest", "divestment", "divesting" or "divestnow" in combination with fossil, fossils, fossilfree, fossilfuel, fossilfuels, keepitintheground, climate, climatechange, actonclimate, climatestrike, climateaction, climateemergency, coal, greennewdeal, 350ppm, fridaysforfuture, cop21 or cop26. Panel A shows the number daily tweets and retweets over time. There are discrete jumps on the days of the Irish divestment announcement: 26 January 2017, 12 and 16 July 2018. Panel B shows an upper bound estimate on the number of views defined by the sum of the followers of the tweeting and retweeting individuals and institutions. The estimated total reach was more than 300 million.

Panel A. Number of Fossil Fuel Divestment Related Tweets and Retweets mentioning "Ireland"



Panel B. Number of Daily Views of Ireland related Divestment Tweets - Upper Bound in Million (10^6)

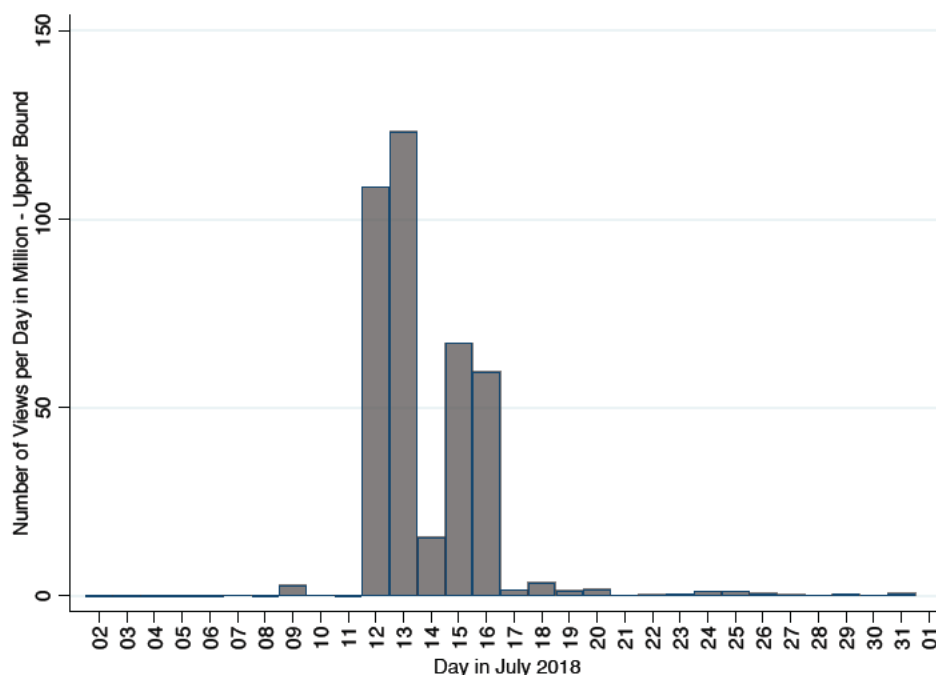
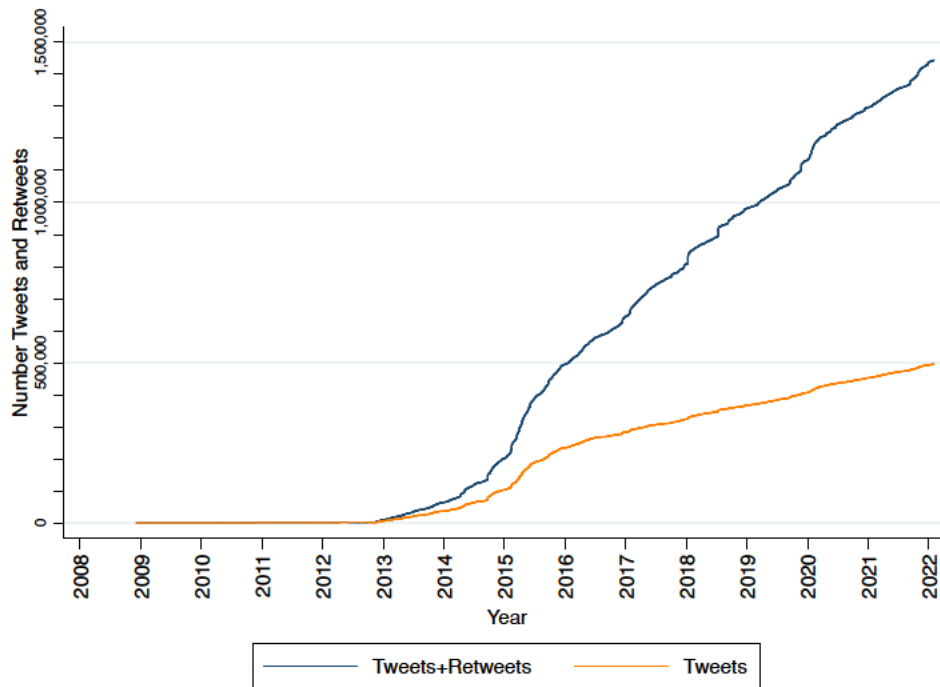


Figure 2

Number of Tweets and Retweets Mentioning Fossil Fuel Divestment

The figure shows the evolution of the number of tweets and retweets mentioning fossil fuel divestment. To be included the tweet needs to contain the words “divest”, “divestment”, “divesting” or “divestnow” in combination with fossil, fossils, fossilfree, fossilfuel, fossilfuels, keepitintheground, climate, climatechange, actonclimate, climatestrike, climateaction, climateemergency, coal, greennewdeal, 350ppm, fridaysforfuture, cop21 or cop26. Panel A shows the evolution in the number of tweets and retweets over time. Panel B shows the upper bound of the number of views measured by the number of followers of authors of the tweet or retweet in March 2023.

Panel A. Evolution of the Number of Tweets and Retweets over Time



Panel B. Evolution of the Number of Views over Time - Upper Bound in Billions (10^9)

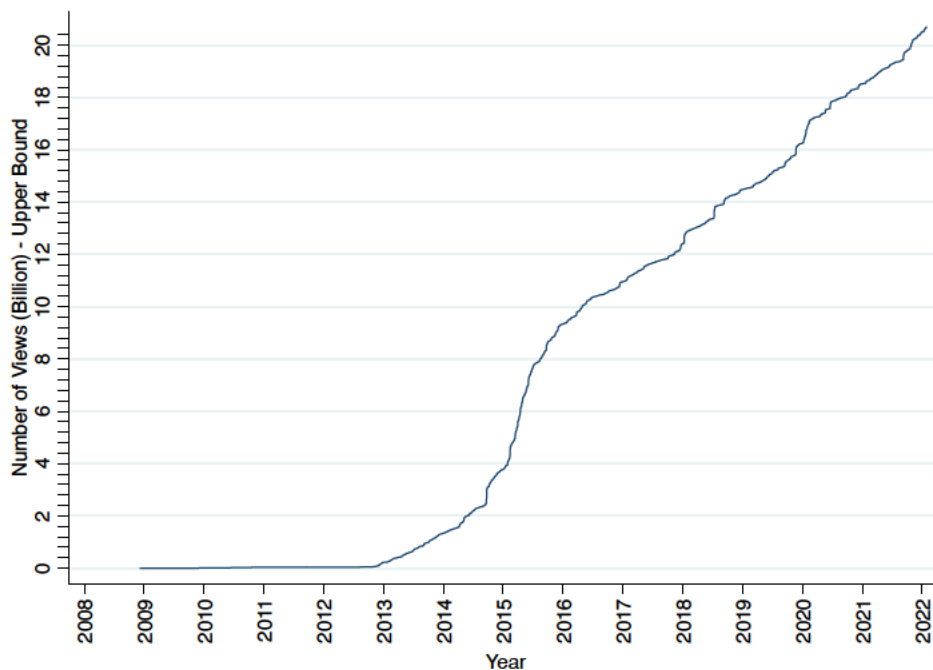
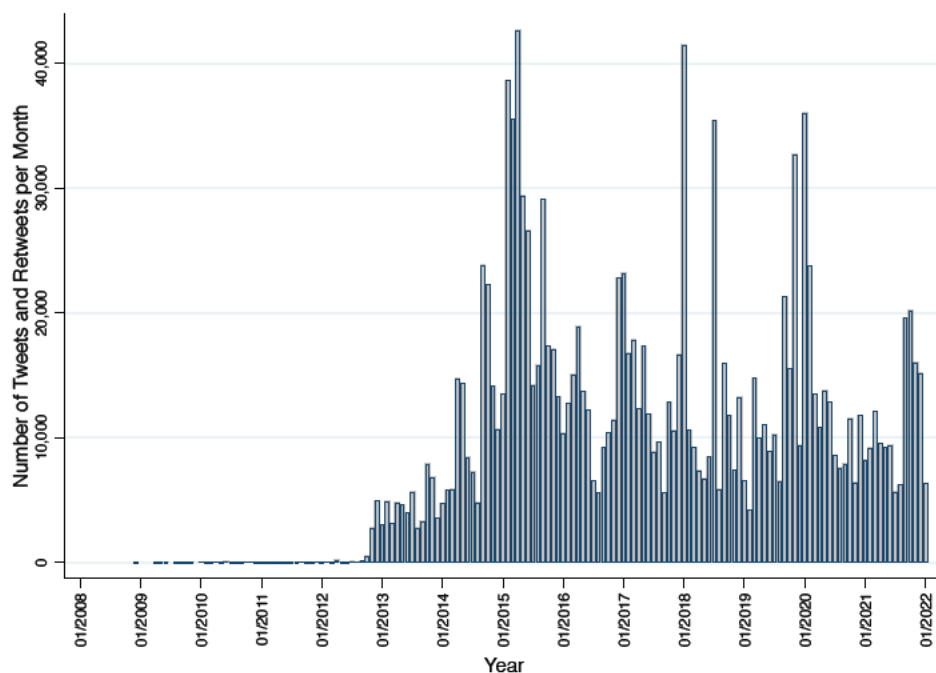


Figure 3

Monthly Frequency of Tweets and Retweets Mentioning Divestment

The figure shows tweets and retweets per month relating to divestment pledges from any source. There is an initial peak in 2015 around the Paris Agreement (COP21). There are further peaks in later years around significant divestment announcements. Panel A shows the number of tweets and retweets per month. Panel B shows the upper bound of the number of views per month.

Panel A. Number of Tweets and Retweets per Month



Panel B. Number of Views per Month in Millions – Upper Bound

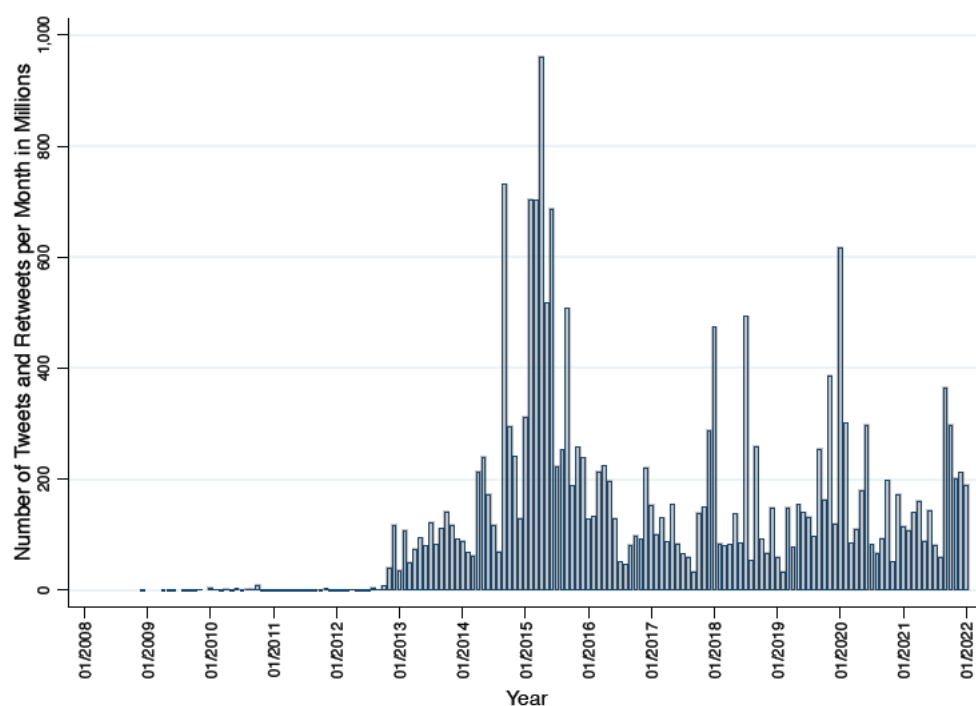
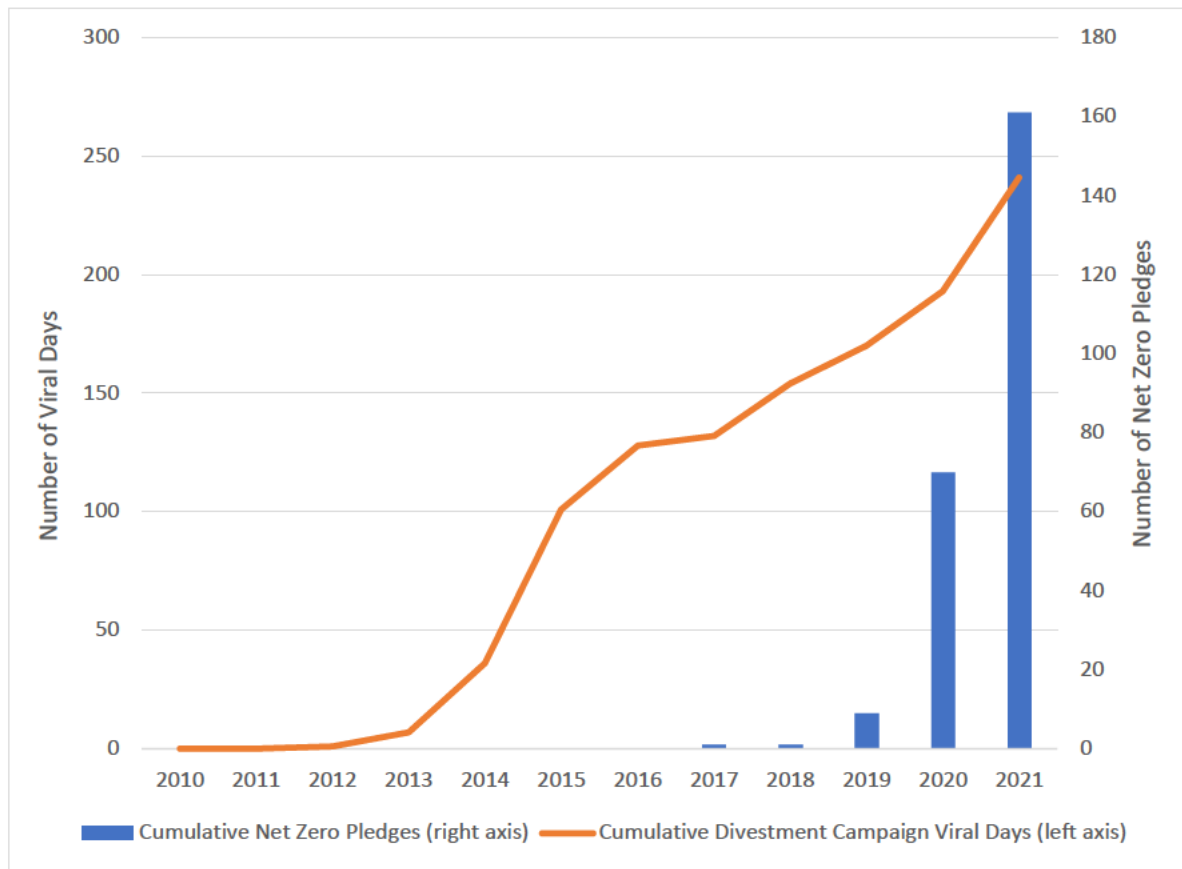


Figure 4

Divestment Pledge Virality vs. Net Zero Pledges (US Case)

The figure shows the cumulative number of viral days (orange, left axis) against the number of net-zero pledges by the country, cities, states, and companies (right axis, blue bar chart).



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Date: Wednesday, April 12, 2023 10:08:39 AM

This email is from a party external to Treasury. Use care with links and attachments.

Dear OIC members,

My wife and i are retired teachers having spent 30 years teaching in the state of Oregon. As PERS members, we feel it is imperative that PERS move our retirement funds away from fossil fuels with no new investments in fossil fuels and with a plan to rapidly move funds currently invested in those resources into alternative investments.

Thank you for your consideration of this request.

Peter & Diane Ware



From: [Jynx Houston](#)
To: [OIC Public Comments](#)
Subject: DIVEST
Date: Tuesday, April 4, 2023 10:22:12 AM

This email is from a party external to Treasury. Use care with links and attachments.

Reinvest in a fossil-free future. You are unbelievably irresponsible in attempting to continue your misguided investments in anti-humanity fossil fuels. Wake ups & listen to Oregonians.

Jynx Houston
Portland 97215

From: [David Parker](#)
To: [OIC Public Comments](#)
Cc: [Treasurer Read](#); [BATES Amy](#); [ENGELSON Eric](#); [KRIFKA Kasey](#)
Subject: New study proves the effectiveness of fossil fuel divestment
Date: Tuesday, April 11, 2023 9:55:08 AM
Attachments: [SSRN-id4386469.pdf](#)

This email is from a party external to Treasury. Use care with links and attachments.

Treasurer Read and the Oregon Investment Council need to inform themselves about the financial risks of continued investment in fossil fuels, and the the effectiveness of divestment in meeting our climate goals in Oregon.

From Bill McKibben's blog:

As the Financial Times reported yesterday, a new study from academics in Stockholm, Brussels, and Harvard indicated:

Fossil fuel divestment pledges by investors including sovereign wealth funds, trusts and foundations which gain traction on social media have an outsized impact on carbon-intensive companies, wiping billions off their market value, new research has found.

Here's the abstract of the paper:

Abstract

A common argument against divestment is that it jettisons voting power and that it has a small effect on stock prices. We argue that divestment is a form of voice that changes social preferences. We show that the Go Fossil Free divestment movement has had a disproportionate impact on share prices by changing the economic narrative. By stigmatising target companies, it has increased stranded asset risk. Divestment pledges that went viral have depressed share prices of all high carbon emitters, including those with no significant divestment. Peak virality coincides with an increase in the carbon premium and precedes net-zero commitments from countries, regions, cities, and business. By altering the social and regulatory environment, divestment induces risk averse investors to decarbonise their portfolios, further reinforcing the narrative.

And here's the paper:

From: [David Labby](#)
To: [OIC Public Comments](#)
Subject: OIC Testimony.
Date: Tuesday, April 11, 2023 3:11:53 PM
Attachments: [clip_image001.png](#)

This email is from a party external to Treasury. Use care with links and attachments.

Dear OIC:

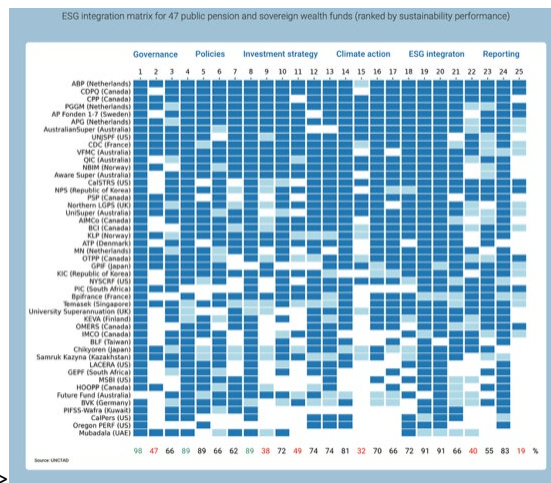
My name is David Labby. I am a PERS beneficiary concerned about the Treasury's performance in addressing the financial and existential threats of climate change. Treasurer Read's track record of broken promises around ESG investing indicates that the OIC will have to play a much more active oversight role than it has in the past if the State is going to have any sort of plan to address these threats.

In his inaugural address [<!--\[if !supportFootnotes\]-->\[i\]<!--\[endif\]-->](#)after becoming Treasurer in 2016, Tobias Read committed to "always invest for the long term" to "address challenges that, if ignored, will impact all Oregonians," specifically citing "an environment and economy threatened by climate change" as one of those "challenges."

He followed up in 2017 by having the Legislature approve Oregon's first investment officer focused on the Environmental, Social and Governance (ESG) factors "in pursuit of improved sustainability metrics, more trans-parent financial reporting, and ways to integrate what we learn into how we make decisions[<!--\[if !supportFootnotes\]-->\[ii\]<!--\[endif\]-->](#)." In September 2018, he further convened an Oregon Sustainable Investing Summit, with keynotes from national financial leaders, highlights of OST renewal investments, and a discussion of "how Treasury evaluates climate risk[<!--\[if !supportFootnotes\]-->\[iii\]<!--\[endif\]-->](#)," among other topics.

What has the OST accomplished in the last 5 years from this early ESG commitment?

The United Nations recently published a 2021 ESG report card on the world's top asset funds. Oregon PERF was included along with 47 of the world's top 100 funds that report on their ESG efforts. Oregon PERF was rated close to the bottom in its ESG performance, 46th out of the 47, right above a sovereign fund in the United Arab Emirates (UAE)[<!--\[if !supportFootnotes\]-->\[iv\]<!--\[endif\]-->](#).



Oregon’s was credited for achieving 9 out of the 25 performance areas. These included, having a clearly stated ESG mission and vision, adopting international standards or benchmarks and joining an international climate response initiative, committing to integrating ESG issues in investment decisions, and actively engaging with companies through stockholder voting.


What was found lacking was the operationalization of OST’s stated commitments. The UN reviewers found no evidence of any team dedicated to coordinate ESG investments, no stated targets/ goals for ESG investing, no use of any ESG screens for actual investment decisions, no specific sector strategies (eg renewable energy), no climate risk metric monitoring or reporting or the use of specific climate targets / goals, nor any evaluation or auditing of its ESG performance with specific metrics.

Indeed, this picture is very consistent with the Read and the Treasury’s response to the demand for climate action. They commissioned and then buried their own report showing significant losses to Treasury from holding vs divesting from fossil fuels; they opposed 2022 legislation to bring greater transparency to Treasury’s fossil fuel holdings; they oppose 2023 legislation calling on them to make no new fossil fuel investments and fully report those they have; and, just recently, they have committed another half billion dollars to funds with fossil fuel exposure.

Treasurer Read has now committed to present a “decarbonization plan” to the Oregon Investment Council by February 2024<!--[if !supportFootnotes]-->[v]<!--[endif]-->. As he approaches the end of his final term as Treasurer, he has the opportunity to deliver on the promise he made at his inauguration in 2017: to “address challenges that, if ignored, will impact all Oregonians” – through measurable action and not just words, hopefully soon.

As a PERS beneficiary, I look to the OIC to hold the Treasury accountable for meaningful action to protect our State, and our pension program, from climate chaos.

David Labby



<!--[if !supportEndnotes]-->

<!--[endif]-->

<!--[if !supportFootnotes]-->[i]<!--[endif]--> <https://www.oregon.gov/treasury/news-data/Documents/News-and-Data-Treasury-News-and-Reports/2017/News-and-Data-Treasury-News-and-Reports-2017-Annual-Report-final.pdf>

<!--[if !supportFootnotes]-->[ii]<!--[endif]--> <https://www.oregon.gov/treasury/invested-for-oregon/Documents/Invested-for-OR-Sustainable-Investing-Stewardship/Invested-for-Oregon-Sustainable-Investing-Stewardship-2017.pdf>

<!--[if !supportFootnotes]-->[iii]<!--[endif]--> Ibid.

<!--[if !supportFootnotes]-->[iv]<!--[endif]--> <https://gsfo.org/assets-owner-rankings>

<!--[if !supportFootnotes]-->[v]<!--[endif]--> <https://www.oregon.gov/treasury/news-data/Documents/topics-of-interest/2022/Treasurer-Reads-Core-Decarbonization-Framework.pdf>

From: [Emily Platt](#)
To: [OIC Public Comments](#)
Subject: Oregon Treasury Divestment
Date: Wednesday, April 5, 2023 10:41:22 AM

This email is from a party external to Treasury. Use care with links and attachments.

Dear Oregon Investment Council Members.

I am a PERS retiree and am deeply disturbed to learn that the investments that support my retirement are major contributors to climate change, human rights abuses, and environmental degradation. As but one example, the OIC invests in Chevron, a company that tramples indigenous rights, represses local resistance, and poisons local environments. In addition, fossil fuel companies made startlingly accurate predictions of the threats that burning fossil fuels posed to the climate. They then enacted reprehensible campaigns to sow doubt about the robustness of climate science, as well as put forth climate denialism - in other words they lied about the dangers of fossil fuels. It is not ethical to invest in fossil fuel companies that lie, cheat and steal – this should be obvious. The OIC is also failing in its fiduciary responsibility to ensure the long-term health of the PERS retirement fund. The recent 2023 IPCC report states in the starkest terms yet that new fossil fuel investment is not consistent with maintaining a livable planet. As the energy sector decarbonizes, we will be left holding worthless fossil fuel investments; private equity investments are especially vulnerable since they are illiquid. Since fossil fuel companies lied about their product, they will likely be exposed to litigation, settlements and legislation that will have negative impacts on their bottom line.

To quote an Amnesty International report of 2021, “The world’s richest governments are effectively condemning millions of people to starvation, drought and displacement through their continued support of the fossil fuel industry.” As a PERS member, I state in the strongest terms possible that I do not want to contribute to unspeakable suffering caused by support of the fossil fuel industry. My husband and I decarbonized our personal portfolio. It is not rocket-science and the portfolio is doing fine. As a PERS retiree, I demand that the Oregon Treasury becomes transparent, refrains from new fossil fuel investments, and enacts a timely phase out of fossil fuel assets.

Thank you for the opportunity to submit testimony.

Sincerely,

Emily Platt, Ph.D.
Portland OR

From: [Sandy Polishuk](#)
To: [OIC Public Comments](#)
Subject: Oregon Treasury Gets an F in ESG Investing
Date: Monday, April 10, 2023 2:29:52 PM

This email is from a party external to Treasury. Use care with links and attachments.

Fossil Fuel investments may be yielding good returns in the short term, but only because these companies are going for broke knowing the clock is ticking to shut them down to save our planet. The recent 2023 IPCC report repeats the warning that new fossil fuel investment is incompatible with global survival and underlines the multi-faceted risk of these investments. Soon these investments will be junk.

Treasury investments are putting our retirement funds and PERS members future income at risk while they are putting the future for our children in peril!

The Treasury needs to end all new investment in fossil fuel companies, including publicly traded and private fund investments.

Do the right thing for PERS members, Oregonians and the planet!

Thank you,

Sandy Polishuk

From: [Rod Such](#)
To: [OIC Public Comments](#)
Subject: Please enter these comments in the minutes for the April 2023 meeting
Date: Wednesday, April 12, 2023 9:34:19 AM

This email is from a party external to Treasury. Use care with links and attachments.

Dear members of the Oregon Investment Council,

I want to share some developments with you that relate to the recently adopted ESG policy for Oregon's investments. The first is a podcast by professional journalists who took an in-depth look into how Oregon came to be invested in the spyware industry. Their reporting exposes the utter lack of due diligence in committing Oregon pensioners' money to the now infamous Israeli spyware firm, the NSO Group.

The original investment occurred as far back as 2014 when Oregon's Public Employee Retirement Fund invested in the private equity firm Francisco Partners, which then had a controlling stake in NSO. Please take the time to listen to this podcast to understand why investments in companies predicated on human rights violations are such bad investments.

<https://podcasts.apple.com/us/podcast/6-how-are-ordinary-americans-supporting-the-makers/id1661177850?i=1000605119966>

A second development is a recent lawsuit filed in a U.S. district court by the Omaha Firefighters and Police union pension fund against another Israeli spyware firm known as Cognyte. The pension fund is suing this company due to lack of transparency and the company's poor financial performance. You can read the details here:

<https://dockets.justia.com/docket/new-york/nysdce/1:2023cv01769/594831>

This raises the question of why the Israeli spyware industry and their private equity benefactors are courting U.S. pension funds and why Israeli spyware has been implicated in both human rights violations and poor investment performance. Cognyte supplied its spyware to the government of Myanmar responsible for the ongoing persecution and killings of the Muslim Rohingya people.

<https://www.business-humanrights.org/en/latest-news/israel-cognyte-facing-legal-action-over-spyware-sold-to-myanmar-co-ahead-of-military-coup->

[despite-govt-ban-on-defence-tech-transfers/](#)

<https://www.state.gov/secretary-antony-j-blinken-at-the-united-states-holocaust-memorial-museum/>

The key to understanding why Israeli spyware has played such a leading role in human rights violations is the nature of the Israeli government. Israel has imposed a system of apartheid on millions of Palestinian Arabs who make up a majority of the population living between the Jordan River and the Mediterranean Sea. apartheid is not my characterization but the conclusion of respected human rights organizations, such as Amnesty International, Human Rights Watch, the United Nations Human Rights Council, and the leading Israeli human rights organizations B'Tselem and Yesh Din. These organizations have confirmed what numerous Palestinian human rights groups have been reporting for decades.

What's the connection between apartheid and spyware? Since its founding in 1948, successive Israeli governments have consistently placed the Palestinian population under mass surveillance in an attempt to prevent any resistance to its system of apartheid. Two of the founders of NSO were veterans of Israel's Intelligence Unit 8200, which specialized in a system of surveillance for the purpose of blackmailing and controlling Palestinian resisters. This unit has also been linked to extrajudicial assassinations regarded as crimes against humanity, as detailed in the Israel journalist Ronen Bergman's *Rise and Kill First* (2018), winner of the National Jewish Book Award.

To establish human rights as a necessary component of ESG investing, the Israel government's ongoing system of apartheid must be incorporated into ESG guidelines. Apartheid is regarded as a crime against humanity under the UN Convention on Apartheid.

Numerous Israeli export companies and banks benefit from the apartheid system, making them complicit in the maintenance of apartheid. As Israel continues to become an even more authoritarian state and as legislation in the Israeli parliament, the Knesset, is on the brink of abolishing the independence of the judiciary, more and more investors are pulling their money out of Israel and cautioning against further investment in that country, as detailed in this recent article <https://jewishcurrents.org/the-other-movement-to-divest-from->

[israel](#) from *Jewish Currents*.

Thank you for your attention to this matter.

Rod Such, Portland, Oregon

From: [David Parker](#)
To: [OIC Public Comments](#)
Subject: public comment for OIC meeting April 19
Date: Friday, April 7, 2023 11:56:54 AM

This email is from a party external to Treasury. Use care with links and attachments.

Dear OIC,

I am a retiree dependent on my PERS pension. I understand you have an obligation to balance risk and reward to maximize the return on our investments. But we in Oregon face a bigger risk if we fail to understand our bigger obligation do everything we can to preserve the possibility of a decent future for people on earth.

Countless decisions that we make now and near term will determine how bad things get for people for many generations to come. I hope you have read the recent 2023 IPCC Report Summary for Policymakers which once again makes clear that new fossil fuel projects are incompatible with a decent future for people on earth — this is the overwhelming risk we face!

This risk is felt by us now in Oregon in wildfires, heat domes, and drought but will be devastating for future generations (including my grandchildren and yours, and their grandchildren's grandchildren) as the weather becomes more extreme, sea levels rise, ecosystems collapse, and climate refugees destabilize economies and governments around the world.

I call upon you to end all new fossil fuel investments, public and private, and STOP using PERS funds to support the destructive fossil fuel industry. Near term and close to home, the Oregon Treasury needs to STOP funding Zenith in the Portland area, the Willows project in Alaska, and Coastal GasLink running through Oregon.

The money controlled by the Oregon Treasury is POWER to fund a rapid transition to renewable energy and mitigate climate change. Please use that power responsibly.

Sincerely,

Dr. David C. Parker



From: [Valori George](#)
To: [OIC Public Comments](#)
Subject: Public comment prior to April 19 OIC meeting
Date: Tuesday, April 11, 2023 7:22:15 PM

This email is from a party external to Treasury. Use care with links and attachments.

Dear Members of the Oregon Investment Council,

Oregon PERS investments are once again making the news, this time in a podcast series titled *Shoot the Messenger: Espionage, Murder and Pegasus Spyware*. A team of investigative reporters, along with the Committee to Protect Journalists, examine the military-grade spyware Pegasus - how it works, what happens to its targets, and how ordinary Americans came to be invested in its makers, the Israeli firm NSO Group.

I urge you to listen to this podcast:

<https://podcasts.apple.com/us/podcast/6-how-are-ordinary-americans-supporting-the-makers/id1661177850?i=1000605119966>

Israeli spyware has been implicated in gross human rights violations, and that spyware can only be exported with the permission of the Israeli Defense Ministry, which means the Israeli government is directly responsible for the resulting human rights violations. And as Israel continues to become more authoritarian, investors are pulling their money out of Israel. This recent article <https://jewishcurrents.org/the-other-movement-to-divest-from-israel> from *Jewish Currents* cautions that investment there could result in poor performance.

Evidently, the Israeli spyware industry and the private equity funds invested in them have been courting U.S. pension funds; and, unfortunately, the lack of due diligence in tying Oregon pensioners' money to this infamous Israeli spyware firm, NSO Group, has resulted in a disastrously poor investment. This points to the need to establish human rights as a necessary component of ESG investing.

Thank you for your consideration,

Valori George
Corvallis, OR.

From: [Kristin Edmark](#)
To: [OIC Public Comments](#)
Subject: Public comment to the April 19, 2023 meeting of the OIC
Date: Sunday, April 9, 2023 10:09:29 AM

This email is from a party external to Treasury. Use care with links and attachments.

Please accept my comment to the April 19, 2023 OIC meeting. From Kristin Edmark, concerned citizen.

My name is Kristin Edmark. My daughter-in-law and son are OPERS members. Their family lost a home in the 2020 Oregon fires. I want to protect the planet for my grandchildren and all living things.

Fossil fuels are no longer competitive and continue in long-term decline

Dropping fossil fuel investments and fossil fuel funders makes sense from a position of fiduciary responsibility. Study after study continues to demonstrate that decreasing fossil fuels increases profit.

A Corporate Knights study (<http://bit.ly/corporate-knights-pers-strs>) shows that, in the 10 years between 2009 and 2019, CalSTRS would have gained \$11.9 billion and CalPers would have gained \$5.5 billion had they been invested in other than oil/gas production.

Corporate Knights found similar results for Colorado and earlier for New York.

February 21, 2022, FFI Solutions released a study showing Maryland State Retirement and Pension System (SRPS), sacrificed 15% percent of profit over 10 years by retaining investments in fossil fuel production. https://chesapeakeclimate.org/wp-content/uploads/2022/02/FFI_Solutions_Backtest_MD-MSRPS-2021.pdf

June a new report will be published explaining how much Oregon has lost in the last 10 years due to having fossil fuel investments similar to the report done by Corporate Knights for Colorado.

Ortec Finance reports are clear regarding Oregon increased returns if fossil fuels are dropped.

Stranded Assets are Real

A third of major North American pipelines have been cancelled due to massive public outcry. The voices of citizens add up in overwhelming opposition to massive new fossil fuel infrastructure to cause long delays, denied permits, legal problems, huge cost over-runs, etc. Large numbers of citizens are working to prevent Aimco/KKR Coastal Gaslink Pipeline now experiencing long delays. TC Energy has committed to paying \$3.3 billion additional funds due to cost over-runs. <https://globalnews.ca/news/8623308/coastal-gaslink-pipeline-budget-tc-energy/> Utilities which are making large investments in methane power will likely have to abandon their investments early due to disadvantageous costs and regulations. Hundreds are speaking up against Zenith Energy, Portland and GTN Xpress. Local people power is growing for clean energy. Climate legislation is increasing. Long-term, illiquid investment in fossil fuel funders will suffer.

I have been told that it would be expensive to drop fossil fuel investments.

Tom Sanzillo of IEEFA has 17 years of experience with the City and the State of New York in senior financial and policy management positions. Tom Sanzillo says that the argument that fossil free indexes are more expensive “just is not accurate.” The fee structure is the similar. California just moved billions into fossil free funds. Oregon partners with companies which offer fossil free funds. According to fossilfreefunds.org, available fossil free indexes are provided by State Street Global Advisors (2 Index Fossil free funds found, SSPGX and SSPSX), BlackRock Institutional Trust Co with iShares (78 fossil free index funds listed) and increasingly others. Fiduciaries base decisions on facts not unfounded fears or outdated assumptions. 150,000 pensions and endowments have divested funds valued at over \$40 Trillion and have still been able to meet benchmarks and goals.

Decrease in fossil fuel funding helps the US Economy stay competitive world-wide

Ortec (Climate Maps, Oct 2021) recommends that Oregon decrease investments in the US because “The US economy is negatively exposed to both physical and transition-related climate risks under all pathways. The country’s position as a net fossil fuel exporter, with low energy efficiency, low carbon pricing and high sensitivity to market sentiment shocks make it highly exposed to transition risks. At the same time it is already experiencing severe extreme weather challenges (both “wet” and “dry”) which will only worsen with increasing temperatures, even under the transition scenarios.”

Ortec, in this and the subsequent report, is saying: Invest in countries which are transitioning to clean energy because the US economy will take a bigger hit because the transition will be slower. (Ortec lists suggested countries.) Oregon is slowing the transition to clean energy by continuing to invest \$billions in fossil fuels and fossil fuel funders thereby harming the US economy.

May 2021 President Biden ordered federal transparency in his Executive order on Climate-Related Fiscal Risk. The federal executive order calls for “the measurement, assessment, mitigation, and disclosure of climate-related financial risk”... and “to protect the life savings and pensions of United States workers and families from the threats of climate-related financial risk...”

According to Alexander, professor emeritus Economics and Environmental Studies, “Slowing climate change matters not just for our climate but for our economy. Seminal research on the economics of climate change by U.K. economist Nicholas Stern estimates the potential impacts of climate change to include a long-term 20 percent reduction in world gross domestic product (GDP). (As the US transitions to clean energy,) The savings would start at around \$65 billion a year in the 2020s, increasing to over \$700 billion a year in the 2040s. Around 1 million additional jobs would be created during the 30-year transition, ... These returns do not include the damages saved from mitigating the worst impacts of climate change...Even if climate change were not such an urgent issue, the shift to renewable energy would make sense on purely economic grounds alone.”

<https://bulletin.kenyon.edu/article/would-transitioning-to-renewable-energy-hurt-the->

[economy/](#)Ortec also uses the figure of 20% reduction in a failed transition.
Oregon Treasury should not be a major contributor to harm to the US economy.

I agree with Tom Sanzillo of IEEFA who has said, "Climate risk is a financial risk. Financial risks require financial actions. And your decisions must always put the beneficiaries first."

**Treasury's own study shows
fossil-fuel divestment
would make > \$1 billion for OPERF**

Climate Risk Scenario Modelling
Public equity sector deep dive

Feb 2022

It makes the case for fossil fuel divestment ... starting now

- Divestment increases OPERF public equity portfolio value by \$1.2 billion over 10 years
- Gains are even greater if fossil companies reject becoming part of clean energy transition
- Treasury can help protect OPERF from 20% devaluation by investing to encourage a clean energy transition
- Gains from divesting other asset classes remain to be studied

Treasury hid this favorable divestment study from public records discovery

01/22: Divest Oregon requests **any** documents relating to climate-related financial risk to OPERF assets

07/22: Treasury releases a general climate risk scan of all OPERF's assets and says that is the only report

08/22-01/23: Divest Oregon presses for more disclosure

01/23: Treasury eventually releases year-old “deep dive” fossil fuel divestment report

Treasury and PERS then hid the study from the Legislature while . . .

- Treasurer Read wrote to every legislator that enacting a divestment law would reduce OPERF's returns and mean less money for all state programs (01/18/23)
- Treasurer Read, PERS Director Olineck and Chief Investment Officer Kim told House Committee considering divestment that any change to investment policy would jeopardize PERS (02/09/23)
- Treasurer Read wrote to same House Committee that divestment would financially harm OPERF and the state budget (02/16/23)

What Treasury asked to know about divestment

Treasury asked international consultant Ortec Finance:

“What if OPERF divested from its liquid-market fossil fuel investments? What is the interplay between risk and return from that?”

Ortec provided Treasury a report “to cut through the immense detail and deliver the key insights.”



Source: Ortec Climate Risk Scenario Modelling pp. 2, 3

How Ortec answered Treasury's question

1. Treasury provided Ortec with OPERF public equity data
2. Ortec calculated fossil fuels were 4.4% of OPERF public equity holdings
3. Ortec modeled the effects of replacing OPERF's fossil fuel public equities with a "Paris-aligned" [low carbon] fund under three future energy scenarios



Source: Ortec Climate Risk Scenario Modelling pp. 3, 5, 6

Ortec's 3 future energy scenarios

1. **Paris Orderly (“PO”)** - transition to clean energy occurs as smoothly as possible; limited physical impacts from climate change
2. **Paris Disorderly (“PD”)** - transition to clean energy disrupts financial markets; stranded assets; limited physical impacts from climate change
3. **Failed Transition (“FT”)** - business as usual without additional clean-energy policies; severe physical impacts increase over time; 3.8°C [6.8F] global warming by 2100

How Ortec studied PERS divestment impacts

- Ran OPERF data through its detailed model developed with Cambridge Econometrics
- Looked at 18 economic sectors and 28 geographic regions where OPERF invested.
- Ran “what if” data 504 times for each scenario.

What Ortec presented to Treasury

- “Per scenario, what happens to expected returns if we replace all fossil-fuel holdings with a ‘Paris-Aligned’ [low carbon] fund”
- “Results are shown relative to a baseline” that assumes no impact from climate change and trends up over time
- Tables show “the equity portfolio impact (relative to baseline) to 5, 10 and 20 year expected returns”

Annualized impact of divestment on OPERF public-equity portfolio returns relative to baseline

Keep fossils

5 10 20

PO	-11.4%	-8.4%	-5.2%
PD	-16.5%	-10.9%	-6.4%
FT	-0.1%	-0.3%	-1.1%

Divest fossils

5 10 20

-0.3%	-0.2%	-0.2%
-2.0%	-0.9%	-0.6%
-0.2%	-0.6%	-2.2%

Annualized impact of divestment on OPERF public-equity portfolio value

	5	10	20
PD	0.71%	0.47%	0.27%
PO	0.41%	0.33%	0.20%
FT	0.00%	-0.01%	-0.05%

OPERF Public Equity portfolio value on December 31, 2021

\$25.7 billion

(More precisely, \$25,734,656,000)



<https://www.oregon.gov/treasury/invested-for-oregon/Documents/Invested-for-OR-Performance-and-Holdings/2021/OPERF-12312021.pdf>

\$ impact of fossil fuel divestment on OPERF public equity portfolio

PO-Paris Orderly
PD-Paris Disorderly
FT-Failed Transition

In 5-10-20 years

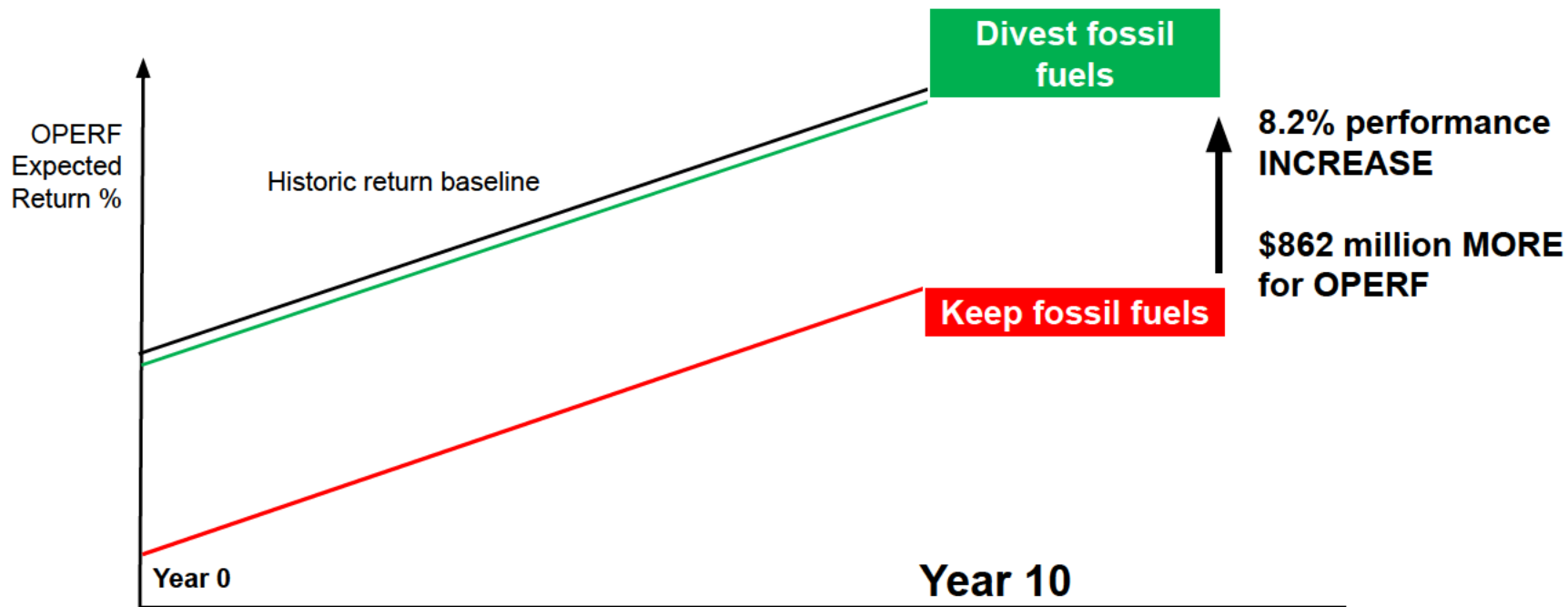
Calculation table from previous two slides

Annualized using compound annual growth rate calculator:
<https://www.omnicalculator.com/finance/cagr>

YEARS	5	10	20
PO - calculation	0.41%x5	0.33%x10	0.20%x20
PO - final value	\$26,266,560,000	\$26,596,622,000	\$26,783,837,000
PO - initial value	\$25,734,656,000	\$25,734,656,000	\$25,734,656,000
PO -divest impact	\$531,904,000	\$861,966,000	\$1,049,181,000
PD - calculation	0.71%x5	0.47%x10	0.27%x20
PD - final value	\$26,661,301,000	\$26,970,089,000	\$27,160,556,000
PD - initial value	\$25,734,656,000	\$25,734,656,000	\$25,734,656,000
PD -divest impact	\$926,645,000	\$1,235,433,000	\$1,425,900,000
FT - calculation	0.00%x5	-0.01%x10	-0.05%x20
FT - final value	\$25,734,657,000	\$25,708,932,000	\$25,478,528,000
FT - initial value	\$25,734,656,000	\$25,734,656,000	\$25,734,656,000
FT -divest impact	0	-\$25,724,000	-\$256,128,000

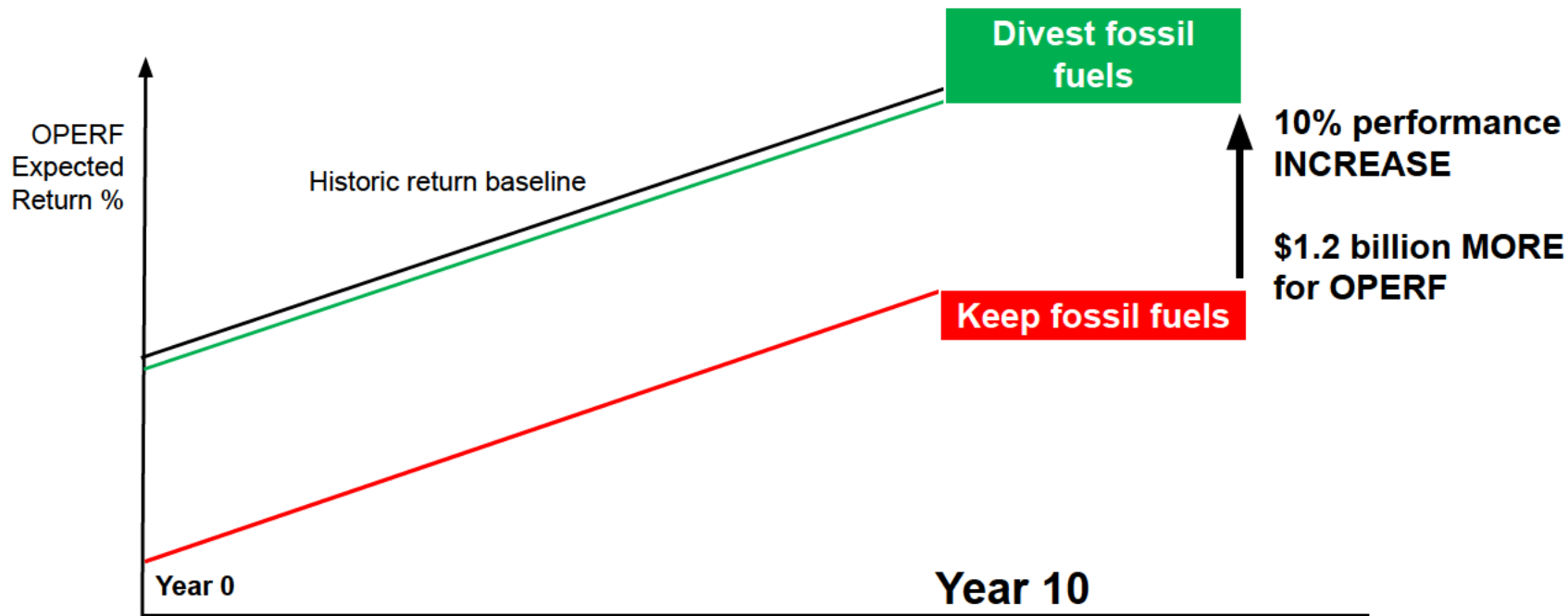
Impact of divestment on OPERF public-equity portfolio

10-year “Paris Orderly” scenario (Energy-transition soft landing)



Impact of divestment on OPERF public-equity portfolio

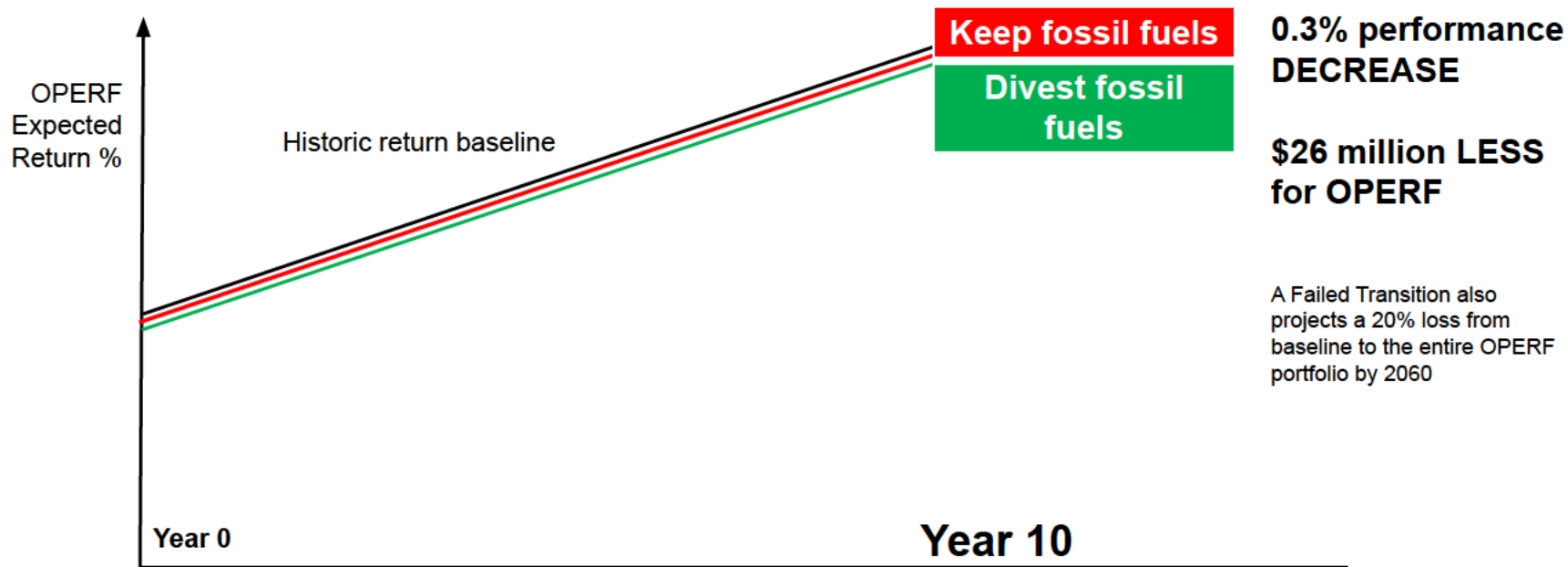
10-year “Paris Disorderly” scenario (Energy-transition bumpy landing)



Impact of divestment on OPERF public-equity portfolio

10-year “Failed Transition” scenario

(Fossil fuel business as usual)



Treasury should not bet OPERF on a “Failed Transition” scenario

- A “Failed Transition” scenario assumes business as usual with no new policy measures
- But Oregon Investment Council’s consultant Meketa says:
 - Climate stimulus and low carbon support policies are being enacted across the globe
 - “The trend toward more policies supporting energy transition efforts is expected to continue”

For OPERF's protection, Treasury should invest to discourage a "Failed Transition"

- Ortec says a "Failed Transition" causes worst outcomes because of increasing physical risks of climate change
- In a "Failed Transition," Ortec forecasts:
 - 63% lower US GDP by 2100
 - "By 2037 OPERF's portfolio value . . . is significantly down compared to an orderly low-carbon transition."
 - "By 2060 your asset portfolio is expected to c.20% lower than baseline."

Ortec's model slowed OPERF's divestment gains over time . . .

	5 years	10 years	20 years
PD	14.5% 	10% 	5.8%

. . . by assuming fossil fuel companies would eventually transition and become “part of the solution”

But if fossil companies reject clean energy, divestment gains OPERF even more

- Some investors asked to study divesting fossil-based utilities in “a worst case of them **failing to respond to engagement/ reducing emissions** - in order to support the portfolio NZ [net zero] commitment.”
- This would increase divestment gains over time
- Treasury did not request Ortec to do that

Treasury should ask Ortec to study fossil fuel companies' rejection of clean energy

- Recently subpoenaed internal fossil-fuel corporate documents reject a clean energy transition strategy
- Fossil companies have been making state-of-the-art internal climate change predictions since the 1970s, while making bad faith claims the science was erroneous or inconclusive

Congress of the United States
House of Representatives
COMMITTEE ON OVERSIGHT AND REFORM

Sources:

https://web.archive.org/web/202300000000000*/https://oversight.house.gov/sites/democrats.oversight.house.gov/files/2022-12-09.COR_Supplemental_Memo-Fossil_Fuel_Industry_Disinformation.pdf;

Science

[Assessing ExxonMobil's global warming projections | Science](#)

PERS beneficiaries, PERS employers and the public deserve to know

- Who received Ortec's divestment study, when, and what were their views and communications about it?
- Why did Treasury hide this report? Who directed that?
- Do we have **ALL** Treasury and Treasury-sponsored studies on fossil fuel divestment and climate change impacts on OPERF?

And now more than ever we deserve to know . . .

- Why is Treasury refusing to divest money-losing, climate-damaging fossil fuel investments?
- Why is Treasury investing to encourage a Failed Transition when there is strong evidence that will result in massive eventual harm to OPERF's value, and its availability for future PERS retirees?

Climate Risk Scenario Modelling

Public equity sector deep dive

Feb 2022



Climate Scenario Analysis

Phase 2 - “What ifs”

What if... OPERF divested from its liquid-market fossil fuel investments (or any other sector)? What is the interplay between risk and return from that?

What if... we looked at the equity (listed and private) book through a deeper sector/geography revenue attribution lens? Does that give a different view and insight into implementation?





Background, scope and approach

We approached the “what if...” exercise from the perspective of developing insights for potential changes OPERF could explore.

Model:

- Both “what ifs” agreed with the team leverage the deterministic, sector-level modelling Ortec Finance (OF) has developed for public equities

Data:

- OF was provided with anonymized public equity data to allow mapping to our modelled region/sector grid. Proxies were agreed with the OPERF team
- OF also used PE and Real asset allocations summaries provided as part of the main project to inform the private assets assessment

Scope:

- OF has used its latest “Jun21” model, rather than the “Dec20” model for this work. It allows us to leverage better insights on more sectors and to differentiate the physical risk impact between different sectors (which was not included in the “Dec20” model).

Approach:

- Using the data provided, we have run our detailed sector/region model
 - 18 sectors
 - 28 regions
 - 504 time series, per scenario
- The purpose of this report is to cut through the immense detail and deliver the key insights.

Next steps:

- We had envisioned the output of this work as feeding into some of the “next steps” noted at the end of the main climate scenario presentation report.

Equity divestment
from fossil-fuel
exposed holding



Overview of fossil-fuel exposures | 4.4% of public equity holding

Fossil-fuel exposures = Coal | Oil and gas | Fossil-based Utilities

To give meaningful insights, we adjusted the utilities data you provided to better reflect the likely underlying profile of fuel-type exposure

- ClimateMAPS is set up to consider key economic activities that are crucial for the understanding of climate risk. The mapping exercise included some compromises, such as the mapping of utility companies to a single GICS sector.
 - However, it is likely that for a diversified portfolio the activities of electric utility companies will be spread over a few of the MAPS sector-activities.
- We adjusted the mapping as follows:
 - “Fossil-based utilities” and “Fossil-based utilities: Nuclear” were summed together
 - We then re-spread the allocation to the two sectors across: “Fossil-based utilities”, “Nuclear”, “Wind & Solar” and “Other low carbon electricity”
 - Which was based on country-level statistics on the energy generation mix for the countries covered.
- The net result is below
 - Combining Coal (0.1%), oil and gas (2.5%) and fossil-fuel utilities (1.4%) = 4.4%:

	Fossil-based utilities	Nuclear	Wind & Solar	Other low carbon electricity	Total
Aggregate	1.03%	1.51%	0.04%	0.04%	2.63%
Aggregate post adjustment	1.36%	0.38%	0.39%	0.49%	2.63%

Impact of replacing fossil-fuel with a “climate aligned benchmark”

Per scenario, what happens to expected returns if we replace all fossil-fuel holdings with a “Paris-Aligned” fund

Annual expected return delta (cumulative, annualized)	Horizon (yrs)		
	5	10	20
Fossil-based equity			
PO	-11.4%	-8.4%	-5.2%
PD	-16.5%	-10.9%	-6.4%
FT	-0.1%	-0.3%	-1.1%
Paris-aligned			
PO	-0.3%	-0.2%	-0.2%
PD	-2.0%	-0.9%	-0.6%
FT	-0.2%	-0.6%	-2.2%

The table below shows the equity portfolio impact (relative to baseline) to 5, 10 and 20 year expected returns, which results from switching the 4.4% fossil-based public equity to an investible Paris-Aligned fund. The significant negative impacts in the PD and PO scenarios are driven by the market pricing-in future transition impacts in the scenarios during those time windows.

Scenario equity portfolio-level relative impact of 4.4% switch			
	5	10	20
PD	0.71%	0.47%	0.27%
PO	0.41%	0.33%	0.20%
FT	0.00%	-0.01%	-0.05%

Engagement and implementation note:

Fossil-fuel entities are arguably both part of the “source” of the climate issue and part of the solution. They also potentially lose out disproportionately in the transition.

However, some investors we have worked with have investigated the impacts of divesting fossil-based utilities in a worst case of them failing to respond to engagement/reducing emissions – in order to support the portfolio NZ commitment.

The impact to low-carbon benchmarks in the Failed Transition scenario, relative to “grey” benchmarks is zero by construction as this scenario focuses on physical risk exclusively.

⇒ A low-carbon fund is not designed to mitigate physical risks.

Using low-carbon benchmarks is not a silver bullet. Although these benchmarks are better positioned to address systemic transition risks by having less exposure to high-emitters/stranded assets, the construction of the benchmark can introduce other biases (by the benchmark provider)

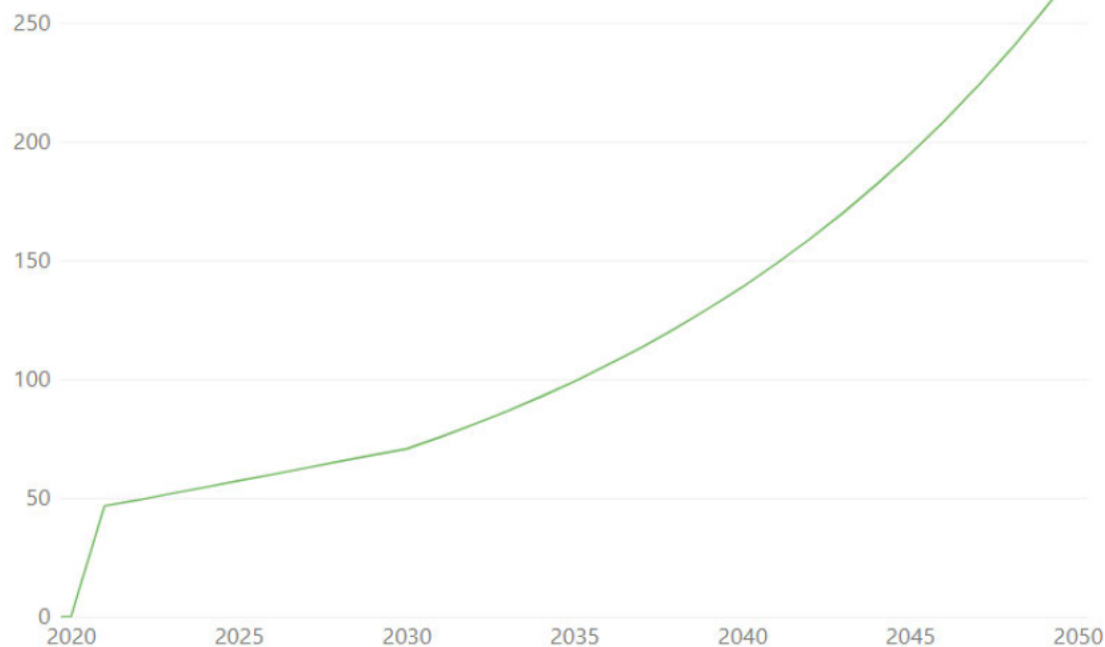
⇒ These biases can negatively impact the actual performance of the BM due to other factors.

Insights on timing of climate-transition relative to (hypothetical) utilities shifting fuel types

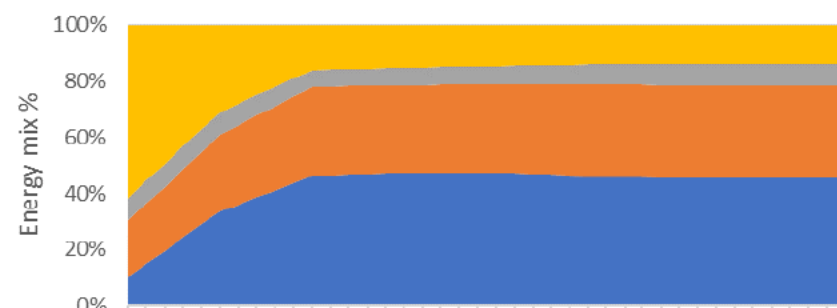
If energy utilities fail to rapidly invest in scaling low-carbon energy, pricing-in of transition policy could materially impact valuations

In a Paris-aligned, orderly transition, typified by the GLOBAL carbon price curve below we consider two US, diversified power companies. GradualCo will transition its energy mix at the pace required for the US energy mix to meet Paris goals. On the other hand, RadicalCo will ramp up much faster (perhaps through M&A) to reduce fossil mix to 16% with 5 years.

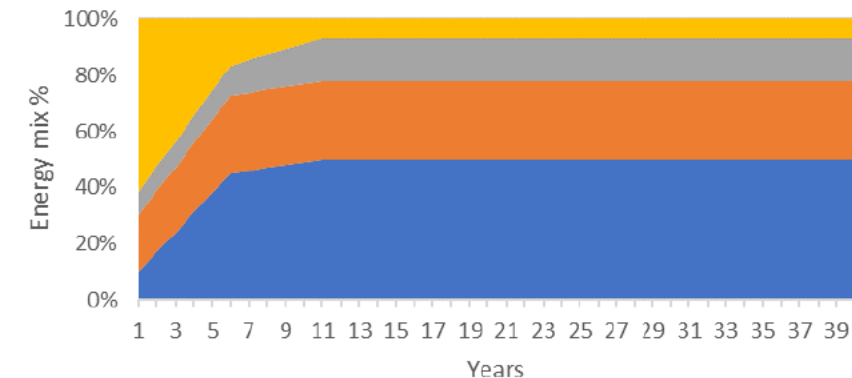
Carbon Price (2021\$/tonne CO2)-Paris Pathways-World



GradualCo shifting energy mix in line with MAPS Paris pathway



RadicalCo with radically shifting energy mix

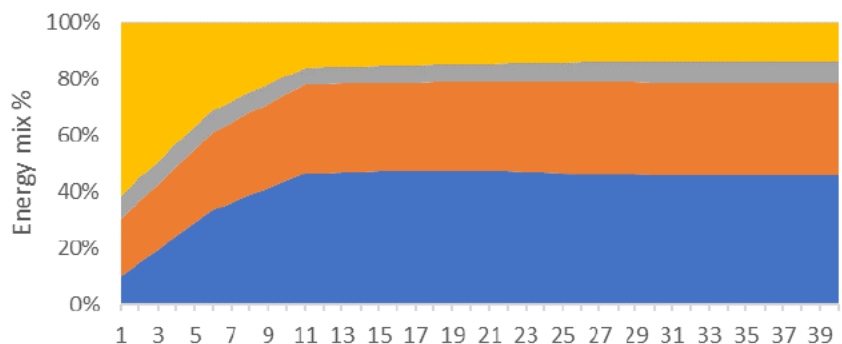


■ Wind & Solar ■ Nuclear ■ Other low carbon ■ Fossil-base utilities

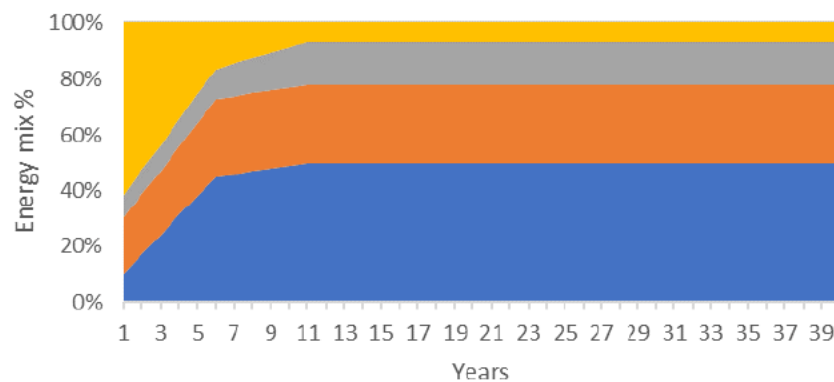
Insights on timing of climate-transition relative to (hypothetical) utilities shifting fuel types

If energy utilities fail to rapidly invest in scaling low-carbon energy, pricing-in of transition policy could materially impact valuations

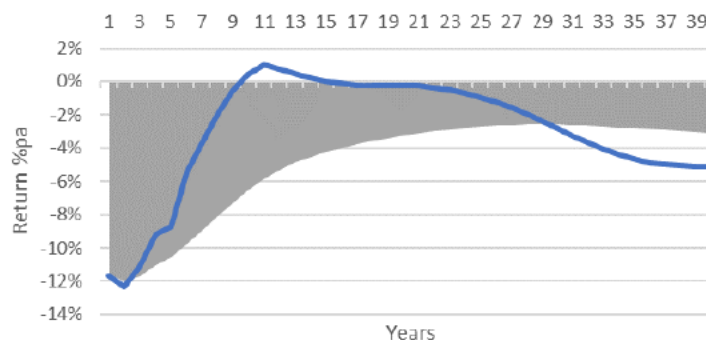
GradualCo shifting energy mix
in line with MAPS Paris pathway



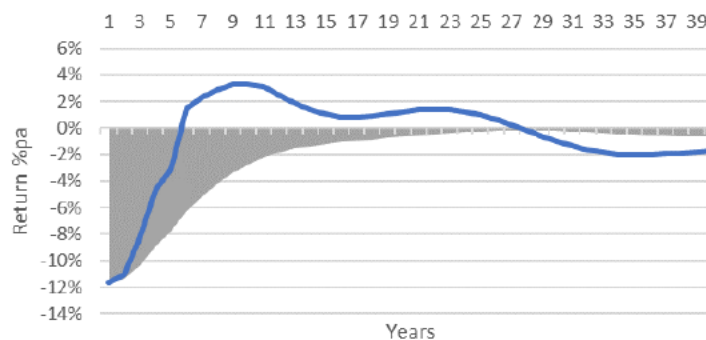
RadicalCo
with radically shifting energy mix



Gradually transitioning GradualCo
Price return delta to baseline - Paris pathway



Radically transitioning RadicalCo
Price return delta to baseline - Paris pathway



Blended CAGR Blended annual return

The pricing-in of transition impacts that occurs over the first 5 years impact both companies.

The model does allow for some costs to be passed through to consumers, however the market still prices-in negative impacts for fossil-based power generation.

Over the long term, RadicalCo recovers to have minimal downside relative to the baseline (shown by the grey CAGR%)

Equity and real assets
sector/region deep dive



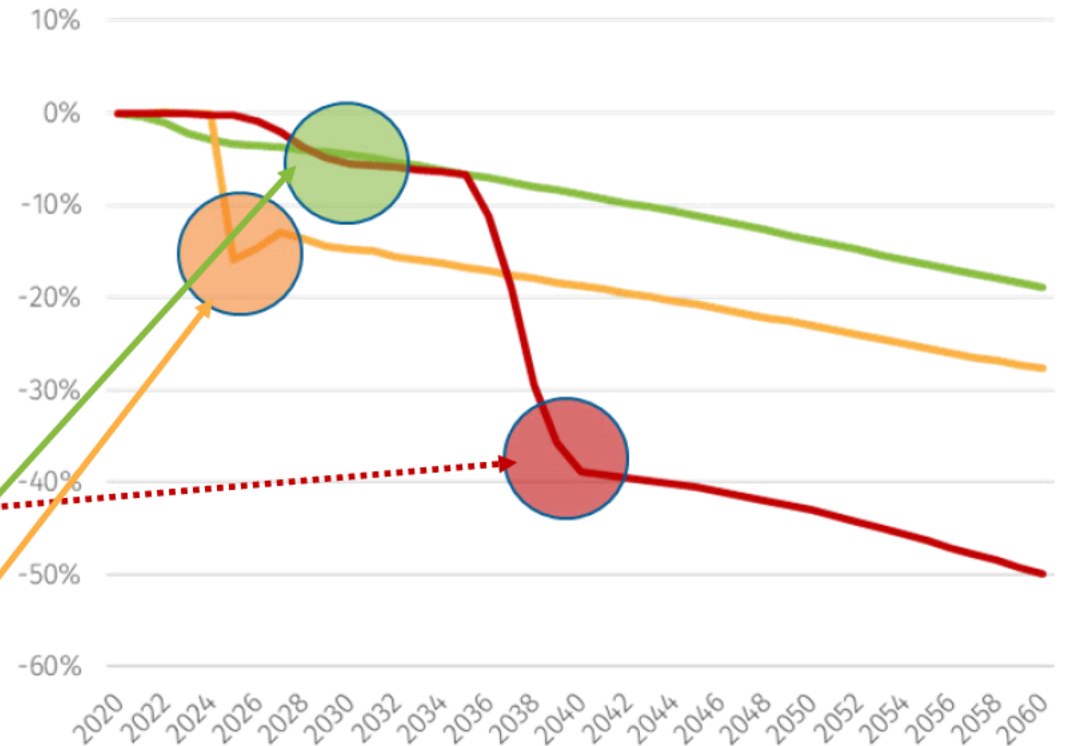
Overview of approach - Sector Risk MAPS

These results forms part of the sector-level insights, lifting useful insights from highly granular data

Sector allocation analysis:

- The premise of these insights is to divide sector/region pairs into categories of risk, based on quintiles of return impact for equity returns.
- We then overlay the portfolio allocations onto each of the sector/region pairs, and map them to the different quintiles.
- This then shows us how the portfolio is allocated to sector/regions of differing levels of climate risk exposure.
- To simplify and focus the output, we have chosen a single time horizon to measure the impacts for the different scenarios.
 - **Failed Transition:** 20y (this is after both pricing in epochs, so the full physical risk impact is captured)
 - **Pairs Orderly:** 10y (this allows time for the transition to be established and economies to stabilise)
 - **Paris Disorderly:** 5y (this is the low point of the disorderly shock and so captures the most concentrated example of transition risk).

Illustrative chart of cumulative return deltas to baseline





Overview of approach - Sector Risk MAPS

These results form part of the sector-level insights, lifting useful insights from highly granular data

Outputs and interpretation:

The main motivation of the outputs is to achieve the following:

- 1) A high-level appreciation of the distribution of allocation to different levels of climate risk exposure
- 2) An ability to help pin-point areas of the portfolio that deserve more **immediate attention in the form of detailed, stock/credit level analysis**
- 3) By cutting through the large volume of data the sector analysis creates, we generate efficient insights more appropriate for senior stakeholders

The portfolio allocations can also be compared to a benchmark. By default, we use MSCI ACWI as representative of the global equity market.

Data reliance:

Necessarily, we can only make inferences based on the data provided to us. Coverage % is included in the tab "SECTOR allocation risk summary"
If it has not been possible to look through into the holdings of funds, for example, then those funds will have been excluded from this analysis.
As such these outputs may provide a partial picture.

Also note that as part of the mapping exercise, pragmatic compromises may have been made.

For example, we would ideally want to reflect the region/sector-activity of economic exposure.

However, these data are typically hard to obtain, so proxies such as GICS/NACE sector may be used and/or region of domicile.

For multinational/diversified companies, the mapping may not fully reflect the scope of exposure. Which would require a more involved mapping exercise.

Remember that sectors should be more accurately thought of as economic activities.

A key example of this is that a large electricity generating company will use a mixture of fuel types to generate power.

Each of these fuels types is represented by an activity within our sector breakdown: Wind/Solar, Fossil fuels, Nuclear and other renewables.

Over the course of the green transition, we would reasonably expect the mix of these activities to shift from fossil to renewables.

A comprehensive dataset can be provided with the full sector/region impact data used for the following slides.

Example quintile grids - Sector Risk MAPS

Failed transition – 20y horizon – physical risk lens

	Consumer discr	Industrials	Health	Telecom	IT	Forestry	Financials	Consumer staples	Materials	Oil and gas	Coal and synthetic fuels	Real estate	Water supply	Other Low carbon and biofuel/elec	Wind and solar	Nuclear	Fossil based utilities	Public admin and defense
China	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2
India	1	1	1	1	2	1	1	1	1	2	2	2	1	2	2	2	2	2
Malaysia	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
Australia	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3
Philippines	1	1	1	1	1	1	1	2	2	3	3	2	2	3	3	3	3	3
US	1	1	1	1	1	1	1	2	2	2	3	2	2	3	3	3	3	3
World	1	1	1	1	1	1	1	2	2	2	3	2	2	3	3	3	3	3
Europe	1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4
Indonesia	1	2	1	1	1	2	2	2	3	4	4	3	3	3	4	3	4	4
Spain	1	1	1	1	2	2	2	3	2	3	3	3	3	4	4	4	4	4
Taiwan	1	2	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4
Netherlands	1	1	2	2	1	1	3	2	3	2	3	3	4	4	4	4	5	5
Japan	1	2	1	2	2	2	2	3	3	4	4	3	3	4	4	4	4	4
Thailand	1	2	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4
Singapore	1	2	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	5
Canada	1	2	3	3	3	1	4	2	3	2	2	4	4	5	5	5	5	5
France	1	2	2	3	3	2	3	3	3	2	3	4	4	5	5	5	5	5
South Korea	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4	4	4
Brazil	2	3	2	2	3	3	3	4	4	4	4	4	4	4	4	4	4	4
UK	1	2	4	3	3	3	1	4	4	2	2	4	5	5	5	5	5	5
Denmark	1	1	4	3	3	1	4	2	3	4	4	5	5	5	5	5	5	5
Italy	1	3	3	3	3	4	4	4	4	4	5	4	4	5	5	5	5	5
Switzerland	1	1	5	4	1	5	1	3	5	5	5	5	5	5	5	5	5	5
Germany	1	2	4	4	3	3	3	4	4	4	4	5	5	5	5	5	5	5
Norway	2	3	4	4	4	3	4	4	5	3	4	5	5	5	5	5	5	5
Sweden	1	3	5	4	3	5	5	5	3	5	5	5	5	5	5	5	5	5
Finland	2	4	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5
Russia	3	4	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5

Paris orderly – 10y horizon – transition risk lens

	Fossil based utilities	Coal and synthetic fuels	Oil and gas	Consumer discr	Nuclear	Financials	Forestry	Health	Public admin and defense	Real estate	Telecom	Materials	Consumer staples	Water supply	IT	Industrials	Other Low carbon and biofuel/elec	Wind and solar
Australia	1	1	1	2	2	2	2	2	2	2	2	3	3	2	2	4	1	2
Canada	1	1	1	1	1	1	2	2	2	2	2	2	3	3	2	2	5	5
Norway	1	1	1	2	2	2	3	2	2	2	3	1	3	3	2	3	5	1
Switzerland	1	2	1	2	1	2	2	2	2	2	2	2	2	2	3	4	5	1
US	1	1	1	2	5	2	2	2	2	2	2	2	3	3	2	2	5	6
Malaysia	1	1	1	2	1	2	2	2	3	3	2	3	2	3	4	4	5	5
Europe	1	1	1	2	1	2	3	2	2	3	3	3	4	5	4	4	2	5
Finland	1	1	2	2	1	2	4	3	3	4	2	4	5	3	4	4	1	2
China	1	1	1	2	5	2	2	3	2	4	3	4	3	2	4	4	1	5
France	1	1	1	2	1	3	2	3	3	3	4	3	3	5	4	4	2	5
Germany	1	1	1	2	1	3	2	2	3	3	4	4	3	3	3	4	5	5
Netherlands	1	1	1	2	5	2	2	2	3	3	3	3	3	2	3	4	5	5
Italy	1	1	1	2	3	3	3	3	3	4	2	4	4	2	5	4	1	5
World	1	1	1	2	5	3	2	2	2	3	2	4	3	3	4	4	4	5
Spain	1	1	1	2	1	3	3	3	2	2	4	4	3	5	3	4	5	5
Indonesia	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	4	5	5
Sweden	1	1	2	2	1	3	4	3	3	4	4	4	3	4	5	4	1	5
Japan	1	1	2	3	1	4	2	3	3	3	4	3	5	3	4	5	5	5
Denmark	1	1	1	2	3	2	3	3	3	3	4	4	3	5	5	4	5	5
Philippines	1	1	1	3	3	4	4	4	2	4	4	4	5	3	4	5	5	5
Singapore	1	1	1	2	4	3	5	5	3	4	4	3	5	4	4	5	5	5
UK	1	1	1	2	5	3	5	3	3	3	5	4	5	3	5	4	5	5
Thailand	1	1	1	2	4	5	4	4	3	3	4	5	5	4	4	4	5	5
Russia	1	1	1	3	5	3	4	4	3	4	4	5	4	4	5	5	5	5
Taiwan	1	1	4	2	5	4	4	4	4	4	4	5	4	4	4	4	5	5
Brazil	1	1	1	5	1	5	2	5	5	4	5	4	5	5	5	5	5	5
South Korea	1	1	4	2	5	5	4	4	4	5	4	4	4	4	4	4	5	5
India	1	1	1	1	5	5	5	4	5	5	5	5	5	5	5	5	5	5

High level insights - Sector Risk MAPS

Averaging the sector quintiles across all regions, combining results from the two transition scenarios to inform systemic transition exposure and using the failed transition to inform physical risk.

Sector/activity	Sector quintile score (low = worse) across all regions			RiskRank
	Transition quintile	Physical risk quintile	Combined	
Consumer discretionary	2.4	1.2	1.8	1
Oil and gas	1.4	3.0	2.2	2
Coal and manufactured fuels	1.1	3.4	2.2	3
Fossil based utilities	1.0	4.0	2.5	4
Forestry	3.0	2.3	2.7	5
Health	3.1	2.3	2.7	6
Financials	3.0	2.5	2.8	7
Telecom	3.3	2.3	2.8	8
Industrials	3.9	1.9	2.9	9
IT	3.7	2.2	3.0	10
Consumer staples	3.4	2.8	3.1	11
Materials	3.4	3.0	3.2	12
Real estate	3.1	3.5	3.3	13
Nuclear	2.8	4.1	3.4	14
Water supply	3.5	3.5	3.5	15
Public administration and defense	3.1	4.1	3.6	16
Other Low carbon and biobased electricity	4.1	4.0	4.0	17
Wind and solar	4.5	4.1	4.3	18

A key takeaway from this table could be a prioritization for deeper analysis of holdings within these sectors

Listed equity



Public equity | High-level Risk MAP insights

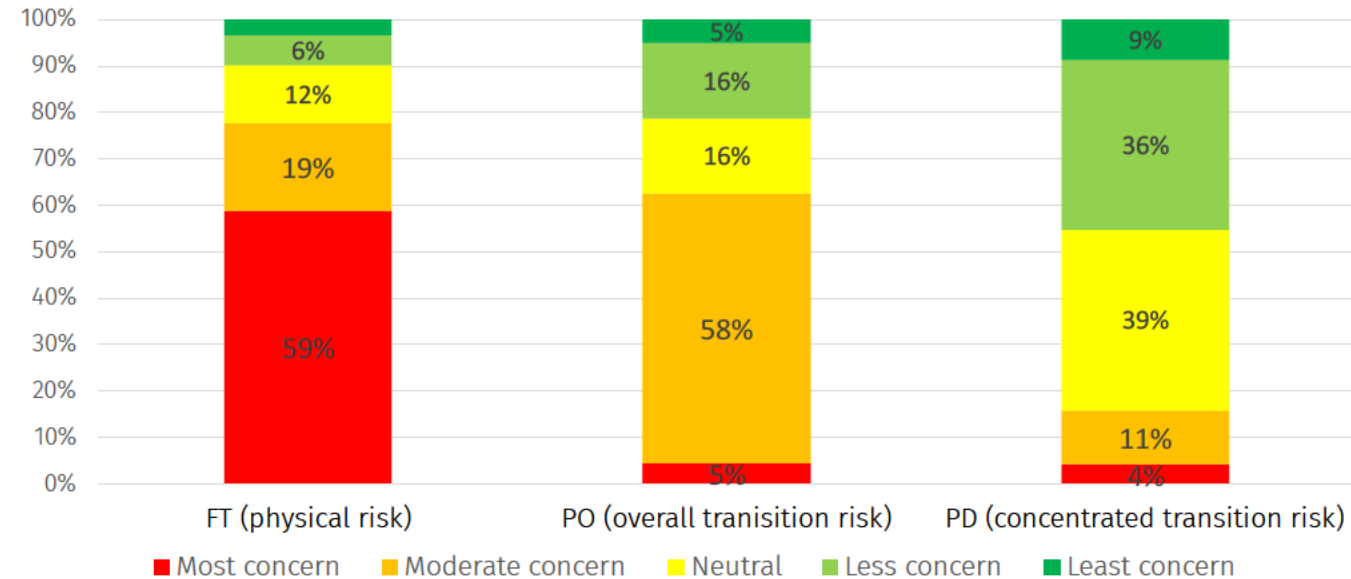
Significant physical risk exposure, moderate overall transition risk.

The failed transition (FT) scenario highlights the physical risk exposures of the portfolio. The sectors mapped to the top 2 quintile are typically either operationally exposed to gradual physical risk (rising temperatures, changing weather patterns), extreme weather, or both. The other physical risk factor is the length and complexity of supply/value chains.

Whilst transition risk is undoubtedly more proximate. These results suggest that physical risk (and the uncertain time when it could be materially priced-in) is significant for this portfolio.

Overall, the portfolio results are similar to the global benchmark.

Portfolio summary | Public equity
Comparison across scenarios: allocation by climate risk quintile



Using these results

We suggest that the sector-level insights from this analysis is used to “triage”/focus deep-dives into the climate-readiness of individual holdings by the asset managers and their analysts; who are best placed to make an “on the ground” assessment of the appropriateness of these holdings given your other investment objectives.

Risk MAP high climate materiality insights| Portfolio

Zooming in on the more climate exposed parts of region/sector grids, we see where portfolio allocations arise in areas that could be more systemically exposed to climate risk.

FT

20y Physical risk outlook		Sector average quintile	1.12	1.76	2.09	2.30	2.27
Region average quintile	PORTFOLIO weights	Consumer discr	Industrials	Health	Telecom	IT	
1.50	China	0.8%	0.3%	0.1%	0.8%	0.2%	
1.76	Australia	0.3%	0.1%	0.2%	0.1%	0.1%	
1.78	India	0.0%	0.0%	0.0%	0.0%	0.0%	
2.00	Malaysia	0.0%	0.2%	0.1%	0.1%	0.3%	
2.00	US	6.3%	5.2%	7.5%	4.9%	13.9%	
2.06	Rest of World	0.4%	0.5%	0.2%	0.3%	0.3%	
2.09	Philippines	0.0%	0.0%	0.0%	0.1%	0.1%	
2.33	Indonesia	0.1%	0.0%	0.1%	0.1%	0.0%	
2.42	Netherlands	0.0%	0.0%	0.0%	0.1%	0.1%	

Through this more detailed view, we can see the sector/region holding that are driving the quintile 1 and 2 allocations in the previous slide.

Note on conditional formatting:

Zero allocation = grey cell background

Otherwise graded yellow (low allocation) to blue (max blue hue shaded cells show the top 10% region/sector pairs across the whole portfolio.)

To highlight the top 10% of sector/regions TEXT is shown in white. A blue cell with black text isn't quite in the top 10%)

PD

5y disorderly transition outlook		Sector average quintile	1.00	1.00	1.48	2.58
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr	
1.57	Norway	0.00%	0.00%	-0.03%	0.00%	
1.67	Finland	-0.04%	0.01%	0.10%	0.32%	
2.00	France	-0.17%	-0.02%	0.00%	-0.33%	
2.00	Russia	-0.08%	0.09%	-0.04%	0.07%	
2.14	Italy	-0.04%	0.01%	0.04%	0.82%	
2.17	Netherlands	0.00%	0.00%	-0.11%	-0.07%	
2.22	China	0.02%	-0.04%	0.12%	-0.77%	
2.38	Germany	0.00%	-0.02%	0.03%	-0.43%	
2.45	Sweden	-0.01%	0.00%	0.08%	0.05%	

PO

10y orderly transition outlook		Sector average quintile	1.00	1.00	1.33	2.15
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr	
2.00	Norway	0.00%	0.00%	0.00%	0.00%	
2.06	Australia	-0.01%	0.04%	-0.01%	0.28%	
2.11	Canada	0.00%	0.01%	0.15%	0.15%	
2.18	Switzerland	0.00%	0.00%	0.24%	0.02%	
2.44	US	0.00%	0.72%	1.27%	6.33%	
2.47	Malaysia	0.00%	0.00%	0.08%	-0.02%	

Risk MAP high climate materiality insights| Active weights

Zooming in on the more climate exposed parts of region/sector grids, we see where over/under weights vs MSCI ACWI arise in areas that could be more systemically exposed to climate risk.

FT

20y Physical risk outlook		Sector average quintile					
			1.12	1.76	2.09	2.30	2.27
Region average quintile	ACTIVE WEIGHT		Consumer discr	Industrials	Health	Telecom	IT
1.50	China	-0.77%	0.05%	-0.25%	-0.15%	-0.14%	
1.76	Australia	0.15%	0.02%	-0.04%	0.06%	-0.01%	
1.78	India	-0.08%	-0.04%	-0.07%	-0.01%	-0.21%	
2.00	Malaysia	-0.02%	0.24%	0.08%	0.08%	0.26%	
2.00	US	-0.72%	1.51%	-0.33%	-1.77%	-2.13%	
2.06	Rest of World	0.15%	0.28%	-0.07%	0.08%	-0.11%	
2.09	Philippines	0.03%	-0.01%	0.00%	0.06%	0.06%	
2.33	Indonesia	0.05%	0.04%	0.06%	0.04%	0.01%	
2.42	Netherlands	-0.07%	-0.09%	-0.08%	0.03%	-0.18%	

PD

5y disorderly transition outlook		Sector average quintile				
			1.00	1.00	1.48	2.58
Region average quintile	ACTIVE WEIGHT		Coal and synth fuels	Fossil based utilitiies	Oil and gas	Consumer discr
1.57	Norway	0.00%	0.00%	-0.03%	0.00%	
1.67	Finland	-0.04%	0.01%	0.10%	0.32%	
2.00	France	-0.17%	-0.02%	0.00%	-0.33%	
2.00	Russia	-0.08%	0.09%	-0.04%	0.07%	
2.14	Italy	-0.04%	0.01%	0.04%	0.82%	
2.17	Netherlands	0.00%	0.00%	-0.11%	-0.07%	
2.22	China	0.02%	-0.04%	0.12%	-0.77%	
2.38	Germany	0.00%	-0.02%	0.03%	-0.43%	
2.45	Sweden	-0.01%	0.00%	0.08%	0.05%	

Through this more detailed view, we can see the over/under weights relative to MSCI ACWI for sector/region holding that are driving the quintile 1 and 2 allocations in the previous slide.

Note on conditional formatting:

Zero allocation = grey cell background

Otherwise graded yellow (low allocation) to blue (max blue hue shaded cells show the top 10% region/sector pairs across the whole portfolio.)

To highlight the top 10% of sector/regions TEXT is shown in white. A blue cell with black text isn't quite in the top 10%)

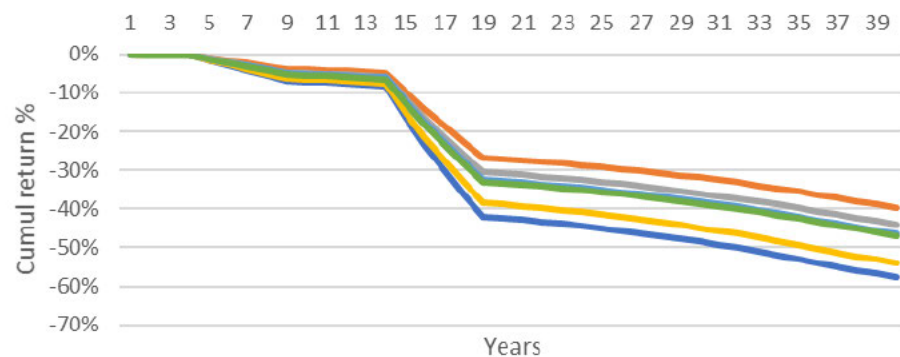
PO

10y orderly transition outlook		Sector average quintile				
			1.00	1.00	1.33	2.15
Region average quintile	ACTIVE WEIGHT		Coal and synth fuels	Fossil based utilitiies	Oil and gas	Consumer discr
2.00	Norway	0.00%	0.00%	-0.03%	0.00%	
2.06	Australia	-0.04%	0.03%	-0.04%	0.15%	
2.11	Canada	-0.13%	-0.03%	-0.11%	0.04%	
2.18	Switzerland	0.00%	0.00%	0.24%	-0.10%	
2.44	US	-0.82%	-0.22%	0.57%	-0.72%	
2.47	Malaysia	0.00%	-0.01%	0.08%	-0.02%	

Sector line charts for most material sector/regions

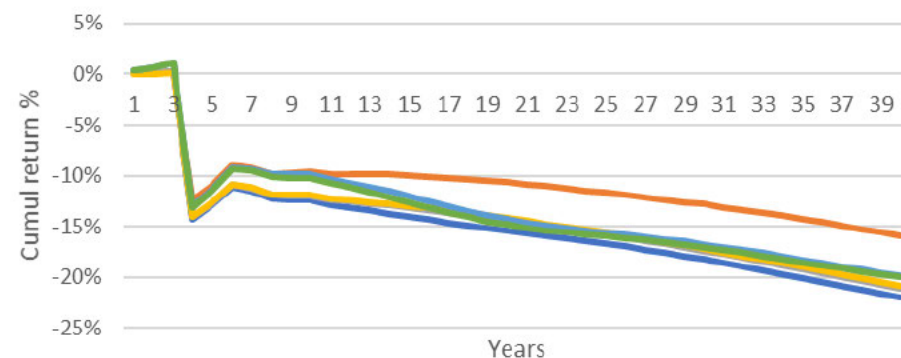
The six most material sectors show a reasonable spread of impacts. These sectors are in the “sectors of concern” for physical risk, but are less significant for transition risk.

FT - Cumul return DELTA - Top six sector/regions

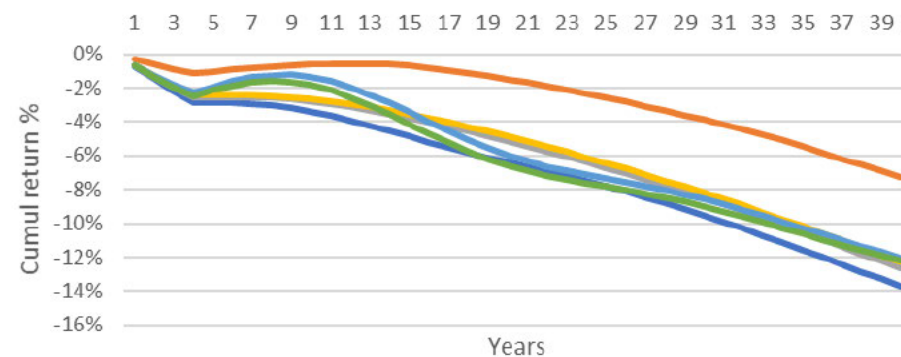


US - Consumer discr US - Consumer staples US - Financials
 US - Health US - Industrials US - IT

PD - Cumul return DELTA - Top six sector/regions



PO - Cumul return DELTA - Top six sector/regions



US - Consumer discr US - Consumer staples US - Financials
 US - Health US - Industrials US - IT

The most material region/sector allocations in the public equity portfolio are:

Region - Sector	Allocation (as % of public equity)
US - IT	13.9%
US - Health	7.5%
US - Consumer discr	6.3%
US - Financials	5.8%
US - Industrials	5.2%
US - Consumer staples	4.3%

Private equity



Mapping for PE sector allocations

- To facilitate the mapping, we collapsed the data provided to us:

STRATEGY		SECURITY		REGION		Actual Weight	TMT	INDUSTRIAL	BUS SERV	CONSUMER	HEALTHCARE	FIG
Venture/Growth	16%	Equity - non-control	100%	North America	37%	5.8%	44%	3%	3%	21%	17%	12%
				Europe	14%	2.2%	37%	1%	9%	13%	21%	19%
				Asia	47%	7.4%	26%	2%	2%	44%	21%	5%
				Latin America	2%	0.3%	30%	3%	3%	22%	23%	18%
Buyout	78%	Equity - control	100%	North America	68%	52.7%	31%	16%	13%	15%	15%	11%
				Europe	26%	20.2%	20%	15%	16%	21%	12%	16%
				Asia	4%	3.1%	18%	18%	10%	32%	11%	11%
				Latin America	2%	1.6%	11%	20%	11%	35%	12%	12%
Distressed Debt	7%	Distressed debt	100%	North America	70%	4.7%	20%	20%	7%	20%	20%	13%
				Europe	25%	1.7%	20%	20%	8%	20%	20%	13%
				Asia	5%	0.3%	20%	20%	10%	20%	20%	10%
				Latin America	0%	0.0%	0%	0%	0%	0%	0%	0%

- To a format that is consistent with input grid for our sector analysis tool:

	Telecom	Industrials	Consumer discretionary	Consumer staples	Health	Financials
US	19.9%	9.4%	12.2%	4.9%	9.6%	7.3%
Europe	5.2%	3.3%	6.0%	2.4%	3.2%	3.8%
China	2.5%	0.8%	2.6%	2.2%	2.0%	0.8%
Brazil	0.3%	0.3%	0.5%	0.3%	0.3%	0.2%

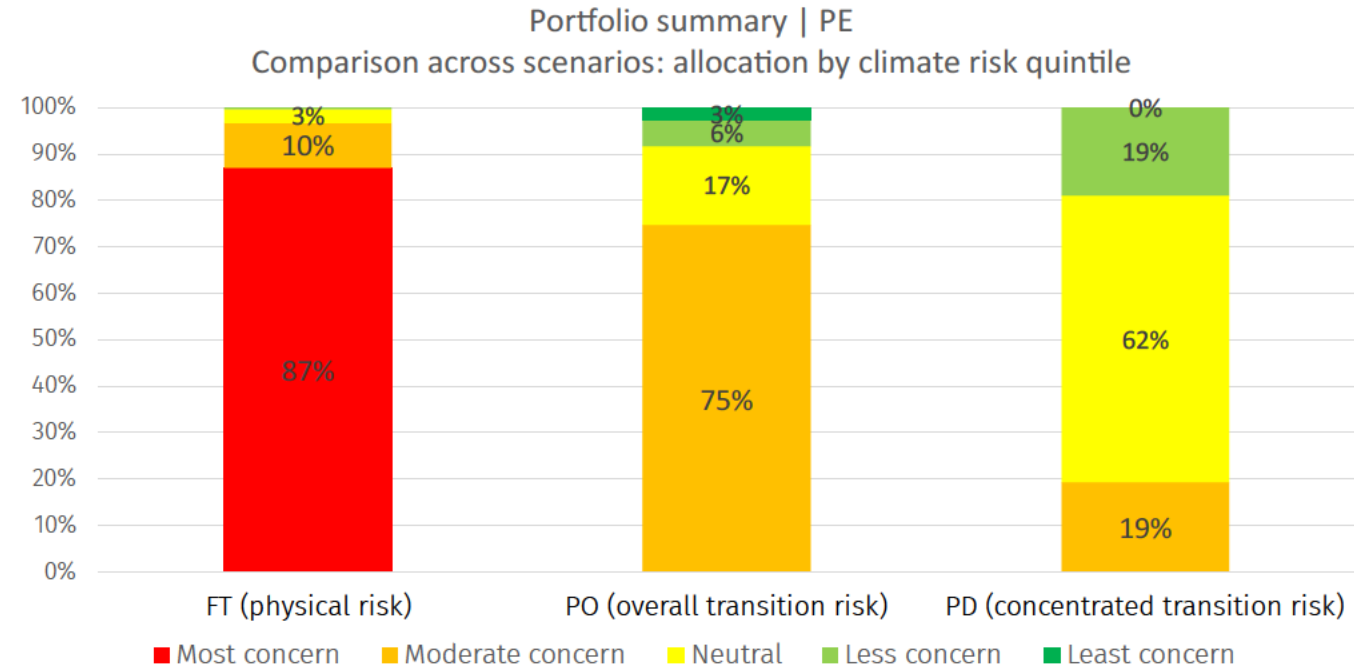
PE | High-level Risk MAP insights

Significant physical risk exposure, moderate overall transition risk.

More so than for listed equity, the failed transition (FT) scenario highlights the physical risk exposures of the PE portfolio. The sectors mapped to the top 2 quintile are typically either operationally exposed to gradual physical risk (rising temperatures, changing weather patterns), extreme weather, or both. The other physical risk factor is the length and complexity of supply/value chains.

Whilst transition risk is undoubtedly more proximate. These result suggest that physical risk (and the uncertain time when it could be materially priced-in) is significant for this portfolio.

The illiquidity of this asset class suggest that climate risk should be considered as part of deal due diligence, since exiting positions can take significant time.



Using these results

We suggest that the sector-level insights from this analysis is used to “triage”/focus deep-dives into the climate-readiness of individual holdings by the asset managers and their analysts; who are best placed to make an “on the ground” assessment of the appropriateness of these holdings given your other investment objectives.

Risk MAP high climate materiality insights| PE

Zooming in on the more climate exposed parts of region/sector grids, we see where portfolio allocations arise in areas that could be more systemically exposed to climate risk.

FT

20y Physical risk outlook		Sector average quintile				
		1.12	1.76	2.09	2.30	2.27
Region average quintile	PORTFOLIO weights	Consumer discr	Industrials	Health	Telecom	IT
1.50	China	2.6%	0.8%	2.0%	2.5%	0.0%
1.76	Australia	0.0%	0.0%	0.0%	0.0%	0.0%
1.78	India	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	Malaysia	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	US	12.2%	9.4%	9.6%	19.9%	0.0%
2.06	Rest of World	0.0%	0.0%	0.0%	0.0%	0.0%
2.09	Philippines	0.0%	0.0%	0.0%	0.0%	0.0%
2.33	Indonesia	0.0%	0.0%	0.0%	0.0%	0.0%
2.42	Netherlands	0.0%	0.0%	0.0%	0.0%	0.0%

Through this more detailed view, we can see the sector/region holding that are driving the quintile 1 and 2 allocations in the previous slide.

Note on conditional formatting:

Zero allocation = grey cell background

Otherwise graded yellow (low allocation) to blue (max blue hue shaded cells show the top 10% region/sector pairs across the whole portfolio.)

To highlight the top 10% of sector/regions TEXT is shown in white. As a blue cell with black text isn't quite in the top 10%)

PD

5y disorderly transition outlook		Sector average quintile			
		1.00	1.00	1.48	2.58
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
1.57	Norway	0.0%	0.0%	0.0%	0.0%
1.67	Finland	0.0%	0.0%	0.0%	0.0%
2.00	France	0.0%	0.0%	0.0%	0.0%
2.00	Russia	0.0%	0.0%	0.0%	0.0%
2.14	Italy	0.0%	0.0%	0.0%	0.0%
2.17	Netherlands	0.0%	0.0%	0.0%	0.0%
2.22	China	0.0%	0.0%	0.0%	2.6%
2.38	Germany	0.0%	0.0%	0.0%	0.0%
2.45	Sweden	0.0%	0.0%	0.0%	0.0%

PO

10y orderly transition outlook		Sector average quintile			
		1.00	1.00	1.33	2.15
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
2.00	Norway	0.0%	0.0%	0.0%	0.0%
2.06	Australia	0.0%	0.0%	0.0%	0.0%
2.11	Canada	0.0%	0.0%	0.0%	0.0%
2.18	Switzerland	0.0%	0.0%	0.0%	0.0%
2.44	US	0.0%	0.0%	0.0%	12.2%
2.47	Malaysia	0.0%	0.0%	0.0%	0.0%

Real assets



Mapping for Real asset sector allocations

- To facilitate the mapping, we collapsed the data provided to us, aggregated over both equity and debt:

	Utilities	Transport	Renewables	Power	Digital	PPPs	O&G mid	O&G up	Metals & Mining	Timberland	Agriculture
North America	6.3%	4.4%	5.3%	7.0%	5.8%	2.5%	11.7%	15.2%	3.6%	4.1%	3.7%
Europe	2.7%	1.6%	2.1%	1.3%	4.5%	0.2%	1.8%	0.1%	0.5%	0.0%	0.2%
Asia	1.2%	0.8%	0.9%	0.3%	1.2%	0.0%	0.9%	0.0%	2.8%	0.0%	0.0%
Brazil	0.5%	0.6%	0.8%	0.0%	1.0%	0.0%	0.5%	0.0%	1.0%	0.0%	0.2%
World	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%

- Into a format that is consistent with input grid for our sector analysis tool*:

	Fossil based utilities	Nuclear	Other Low carbon and biobased electricity	Wind and solar	Industrials	IT	Public admin and defence	Oil and gas	Materials	Forestry	Consumer staples
US	7.9%	0.9%	0.5%	5.9%	4.4%	5.3%	5.8%	2.5%	26.9%	3.6%	4.1%
Europe	1.7%	0.2%	0.5%	3.0%	1.6%	2.1%	4.5%	0.2%	1.9%	0.5%	0.0%
China	0.9%	0.0%	0.2%	1.1%	0.8%	0.9%	1.2%	0.0%	0.9%	2.8%	0.0%
Brazil	0.1%	0.0%	0.6%	0.9%	0.6%	0.8%	1.0%	0.0%	0.5%	1.0%	0.0%
World	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%

*this included "respreading" the power and utilities allocation as described on slide 5

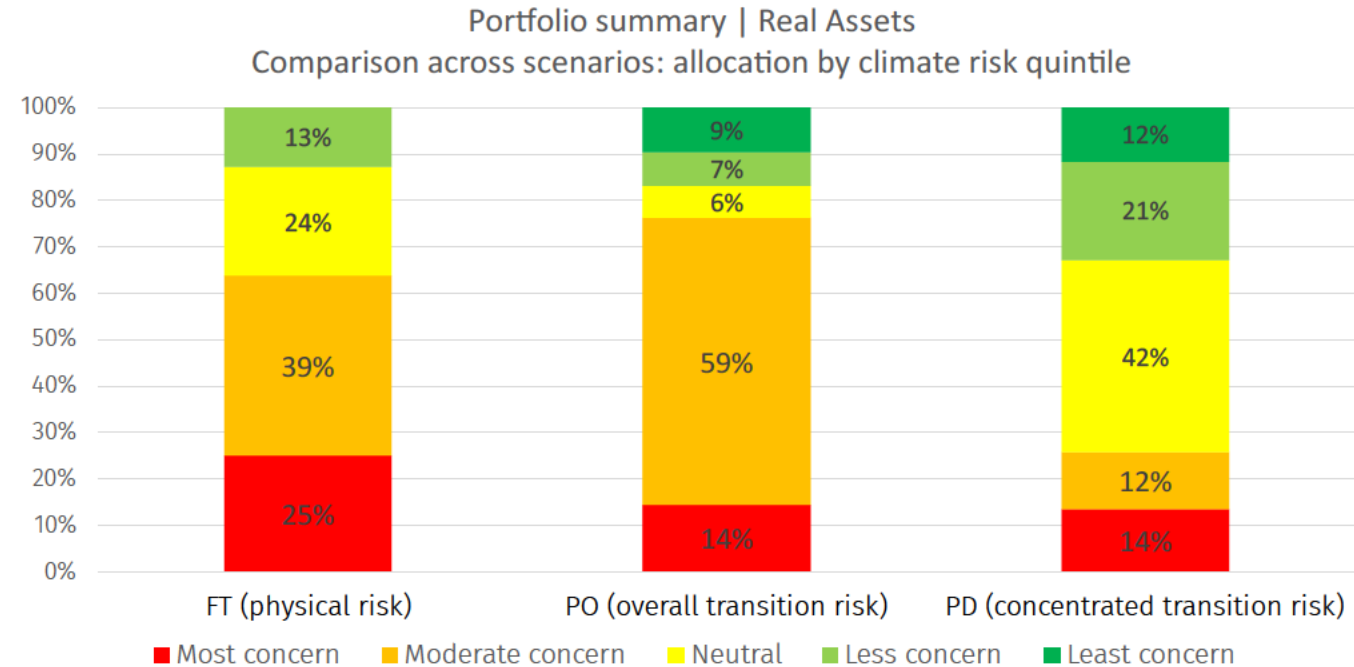
Real assets | High-level Risk MAP insights

Moderate physical risk exposure, moderate overall transition risk.

Compared to the other two portfolios, the risk profile distribution is more balanced across physical and transition risk, and with less extreme allocations to “concerning” sectors.

There remains, however c.60% (physical risk) and c.75% (transition risk) of holdings falling in the upper two quintiles. Perhaps indicating valuable areas to focus any more detailed assessments.

The illiquidity of this asset class suggest that climate risk should be considered as part of deal due diligence, since exiting positions can take significant time.



Using these results

We suggest that the sector-level insights from this analysis is used to “triage”/focus deep-dives into the climate-readiness of individual holdings by the asset managers and their analysts; who are best placed to make an “on the ground” assessment of the appropriateness of these holdings given your other investment objectives.

Risk MAP high climate materiality insights | Real assets

Zooming in on the more climate exposed parts of region/sector grids, we see where portfolio allocations arise in areas that could be more systemically exposed to climate risk.

FT

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1.50	China	0.0%	0.8%	0.0%	0.0%	0.9%
1.76	Australia	0.0%	0.0%	0.0%	0.0%	0.0%
1.78	India	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	Malaysia	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	US	0.0%	4.4%	0.0%	0.0%	5.3%
2.06	Rest of World	0.0%	0.0%	0.0%	0.0%	0.0%
2.09	Philippines	0.0%	0.0%	0.0%	0.0%	0.0%
2.33	Indonesia	0.0%	0.0%	0.0%	0.0%	0.0%
2.42	Netherlands	0.0%	0.0%	0.0%	0.0%	0.0%

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PD

5y disorderly transition outlook		Sector average quintile			
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Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
1.57	Norway	0.0%	0.0%	0.0%	0.0%
1.67	Finland	0.0%	0.0%	0.0%	0.0%
2.00	France	0.0%	0.0%	0.0%	0.0%
2.00	Russia	0.0%	0.0%	0.0%	0.0%
2.14	Italy	0.0%	0.0%	0.0%	0.0%
2.17	Netherlands	0.0%	0.0%	0.0%	0.0%
2.22	China	0.0%	0.0%	0.0%	2.6%
2.38	Germany	0.0%	0.0%	0.0%	0.0%
2.45	Sweden	0.0%	0.0%	0.0%	0.0%

PO

10y orderly transition outlook		Sector average quintile			
		1.00	1.00	1.33	2.15
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
2.00	Norway	0.0%	0.0%	0.0%	0.0%
2.06	Australia	0.0%	0.0%	0.0%	0.0%
2.11	Canada	0.0%	0.0%	0.0%	0.0%
2.18	Switzerland	0.0%	0.0%	0.0%	0.0%
2.44	US	0.0%	7.9%	2.5%	0.0%
2.47	Malaysia	0.0%	0.0%	0.0%	0.0%



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Amendments to 3/8/23 Testimony of Rick Pope to Oregon Investment Council

3/16/2023

Note: the only amendments are to the calculated OPERF 10 and 20 year values under Ortec's Failed Transition scenario, and to part of the title of the figure showing the 10 year value.

I made a decimal error in my 3/8/23 testimony so the decrease in value by divesting fossil fuels in a Failed Transition in 10 years is \$25.7 million not \$257 million; and in 20 years is \$257 million not \$2.57 billion. Changed calculations are to the Failed Transition diagram on p. 4 and bullets at bottom of p. 8 below. The title of the Failed Transition diagram on p. 3 now reads "Replace fossil fuels with 'Paris-Aligned' fund" instead of "Keep fossil fuel public equities." All other testimony remains the same.

More than a year ago I requested from Treasury any document relating to assessments of or responses to climate-related financial risk to OPERF investments.

After the Treasurer wrote to every legislator that fossil fuel divestment would almost certainly reduce OPERF returns, and during your last meeting, Treasury produced a year-old study it commissioned from Ortec Finance, its chosen international financial expert.

This deep dive report posed and answered the question: "What if OPERF divested from its liquid-market fossil fuel investments?" Its stated purpose: "to cut through the immense detail and deliver the key insights."

What were those key insights?

In two of three studied scenarios, Ortec found fossil fuel divestment would increase OPERF's public equity portfolio by \$1 billion over 10 years. Ortec predicted a modest 10-year loss only in a scenario where there is no transition to clean energy until every last bit of coal, oil and gas is extracted and burned. That's cold comfort for OPERF. In that scenario, Ortec also found the economic damage to OPERF's entire portfolio from climate change would vastly outweigh the modest benefit to its public-equity portfolio by staying invested in fossil fuels.

Treasury's suppression of this report for the past year, all while fossil fuel divestment was being put front and center by OPERF beneficiaries, creates serious transparency and trust concerns. This transgression should not be allowed to fester unaddressed.

We respectfully request that you place this matter on the agenda for the OIC's next meeting. We ask the OIC to determine and tell PERS beneficiaries, PERS employers, and the taxpaying public when and where the findings of the Ortec divestment report were received, when and where the findings were disseminated, and how the findings were considered and viewed by each of their various recipients.

I prepared diagrams that follow, showing how Ortec reached its 10-year bottom line conclusions. Following the diagrams are details on how Treasury suppressed the Ortec divestment report, what the report studied and what it concluded.

Diagrams showing Ortec divestment report methodology and conclusions

The following illustrative diagrams I created show how Ortec presented its conclusions on the impact of replacing OPERF's fossil fuel public equities in three scenarios The studied impact is to OPERF's public-equity portfolio.

The three scenarios are:

1. A clean-energy transition "soft landing" with no great economic shocks, which Ortec labeled a "PO" or Paris orderly transition.
2. A clean-energy transition "bumpy landing with a significant economic shock, which Ortec labeled a "PD" or Paris disorderly transition.
3. Business as usual with no policy-driven clean-energy transition, which Ortec labeled an "FT" or failed transition.

The diagrams consist of:

1. A black baseline, representing historic increasing investment values in the absence of climate change.
2. A green line reflecting change from the baseline in each climate-changing scenario where Treasury replaced OPERF fossil fuel public equities.
3. A red line reflecting change from the baseline in the same climate-changing scenario where Treasury kept OPERF fossil fuel public equities.

Average annualized return and monetary differences between the red and green lines on the diagrams are stated at p. 6 of Ortec's divestment report, Exhibit 1 to my testimony.

Ortec's description of its Paris Orderly, Paris Disorderly and Failed Transition scenarios are in its earlier climate scan report to Treasury, Exhibit 6 p. 6 to my testimony.

If clean-energy transition fails, Ortec found in its earlier study for Treasury, that gain will be overwhelmed by losses to the entire OPERF portfolio from increasing costs of climate-caused physical damage. On this point Ortec concluded:

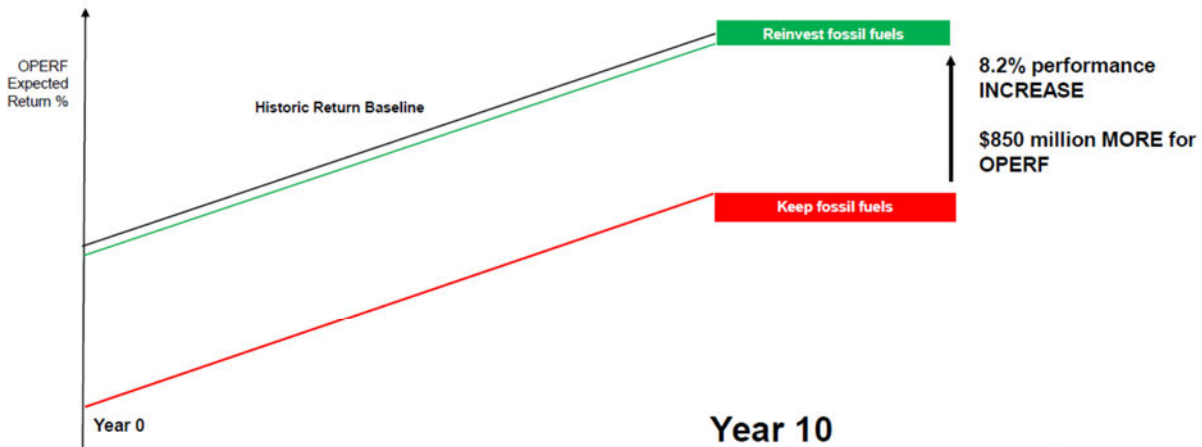
Worst outcomes come in a failed transition due to physical risks

Globally, the physical risks experienced when transition to a greener economy fails, have the most significant impacts (63% lower US GDP by 2100). Notably, by 2037 OPERF's portfolio value in the Failed Transition scenario is significantly down compared to an orderly low carbon transition. *In a Failed Transition, by 2060 your asset portfolio value is expected to c.20% lower than baseline (emphasis added).*¹

¹ Exhibit 6 p. 3.

Impact on OPERF public-equity portfolio:
Replace fossil fuels with “Paris-aligned” fund

“Paris Orderly” energy-transition soft landing scenario after 10 years

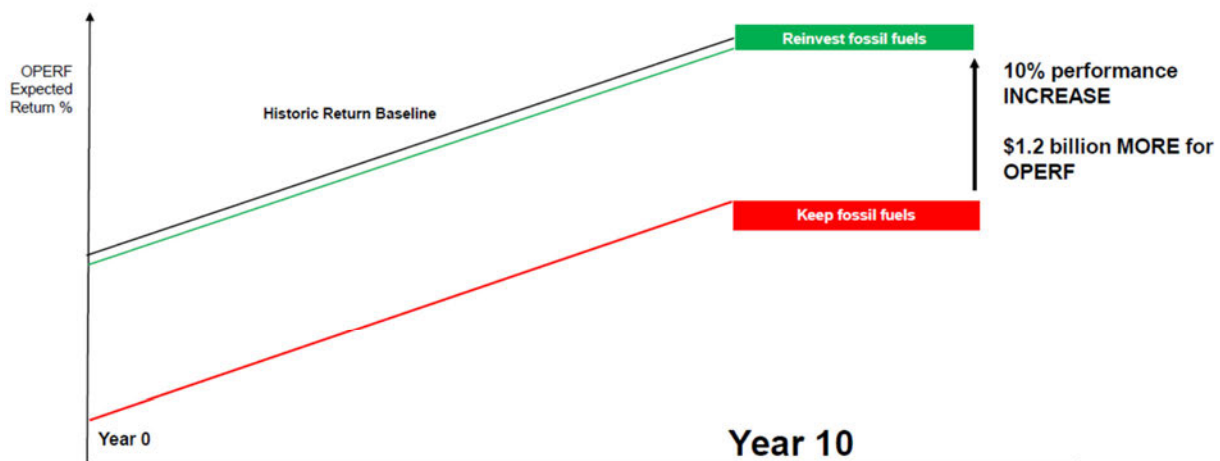


Sources:

- Ortec “Public Equity Deep Dive” p. 6
- Ortec “Climate MAPS report p. 6
- Treasury OPERF public equities valuation 12/31/21

Impact on OPERF public-equity portfolio:
Replace fossil fuels with “Paris-aligned” fund

“Paris Disorderly” energy-transition bumpy landing scenario after 10 years

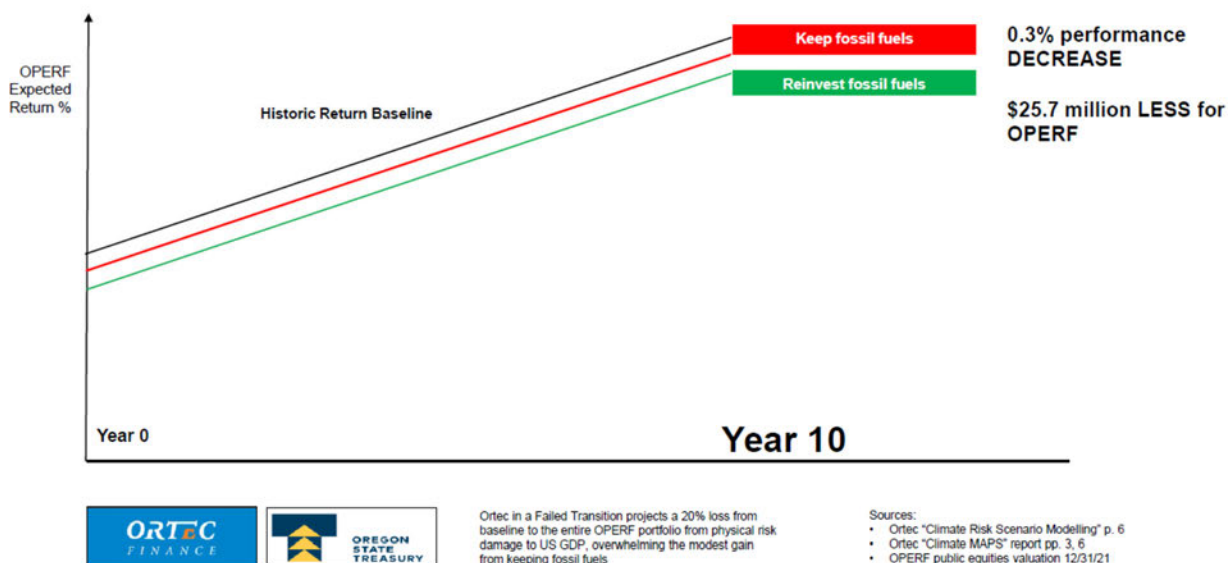


Sources:

- Ortec “Public Equity Deep Dive” p. 6
- Ortec “Climate MAPS report p. 6
- OPERF public equities valuation 12/31/21

**Impact on OPERF public-equity portfolio:
Keep fossil fuel public equities**

“Failed Transition” (fossil-fuel business as usual) scenario after 10 years



**Treasury suppresses the Ortec fossil fuel divestment report
during a year-long public records request**

Materials presented to the Oregon Investment Council on 9/8/21 described a consultant engagement with Manifest Climate of Toronto and Ortec Finance of Rotterdam to better understand “climate risk at the total portfolio level.” Treasury said that job was outside its expertise, and “requires outside help offering complex tools & econometric analyses that account for uncertainty and interconnectivity of factors being modeled.”²

I made a public records request in December 2021 for Treasury’s request for proposals and responses to them, and for the consulting contract.

Displaying their confidence in the specific consultants, Treasury asked for a proposal only from Ortec and Manifest. The contract was signed in May 2021 by Chief Investment Officer Rex Kim. The scope of work is attached.³

On January 12, 2022, I made a public records request for “Any documents . . . that relate to assessments of or responses to climate-related financial risk to assets held in investment

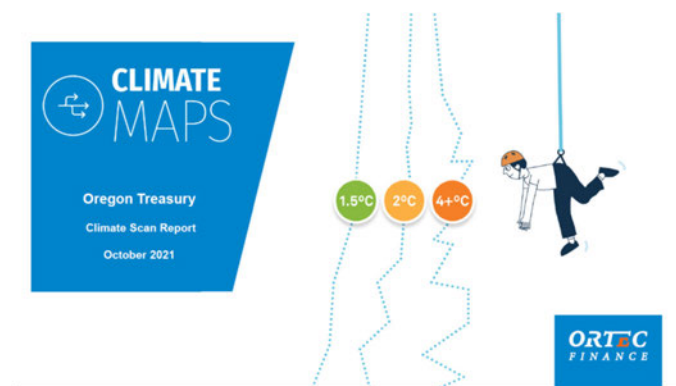
² Exhibit 2 p. 3, 4.

³ Exhibit 3.

funds as defined by ORS 293.701.”

Treasury produced nothing in response until July 20, 2022, when it said it was focusing on **“the deliverable,” (singular not plural)**, from the contractor, and that a heavily redacted **“final report”** was available from Treasury’s public records center (emphases added).⁴ That report, titled “Climate MAPS, Oregon Treasury Climate Scan Report, October 2021,” addressed “climate risk exposure” to the “OPERF investment portfolio” through a “view from 10,000 feet.”

In August 2022, I began an ongoing mediation over these redactions and other requested documents through Oregon’s Public Records Advocate. As a result, Treasury on December 23, 2022, released a less-redacted version of the allegedly final “Climate MAPS” report.⁵



On January 17, 2023, I wrote to Treasury that “as part of this request, please provide me a copy of any document establishing climate risk investment policies to be followed by

Treasury investment staff.”

Treasurer Read tells every legislator that divestment will “almost certainly” cause lower returns for OPERF

On January 18, 2023, Treasurer Read wrote to all members of the Oregon Legislature, contending that fossil-fuel investment restrictions in HB 2601 **“will almost certainly lead to a reduction in investment returns. . . .”** (emphasis added).⁶ He made no mention of the Ortec divestment study his chief investment officer had commissioned.

Treasury finally discloses the Ortec report that found divestment producing higher returns for OPERF

On January 25, 2023, a week after Treasurer Read’s letter, that Treasury disclosed to me Ortec’s additional report dated February 2022—a year earlier. It is titled “Climate Risk Scenario Modelling, Public equity sector deep dive.”⁷

It posed and answered the question: “What if OPERF divested from its liquid-market fossil fuel investments?”⁸ It stated its purpose: “to cut through the immense detail and deliver

⁴ Exhibit 4.

⁵ Exhibit 6.

⁶ Exhibit 7 p. 1.

⁷ Exhibit 1.

⁸ Exhibit 1 p. 2.

the key insights.”⁹

That is what Treasury suppressed for the past year.



For this analysis, Treasury provided Ortec with data on OPERF’s public equity investments. Ortec applied its detailed model to OPERF’s data across 18 investment sectors, 28 geographic investment regions, and 504 time series per climate scenario.¹⁰

Ortec next described how it determined that OPERF’s fossil-fuel exposures constituted 4.4% of its public equity holdings.¹¹ (Treasury separately valued OPERF’s public equity portfolio at \$25.7 billion in December 2021, two months before Ortec submitted its “deep dive” report.)¹²

Ortec then presented its key findings –the “Impact of replacing fossil-fuel with a ‘climate aligned benchmark,’” by looking at three scenarios it also used in its October 2021 “view from 10,000 feet” report:

- What Ortec labels a “Paris Orderly” pathway, which assumes a soft landing from energy transition. This model tests OPERF exposure to the risks and opportunities from systemic drivers of an orderly energy transition and locked-in physical risk.

⁹ Exhibit 1 p. 5.

¹⁰ Exhibit 1 p. 3.

¹¹ Exhibit 1. P. 5.

¹² Exhibit 8.

- What Ortec labels a “Paris Disorderly” pathway assumes a bumpy landing from energy transition. This model shows the resilience of OPERF’s portfolio to sudden transition shocks triggering a market dislocation centered on high emitting stocks;
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Ortec measured the impacts assuming a rising “baseline” of historic market performance without regard to climate change.¹⁴ Thus, negative performance compared to the baseline still produces absolute increases over time – just not as much for some OPERF climate-impacted investments as for others.

Ortec’s answer to “What if OPERF divested from its liquid-market fossil fuel investments? What is the interplay between risk and return from that?”

In a key table, Ortec calculated what would happen if OPERF switched its public-equity portfolio out of fossil fuels and into a climate-aligned benchmark:¹⁵

- **In the Paris Orderly (PO) “soft landing” scenario**, switching OPERF’s public equity portfolio out of its 4.4% fossil fuel holdings and into climate alignment would, relative to baseline:
 - Over 5 years
 - **Improve** its performance by **11.1%** annually
 - **Increase** its value by .41% per year (**\$527 million**) total, using Treasury’s 12/21 valuation of OPERF’s public equity portfolio)
 - Over 10 years
 - **Improve** its performance by **8.2%** annually
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 - Over 20 years
 - **Improve** its performance by **4.9%** annually;
 - **Increase** its value by .20% per year (**\$1 billion**)
- **In the Paris Disorderly (PD) “bumpy landing” scenario**, switching OPERF’s public equity portfolio out of its 4.4% fossil fuel holdings and into climate alignment would, relative to baseline:
 - Over 5 years
 - **Improve** its performance by **14.5%** annually

¹³ Exhibit 6 p. 6; Exhibit 1 p. 6.

¹⁴ Exhibit 6 p. 7; Exhibit 1 p. 6.

¹⁵ Exhibit 1 p. 6. The black boxes are added to direct attention to the two tables described in the text of my testimony. The decreasing performance differential over time results from an assumption in the model that fossil fuel companies over time will themselves transition to renewables.

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 - Over 5 years
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 - Remain flat in relative value
 - Over 10 years
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 - Decrease its value by .01% per year over 10 years (-\$25.7 million)
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 - Decrease its performance by 1.1% annually
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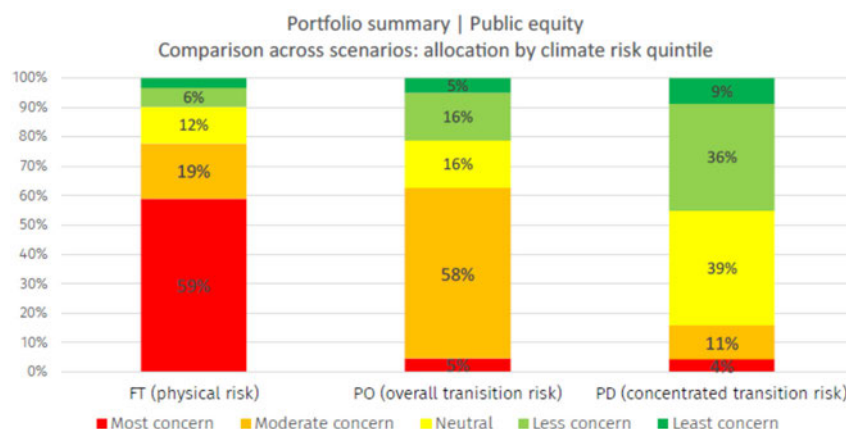
Under all scenarios, as shown below Ortec found OPERF's fossil fuel investments top-rated risks:¹⁸

High level insights - Sector Risk MAPS

Averaging the sector quintiles across all regions, combining results from the two transition scenarios to inform systemic transition exposure and using the failed transition to inform physical risk.

Sector/activity	Sector quintile score (low = worse) across all regions			RiskRank
	Transition quintile	Physical risk quintile	Combined	
Consumer discretionary	2.4	1.2	1.8	1
Oil and gas	1.4	3.0	2.2	2
Coal and manufactured fuels	1.1	3.4	2.2	3
Fossil based utilities	1.0	4.0	2.5	4

Also, as shown below, Ortec found the Failed Transition scenario produced far more risk generally to OPERF's portfolio than any other scenario. There, as seen on the left, almost 60% of the portfolio is in a risk "red zone."¹⁹



In a separate private equity section, Ortec warned that "the illiquidity of this asset class suggest that climate risk should be considered as part of deal due diligence, since exiting positions can take significant time."²⁰

¹⁸ Exhibit 1 p. 13.

¹⁹ Exhibit 1 p. 15.

²⁰ Exhibit 1 p. 21.

A serious failure of transparency and trust

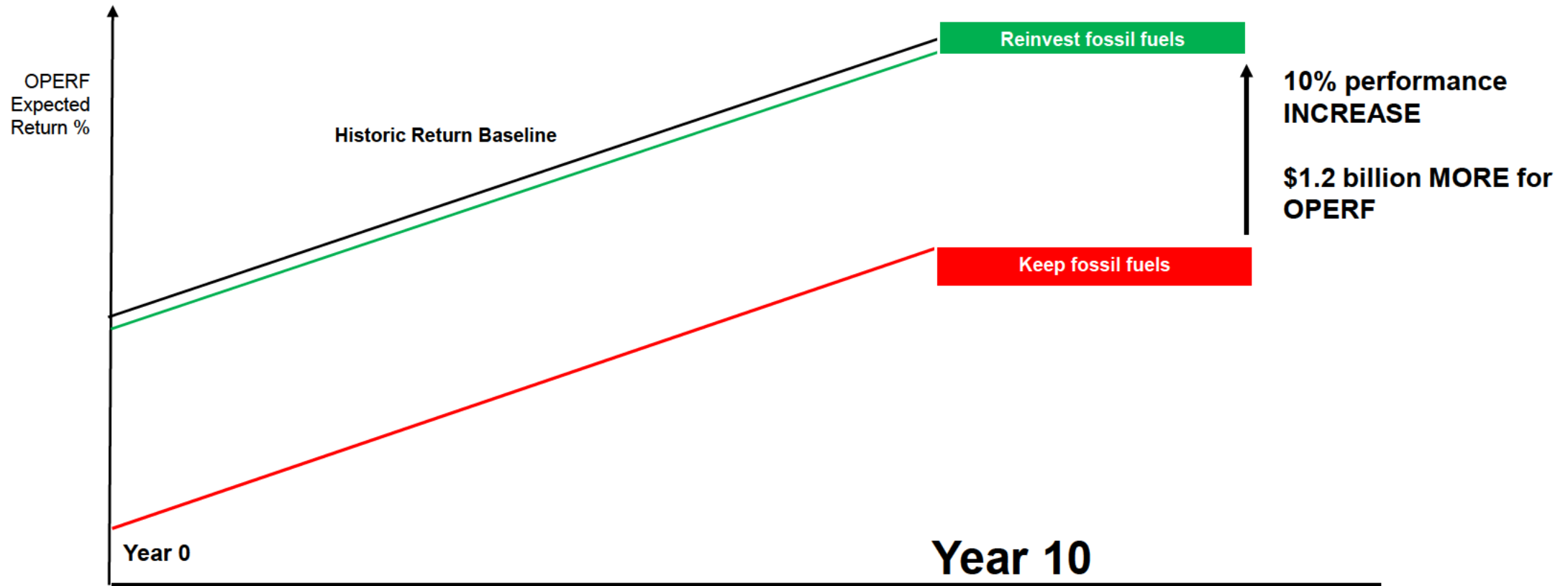
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Impact on OPERF public-equity portfolio: Replace fossil fuels with “Paris-aligned” fund

“Paris Disorderly” energy-transition bumpy landing scenario after 10 years



- Ortec “Climate Risk Scenario Modelling” p. 6
- Ortec “Climate MAPS” report p. 6
- OPERF public equities valuation 12/31/21

Testimony of Rick Pope to Oregon Investment Council

3/8/2023

More than a year ago I requested from Treasury any document relating to assessments of or responses to climate-related financial risk to OPERF investments.

After the Treasurer wrote to every legislator that fossil fuel divestment would almost certainly reduce OPERF returns, and during your last meeting, Treasury produced a year-old study it commissioned from Ortec Finance, its chosen international financial expert.

This deep dive report posed and answered the question: “What if OPERF divested from its liquid-market fossil fuel investments?” Its stated purpose: “to cut through the immense detail and deliver the key insights.”

What were those key insights?

In two of three studied scenarios, Ortec found fossil fuel divestment would increase OPERF’s public equity portfolio by \$1 billion over 10 years. Ortec predicted a modest 10-year loss only in a scenario where there is no transition to clean energy until every last bit of coal, oil and gas is extracted and burned. That’s cold comfort for OPERF. In that scenario, Ortec also found the economic damage to OPERF’s entire portfolio from climate change would vastly outweigh the modest benefit to its public-equity portfolio by staying invested in fossil fuels.

Treasury’s suppression of this report for the past year, all while fossil fuel divestment was being put front and center by OPERF beneficiaries, creates serious transparency and trust concerns. This transgression should not be allowed to fester unaddressed.

We respectfully request that you place this matter on the agenda for the OIC’s next meeting. We ask the OIC to determine and tell PERS beneficiaries, PERS employers, and the taxpaying public when and where the findings of the Ortec divestment report were received, when and where the findings were disseminated, and how the findings were considered and viewed by each of their various recipients.

I prepared diagrams that follow, showing how Ortec reached its 10-year bottom line conclusions. Following the diagrams are details on how Treasury suppressed the Ortec divestment report, what the report studied and what it concluded.

Diagrams showing Ortec divestment report methodology and conclusions

The following illustrative diagrams I created show how Ortec presented its conclusions on the impact of replacing OPERF’s fossil fuel public equities in three scenarios The studied impact is to OPERF’s public-equity portfolio.

The three scenarios are:

1. A clean-energy transition “soft landing” with no great economic shocks, which Ortec labeled a “PO” or Paris orderly transition.
2. A clean-energy transition “bumpy landing with a significant economic shock, which Ortec labeled a “PD” or Paris disorderly transition.
3. Business as usual with no policy-driven clean-energy transition, which Ortec labeled an “FT” or failed transition.

The diagrams consist of:

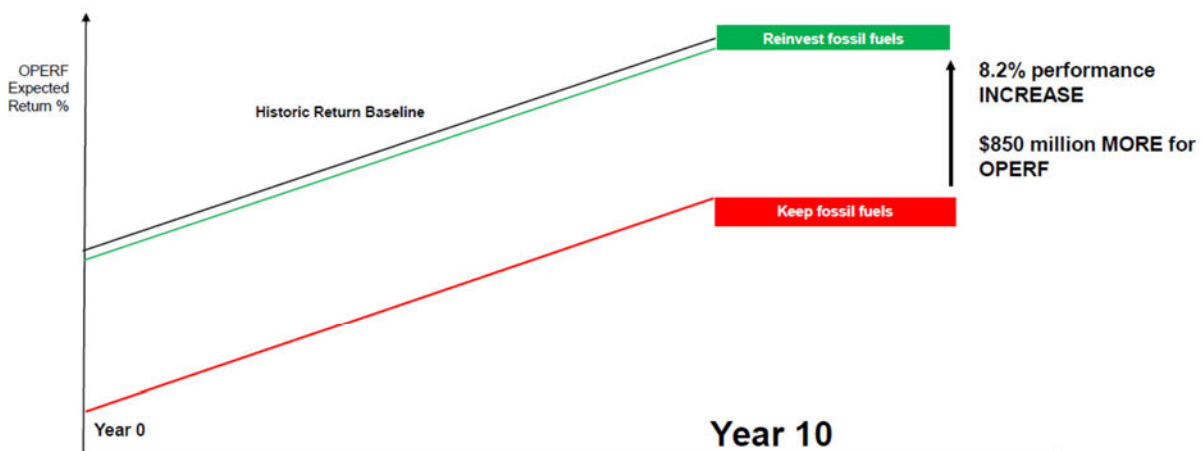
1. A black baseline, representing historic increasing investment values in the absence of climate change.
2. A green line reflecting change from the baseline in each climate-changing scenario where Treasury replaced OPERF fossil fuel public equities.
3. A red line reflecting change from the baseline in the same climate-changing scenario where Treasury kept OPERF fossil fuel public equities.

Average annualized return and monetary differences between the red and green lines on the diagrams are stated at p. 6 of Ortec’s divestment report, Exhibit 1 to my testimony.

Ortec’s description of its Paris Orderly, Paris Disorderly and Failed Transition scenarios are in its earlier climate scan report to Treasury, Exhibit 6 p. 6 to my testimony.

**Impact on OPERF public-equity portfolio:
Replace fossil fuels with “Paris-aligned” fund**

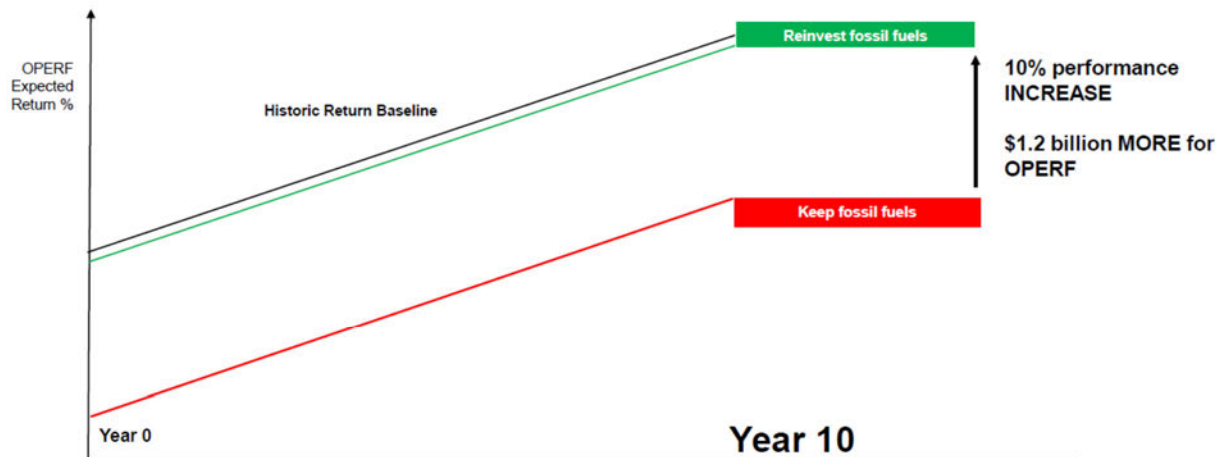
“Paris Orderly” energy-transition soft landing scenario after 10 years



Sources:
 • Ortec “Public Equity Deep Dive” p. 6
 • Ortec “Climate MAPS report p. 6
 • Treasury OPERF public equities valuation 12/31/21

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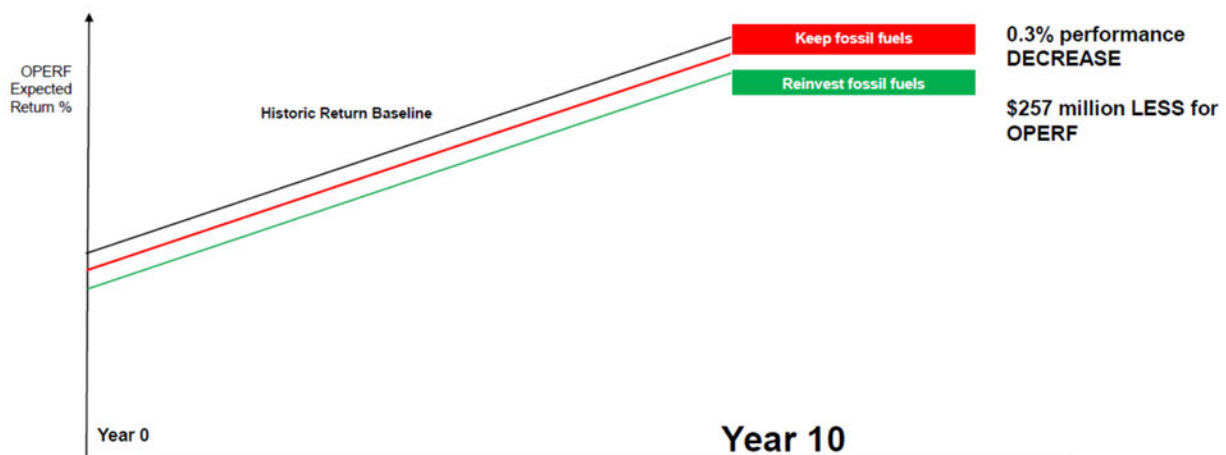


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Impact on OPERF public-equity portfolio:
Keep fossil fuel public equities

“Failed Transition” (fossil-fuel business as usual) scenario after 10 years



Ortec in a Failed Transition projects a 20% loss from baseline to the entire OPERF portfolio from physical risk damage to US GDP, overwhelming the modest gain from keeping fossil fuels

Sources:

- Ortec "Public Equity Deep Dive" p. 6
- Ortec "Climate MAPS report pp. 3, 6
- OPERF public equities valuation 12/31/21

If clean-energy transition fails, Ortec found in its earlier study for Treasury, that gain will be overwhelmed by losses to the entire OPERF portfolio from increasing costs of climate-caused physical damage. On this point Ortec concluded:

Worst outcomes come in a failed transition due to physical risks

Globally, the physical risks experienced when transition to a greener economy fails, have the most significant impacts (63% lower US GDP by 2100). Notably, by 2037 OPERF's portfolio value in the Failed Transition scenario is significantly down compared to an orderly low carbon transition. *In a Failed Transition, by 2060 your asset portfolio value is expected to c.20% lower than baseline* (emphasis added).¹

**Treasury suppresses the Ortec fossil fuel divestment report
during a year-long public records request**

Materials presented to the Oregon Investment Council on 9/8/21 described a consultant engagement with Manifest Climate of Toronto and Ortec Finance of Rotterdam to better understand "climate risk at the total portfolio level." Treasury said that job was outside its expertise, and "requires outside help offering complex tools & econometric analyses that account for uncertainty and interconnectivity of factors being modeled."²

I made a public records request in December 2021 for Treasury's request for proposals and responses to them, and for the consulting contract.

Displaying their confidence in the specific consultants, Treasury asked for a proposal only from Ortec and Manifest. The contract was signed in May 2021 by Chief Investment Officer Rex Kim. The scope of work is attached.³

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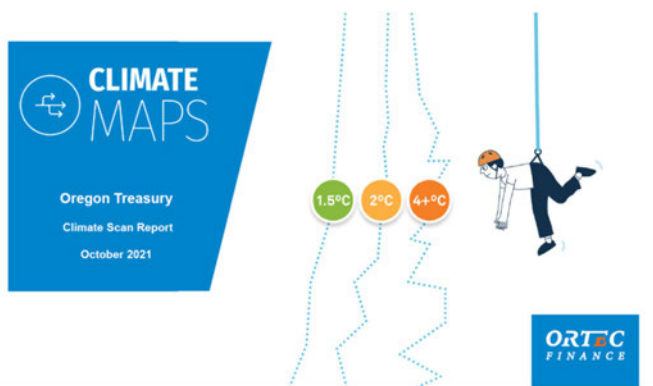
¹ Exhibit 6 p. 3.

² Exhibit 2 p. 3, 4.

³ Exhibit 3.

⁴ Exhibit 4.

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⁶ Exhibit 6.

⁷ Exhibit 7 p. 1.

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For this analysis, Treasury provided Ortec with data on OPERF's public equity investments. Ortec applied its detailed model to OPERF's data across 18 investment sectors, 28 geographic investment regions, and 504 time series per climate scenario.¹¹

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- **In the Paris Disorderly (PD) “bumpy landing” scenario**, switching OPERF’s public equity portfolio out of its 4.4% fossil fuel holdings and into climate alignment would, relative to baseline:
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 - **Improve** its performance by **14.5%** annually
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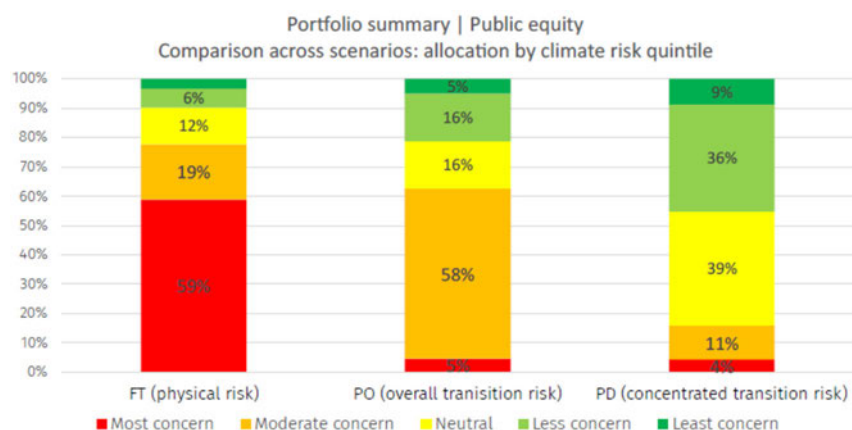
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Climate Risk Scenario Modelling

Public equity sector deep dive

Feb 2022



Climate Scenario Analysis

Phase 2 - “What ifs”

What if... OPERF divested from its liquid-market fossil fuel investments (or any other sector)? What is the interplay between risk and return from that?

What if... we looked at the equity (listed and private) book through a deeper sector/geography revenue attribution lens? Does that give a different view and insight into implementation?





Background, scope and approach

We approached the “what if...” exercise from the perspective of developing insights for potential changes OPERF could explore.

Model:

- Both “what ifs” agreed with the team leverage the deterministic, sector-level modelling Ortec Finance (OF) has developed for public equities

Data:

- OF was provided with anonymized public equity data to allow mapping to our modelled region/sector grid. Proxies were agreed with the OPERF team
- OF also used PE and Real asset allocations summaries provided as part of the main project to inform the private assets assessment

Scope:

- OF has used its latest “Jun21” model, rather than the “Dec20” model for this work. It allows us to leverage better insights on more sectors and to differentiate the physical risk impact between different sectors (which was not included in the “Dec20” model).

Approach:

- Using the data provided, we have run our detailed sector/region model
 - 18 sectors
 - 28 regions
 - 504 time series, per scenario
- The purpose of this report is to cut through the immense detail and deliver the key insights.

Next steps:

- We had envisioned the output of this work as feeding into some of the “next steps” noted at the end of the main climate scenario presentation report.

Equity divestment from fossil-fuel exposed holding



Overview of fossil-fuel exposures | 4.4% of public equity holding

Fossil-fuel exposures = Coal | Oil and gas | Fossil-based Utilities

To give meaningful insights, we adjusted the utilities data you provided to better reflect the likely underlying profile of fuel-type exposure

- ClimateMAPS is set up to consider key economic activities that are crucial for the understanding of climate risk. The mapping exercise included some compromises, such as the mapping of utility companies to a single GICS sector.
 - However, it is likely that for a diversified portfolio the activities of electric utility companies will be spread over a few of the MAPS sector-activities.
- We adjusted the mapping as follows:
 - “Fossil-based utilities” and “Fossil-based utilities: Nuclear” were summed together
 - We then re-spread the allocation to the two sectors across: “Fossil-based utilities”, “Nuclear”, “Wind & Solar” and “Other low carbon electricity”
 - Which was based on country-level statistics on the energy generation mix for the countries covered.
- The net result is below
 - Combining Coal (0.1%), oil and gas (2.5%) and fossil-fuel utilities (1.4%) = 4.4%:

	<i>Fossil-based utilities</i>	<i>Nuclear</i>	<i>Wind & Solar</i>	<i>Other low carbon electricity</i>	<i>Total</i>
<i>Aggregate</i>	1.03%	1.51%	0.04%	0.04%	2.63%
<i>Aggregate post adjustment</i>	1.36%	0.38%	0.39%	0.49%	2.63%

Impact of replacing fossil-fuel with a “climate aligned benchmark”

Per scenario, what happens to expected returns if we replace all fossil-fuel holdings with a “Paris-Aligned” fund

Annual expected return delta (cumulative, annualized)	Horizon (yrs)		
	5	10	20
Fossil-based equity			
PO	-11.4%	-8.4%	-5.2%
PD	-16.5%	-10.9%	-6.4%
FT	-0.1%	-0.3%	-1.1%
Paris-aligned			
PO	-0.3%	-0.2%	-0.2%
PD	-2.0%	-0.9%	-0.6%
FT	-0.2%	-0.6%	-2.2%

The table below shows the equity portfolio impact (relative to baseline) to 5, 10 and 20 year expected returns, which results from switching the 4.4% fossil-based public equity to an investible Paris-Aligned fund. The significant negative impacts in the PD and PO scenarios are driven by the market pricing-in future transition impacts in the scenarios during those time windows.

Scenario equity portfolio-level relative impact of 4.4% switch			
	5	10	20
PD	0.71%	0.47%	0.27%
PO	0.41%	0.33%	0.20%
FT	0.00%	-0.01%	-0.05%

Engagement and implementation note:

Fossil-fuel entities are arguably both part of the “source” of the climate issue and part of the solution. They also potentially lose out disproportionately in the transition.

However, some investors we have worked with have investigated the impacts of divesting fossil-based utilities in a worst case of them failing to respond to engagement/reducing emissions – in order to support the portfolio NZ commitment.

The impact to low-carbon benchmarks in the Failed Transition scenario, relative to “grey” benchmarks is zero by construction as this scenario focuses on physical risk exclusively.

⇒ A low-carbon fund is not designed to mitigate physical risks.

Using low-carbon benchmarks is not a silver bullet. Although these benchmarks are better positioned to address systemic transition risks by having less exposure to high-emitters/stranded assets, the construction of the benchmark can introduce other biases (by the benchmark provider)

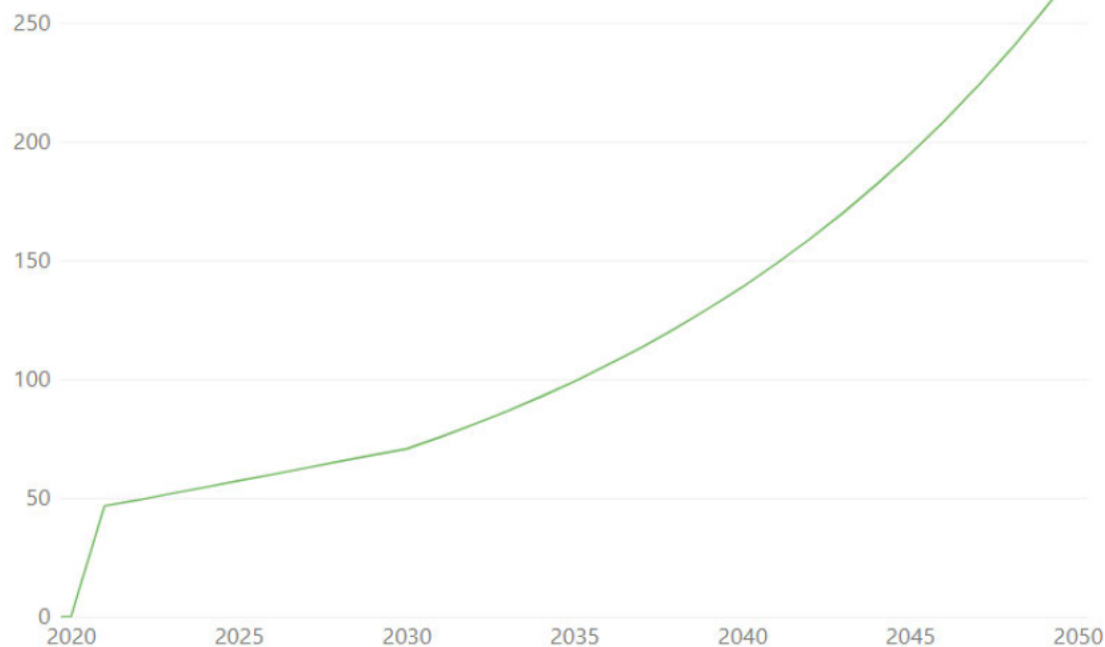
⇒ These biases can negatively impact the actual performance of the BM due to other factors.

Insights on timing of climate-transition relative to (hypothetical) utilities shifting fuel types

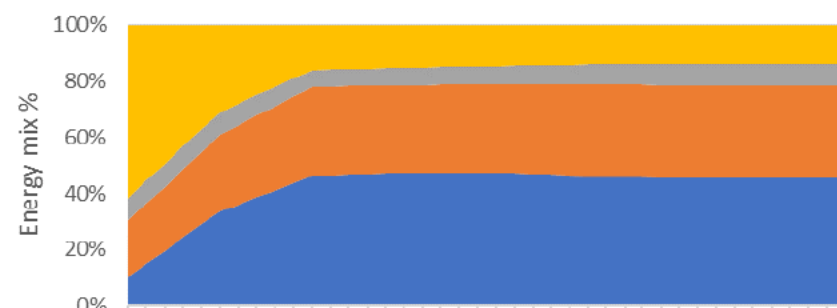
If energy utilities fail to rapidly invest in scaling low-carbon energy, pricing-in of transition policy could materially impact valuations

In a Paris-aligned, orderly transition, typified by the GLOBAL carbon price curve below we consider two US, diversified power companies. GradualCo will transition its energy mix at the pace required for the US energy mix to meet Paris goals. On the other hand, RadicalCo will ramp up much faster (perhaps through M&A) to reduce fossil mix to 16% with 5 years.

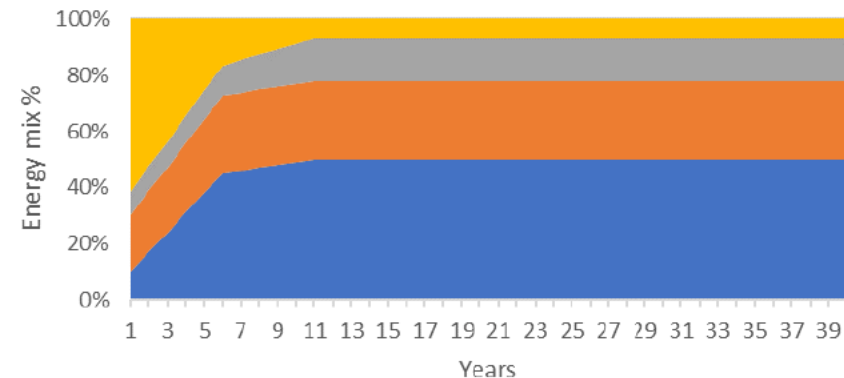
Carbon Price (2021\$/tonne CO2)-Paris Pathways-World



GradualCo shifting energy mix in line with MAPS Paris pathway



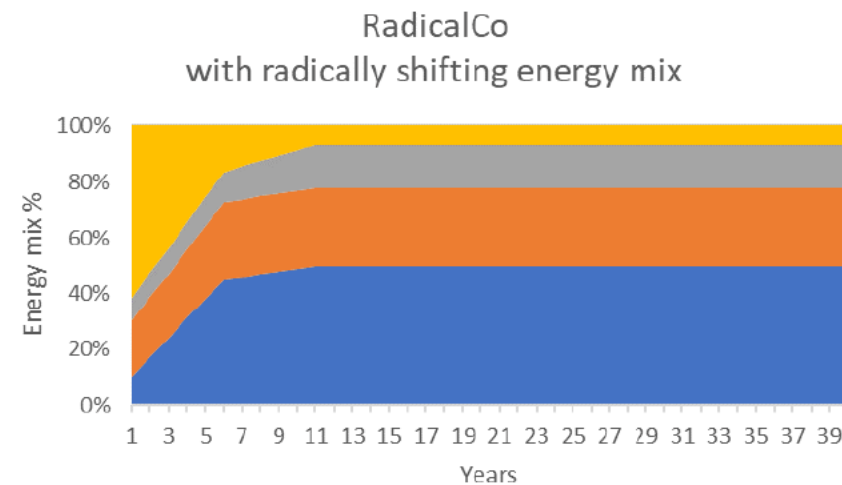
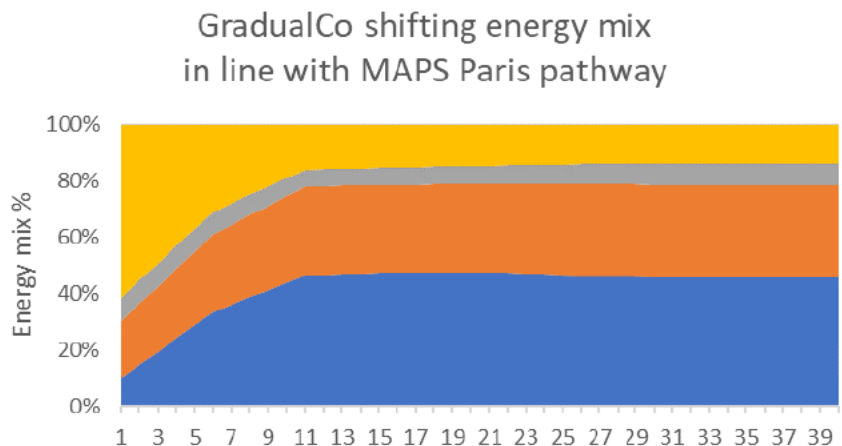
RadicalCo with radically shifting energy mix



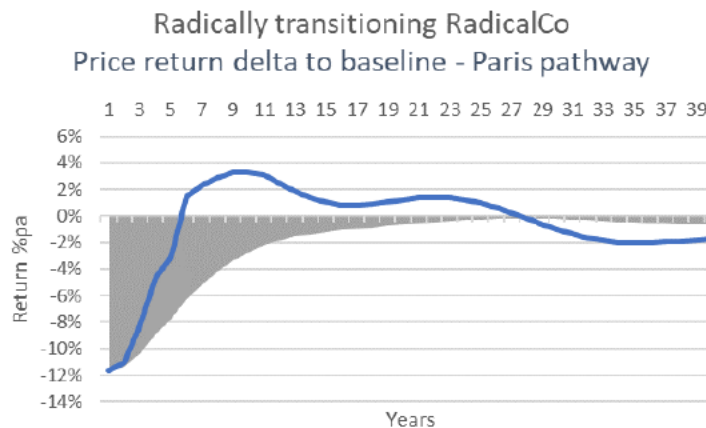
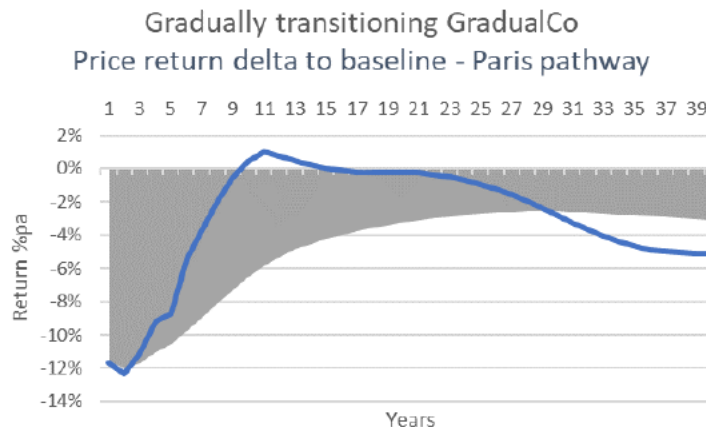
■ Wind & Solar ■ Nuclear ■ Other low carbon ■ Fossil-base utilities

Insights on timing of climate-transition relative to (hypothetical) utilities shifting fuel types

If energy utilities fail to rapidly invest in scaling low-carbon energy, pricing-in of transition policy could materially impact valuations



■ Wind & Solar ■ Nuclear ■ Other low carbon ■ Fossil-base utilities



■ Blended CAGR ■ Blended annual return

The pricing-in of transition impacts that occurs over the first 5 years impact both companies.

The model does allow for some costs to be passed through to consumers, however the market still prices-in negative impacts for fossil-based power generation.

Over the long term, RadicalCo recovers to have minimal downside relative to the baseline (shown by the grey CAGR%)

Equity and real assets sector/region deep dive



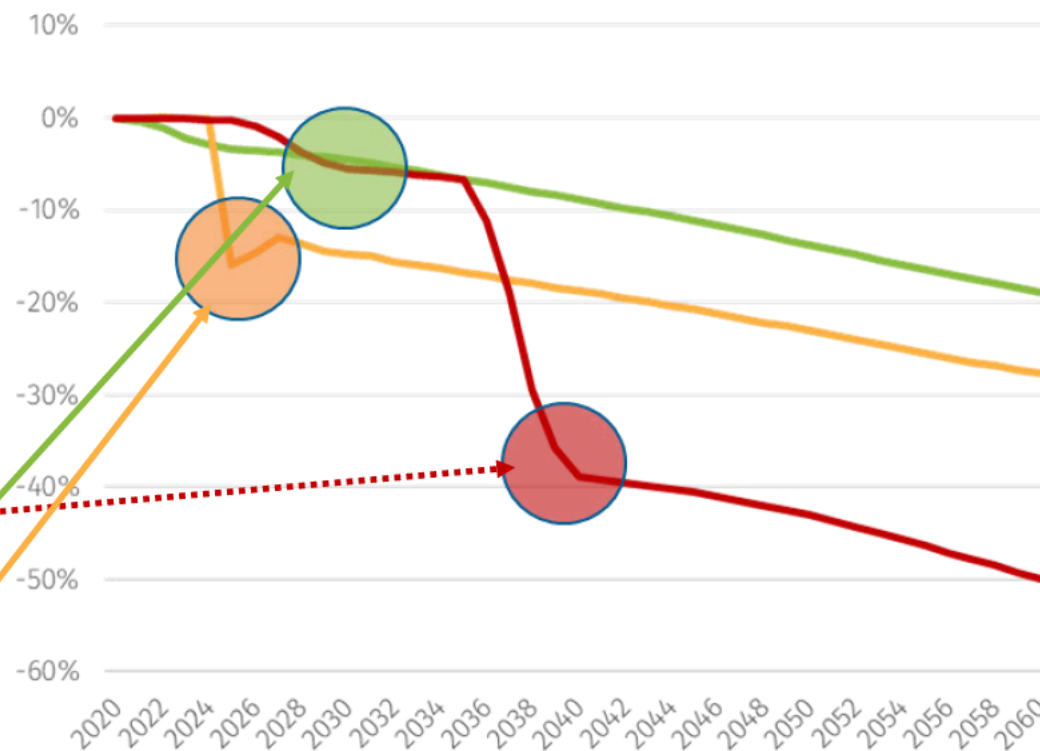
Overview of approach - Sector Risk MAPS

These results forms part of the sector-level insights, lifting useful insights from highly granular data

Sector allocation analysis:

- The premise of these insights is to divide sector/region pairs into categories of risk, based on quintiles of return impact for equity returns.
- We then overlay the portfolio allocations onto each of the sector/region pairs, and map them to the different quintiles.
- This then shows us how the portfolio is allocated to sector/regions of differing levels of climate risk exposure.
- To simplify and focus the output, we have chosen a single time horizon to measure the impacts for the different scenarios.
 - **Failed Transition:** 20y (this is after both pricing in epochs, so the full physical risk impact is captured)
 - **Pairs Orderly:** 10y (this allows time for the transition to be established and economies to stabilise)
 - **Paris Disorderly:** 5y (this is the low point of the disorderly shock and so captures the most concentrated example of transition risk).

Illustrative chart of cumulative return deltas to baseline





Overview of approach - Sector Risk MAPS

These results form part of the sector-level insights, lifting useful insights from highly granular data

Outputs and interpretation:

The main motivation of the outputs is to achieve the following:

- 1) A high-level appreciation of the distribution of allocation to different levels of climate risk exposure
- 2) An ability to help pin-point areas of the portfolio that deserve more **immediate attention in the form of detailed, stock/credit level analysis**
- 3) By cutting through the large volume of data the sector analysis creates, we generate efficient insights more appropriate for senior stakeholders

The portfolio allocations can also be compared to a benchmark. By default, we use MSCI ACWI as representative of the global equity market.

Data reliance:

Necessarily, we can only make inferences based on the data provided to us. Coverage % is included in the tab "SECTOR allocation risk summary"
If it has not been possible to look through into the holdings of funds, for example, then those funds will have been excluded from this analysis.
As such these outputs may provide a partial picture.

Also note that as part of the mapping exercise, pragmatic compromises may have been made.

For example, we would ideally want to reflect the region/sector-activity of economic exposure.

However, these data are typically hard to obtain, so proxies such as GICS/NACE sector may be used and/or region of domicile.

For multinational/diversified companies, the mapping may not fully reflect the scope of exposure. Which would require a more involved mapping exercise.

Remember that sectors should be more accurately thought of as economic activities.

A key example of this is that a large electricity generating company will use a mixture of fuel types to generate power.

Each of these fuels types is represented by an activity within our sector breakdown: Wind/Solar, Fossil fuels, Nuclear and other renewables.

Over the course of the green transition, we would reasonably expect the mix of these activities to shift from fossil to renewables.

A comprehensive dataset can be provided with the full sector/region impact data used for the following slides.

Example quintile grids - Sector Risk MAPS

Failed transition – 20y horizon – physical risk lens

	Consumer discr	Industrials	Health	Telecom	IT	Forestry	Financials	Consumer staples	Materials	Oil and gas	Coal and synthetic fuels	Real estate	Water supply	Other Low carbon and biofuel/elec	Wind and solar	Nuclear	Fossil based utilities	Public admin and defense
China	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2
India	1	1	1	1	2	1	1	1	1	2	2	2	1	2	2	2	2	2
Malaysia	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
Australia	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3
Philippines	1	1	1	1	1	1	1	2	2	3	3	2	2	3	3	3	3	3
US	1	1	1	1	1	1	1	2	2	2	3	2	2	3	3	3	3	3
World	1	1	1	1	1	1	1	2	2	2	3	2	2	3	3	3	3	3
Europe	1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4
Indonesia	1	2	1	1	1	2	2	2	3	4	4	3	3	3	4	3	4	4
Spain	1	1	1	1	2	2	2	3	2	3	3	3	3	4	4	4	4	4
Taiwan	1	2	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4
Netherlands	1	1	2	2	1	1	3	2	3	2	3	3	4	4	4	4	5	5
Japan	1	2	1	2	2	2	2	3	3	4	4	3	3	4	4	4	4	4
Thailand	1	2	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4
Singapore	1	2	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	5
Canada	1	2	3	3	3	1	4	2	3	2	2	4	4	5	5	5	5	5
France	1	2	2	3	3	2	3	3	3	2	3	4	4	5	5	5	5	5
South Korea	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4	4	4
Brazil	2	3	2	2	3	3	3	4	4	4	4	4	4	4	4	4	4	4
UK	1	2	4	3	3	3	1	4	4	2	2	4	5	5	5	5	5	5
Denmark	1	1	4	3	3	1	4	2	3	4	4	5	5	5	5	5	5	5
Italy	1	3	3	3	3	4	4	4	4	4	5	4	4	5	5	5	5	5
Switzerland	1	1	5	4	1	5	1	3	5	5	5	5	5	5	5	5	5	5
Germany	1	2	4	4	3	3	3	4	4	4	4	5	5	5	5	5	5	5
Norway	2	3	4	4	4	3	4	4	5	3	4	5	5	5	5	5	5	5
Sweden	1	3	5	4	3	5	5	5	3	5	5	5	5	5	5	5	5	5
Finland	2	4	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5
Russia	3	4	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5

Paris orderly – 10y horizon – transition risk lens

	Fossil based utilities	Coal and synthetic fuels	Oil and gas	Consumer discr	Nuclear	Financials	Forestry	Health	Public admin and defense	Real estate	Telecom	Materials	Consumer staples	Water supply	IT	Industrials	Other Low carbon and biofuel/elec	Wind and solar
Australia	1	1	1	2	2	2	2	2	2	2	2	3	3	2	2	4	1	2
Canada	1	1	1	1	1	1	2	2	2	2	2	2	3	3	2	2	5	5
Norway	1	1	1	2	2	2	3	2	2	2	3	1	3	3	2	3	5	1
Switzerland	1	2	1	2	1	2	2	2	2	2	2	2	2	2	3	4	5	1
US	1	1	1	2	5	2	2	2	2	2	2	2	3	3	2	2	5	6
Malaysia	1	1	1	2	1	2	2	2	3	3	2	3	2	3	4	4	5	5
Europe	1	1	1	2	1	2	3	2	2	3	3	3	4	5	4	4	2	5
Finland	1	1	2	2	1	2	4	3	3	4	2	4	5	3	4	4	1	2
China	1	1	1	2	5	2	2	3	2	4	3	4	3	2	4	4	1	5
France	1	1	1	2	1	3	2	3	3	3	4	3	3	5	4	4	2	5
Germany	1	1	1	2	1	3	2	2	3	3	4	4	3	3	3	4	5	5
Netherlands	1	1	1	2	5	2	2	2	3	3	3	3	3	2	3	4	5	5
Italy	1	1	1	2	3	3	3	3	3	4	2	4	4	2	5	4	1	5
World	1	1	1	2	5	3	2	2	2	3	2	4	3	3	4	4	4	5
Spain	1	1	1	2	1	3	3	3	2	2	4	4	3	5	3	4	5	5
Indonesia	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	4	5	5
Sweden	1	1	2	2	1	3	4	3	3	4	4	4	3	4	5	4	1	5
Japan	1	1	2	3	1	4	2	3	3	3	4	3	5	3	4	5	5	5
Denmark	1	1	1	2	3	2	3	3	3	3	4	4	3	5	5	4	5	5
Philippines	1	1	1	3	3	4	4	4	2	4	4	4	5	3	4	5	5	5
Singapore	1	1	1	2	4	3	5	5	3	4	4	3	5	4	4	5	5	5
UK	1	1	1	2	5	3	5	3	3	3	5	4	5	3	5	4	5	5
Thailand	1	1	1	2	4	5	4	4	3	3	4	5	5	4	4	4	5	5
Russia	1	1	1	3	5	3	4	4	3	4	4	5	4	4	5	5	5	5
Taiwan	1	1	4	2	5	4	4	4	4	4	4	5	4	4	4	4	5	5
Brazil	1	1	1	5	1	5	2	5	5	4	5	4	5	5	5	5	5	5
South Korea	1	1	4	2	5	5	4	4	4	5	4	4	4	4	4	4	5	5
India	1	1	1	1	5	5	5	4	5	5	5	5	5	5	5	5	5	5

High level insights - Sector Risk MAPS

Averaging the sector quintiles across all regions, combining results from the two transition scenarios to inform systemic transition exposure and using the failed transition to inform physical risk.

Sector/activity	Sector quintile score (low = worse) across all regions			RiskRank
	Transition quintile	Physical risk quintile	Combined	
Consumer discretionary	2.4	1.2	1.8	1
Oil and gas	1.4	3.0	2.2	2
Coal and manufactured fuels	1.1	3.4	2.2	3
Fossil based utilities	1.0	4.0	2.5	4
Forestry	3.0	2.3	2.7	5
Health	3.1	2.3	2.7	6
Financials	3.0	2.5	2.8	7
Telecom	3.3	2.3	2.8	8
Industrials	3.9	1.9	2.9	9
IT	3.7	2.2	3.0	10
Consumer staples	3.4	2.8	3.1	11
Materials	3.4	3.0	3.2	12
Real estate	3.1	3.5	3.3	13
Nuclear	2.8	4.1	3.4	14
Water supply	3.5	3.5	3.5	15
Public administration and defense	3.1	4.1	3.6	16
Other Low carbon and biobased electricity	4.1	4.0	4.0	17
Wind and solar	4.5	4.1	4.3	18

A key takeaway from this table could be a prioritization for deeper analysis of holdings within these sectors

Listed equity



Public equity | High-level Risk MAP insights

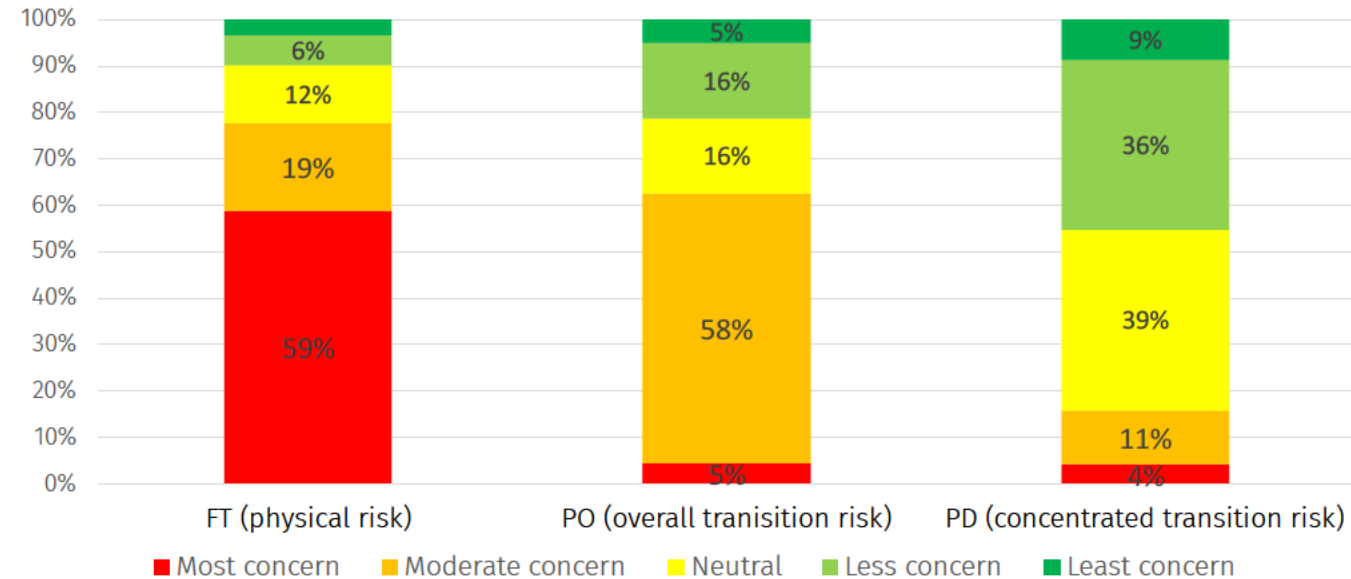
Significant physical risk exposure, moderate overall transition risk.

The failed transition (FT) scenario highlights the physical risk exposures of the portfolio. The sectors mapped to the top 2 quintile are typically either operationally exposed to gradual physical risk (rising temperatures, changing weather patterns), extreme weather, or both. The other physical risk factor is the length and complexity of supply/value chains.

Whilst transition risk is undoubtedly more proximate. These results suggest that physical risk (and the uncertain time when it could be materially priced-in) is significant for this portfolio.

Overall, the portfolio results are similar to the global benchmark.

Portfolio summary | Public equity
Comparison across scenarios: allocation by climate risk quintile



Using these results

We suggest that the sector-level insights from this analysis is used to “triage”/focus deep-dives into the climate-readiness of individual holdings by the asset managers and their analysts; who are best placed to make an “on the ground” assessment of the appropriateness of these holdings given your other investment objectives.

Risk MAP high climate materiality insights| Portfolio

Zooming in on the more climate exposed parts of region/sector grids, we see where portfolio allocations arise in areas that could be more systemically exposed to climate risk.

FT

20y Physical risk outlook		Sector average quintile				
		1.12	1.76	2.09	2.30	2.27
Region average quintile	PORTFOLIO weights	Consumer discr	Industrials	Health	Telecom	IT
1.50	China	0.8%	0.3%	0.1%	0.8%	0.2%
1.76	Australia	0.3%	0.1%	0.2%	0.1%	0.1%
1.78	India	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	Malaysia	0.0%	0.2%	0.1%	0.1%	0.3%
2.00	US	6.3%	5.2%	7.5%	4.9%	13.9%
2.06	Rest of World	0.4%	0.5%	0.2%	0.3%	0.3%
2.09	Philippines	0.0%	0.0%	0.0%	0.1%	0.1%
2.33	Indonesia	0.1%	0.0%	0.1%	0.1%	0.0%
2.42	Netherlands	0.0%	0.0%	0.0%	0.1%	0.1%

Through this more detailed view, we can see the sector/region holding that are driving the quintile 1 and 2 allocations in the previous slide.

Note on conditional formatting:

Zero allocation = grey cell background

Otherwise graded yellow (low allocation) to blue (max blue hue shaded cells show the top 10% region/sector pairs across the whole portfolio.)

To highlight the top 10% of sector/regions TEXT is shown in white. A blue cell with black text isn't quite in the top 10%)

PD

5y disorderly transition outlook		Sector average quintile			
		1.00	1.00	1.48	2.58
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
1.57	Norway	0.00%	0.00%	-0.03%	0.00%
1.67	Finland	-0.04%	0.01%	0.10%	0.32%
2.00	France	-0.17%	-0.02%	0.00%	-0.33%
2.00	Russia	-0.08%	0.09%	-0.04%	0.07%
2.14	Italy	-0.04%	0.01%	0.04%	0.82%
2.17	Netherlands	0.00%	0.00%	-0.11%	-0.07%
2.22	China	0.02%	-0.04%	0.12%	-0.77%
2.38	Germany	0.00%	-0.02%	0.03%	-0.43%
2.45	Sweden	-0.01%	0.00%	0.08%	0.05%

PO

10y orderly transition outlook		Sector average quintile			
		1.00	1.00	1.33	2.15
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
2.00	Norway	0.00%	0.00%	0.00%	0.00%
2.06	Australia	-0.01%	0.04%	-0.01%	0.28%
2.11	Canada	0.00%	0.01%	0.15%	0.15%
2.18	Switzerland	0.00%	0.00%	0.24%	0.02%
2.44	US	0.00%	0.16%	6.33%	
2.47	Malaysia	0.00%	0.00%	0.08%	-0.02%

Exhibit 1 p.16

Risk MAP high climate materiality insights| Active weights

Zooming in on the more climate exposed parts of region/sector grids, we see where over/under weights vs MSCI ACWI arise in areas that could be more systemically exposed to climate risk.

FT

20y Physical risk outlook		Sector average quintile				
		1.12	1.76	2.09	2.30	2.27
Region average quintile	ACTIVE WEIGHT	Consumer discr	Industrials	Health	Telecom	IT
1.50	China	-0.77%	0.05%	-0.25%	-0.15%	-0.14%
1.76	Australia	0.15%	0.02%	-0.04%	0.06%	-0.01%
1.78	India	-0.08%	-0.04%	-0.07%	-0.01%	-0.21%
2.00	Malaysia	-0.02%	0.24%	0.08%	0.08%	0.26%
2.00	US	-0.72%	1.51%	-0.33%	-1.77%	-2.13%
2.06	Rest of World	0.15%	0.28%	-0.07%	0.08%	-0.11%
2.09	Philippines	0.03%	-0.01%	0.00%	0.06%	0.06%
2.33	Indonesia	0.05%	0.04%	0.06%	0.04%	0.01%
2.42	Netherlands	-0.07%	-0.09%	-0.08%	0.03%	-0.18%

PD

5y disorderly transition outlook		Sector average quintile			
		1.00	1.00	1.48	2.58
Region average quintile	ACTIVE WEIGHT	Coal and synth fuels	Fossil based utilitiies	Oil and gas	Consumer discr
1.57	Norway	0.00%	0.00%	-0.03%	0.00%
1.67	Finland	-0.04%	0.01%	0.10%	0.32%
2.00	France	-0.17%	-0.02%	0.00%	-0.33%
2.00	Russia	-0.08%	0.09%	-0.04%	0.07%
2.14	Italy	-0.04%	0.01%	0.04%	0.82%
2.17	Netherlands	0.00%	0.00%	-0.11%	-0.07%
2.22	China	0.02%	-0.04%	0.12%	-0.77%
2.38	Germany	0.00%	-0.02%	0.03%	-0.43%
2.45	Sweden	-0.01%	0.00%	0.08%	0.05%

Through this more detailed view, we can see the over/under weights relative to MSCI ACWI for sector/region holding that are driving the quintile 1 and 2 allocations in the previous slide.

Note on conditional formatting:

Zero allocation = grey cell background

Otherwise graded yellow (low allocation) to blue (max blue hue shaded cells show the top 10% region/sector pairs across the whole portfolio.)

To highlight the top 10% of sector/regions TEXT is shown in white. A blue cell with black text isn't quite in the top 10%)

PO

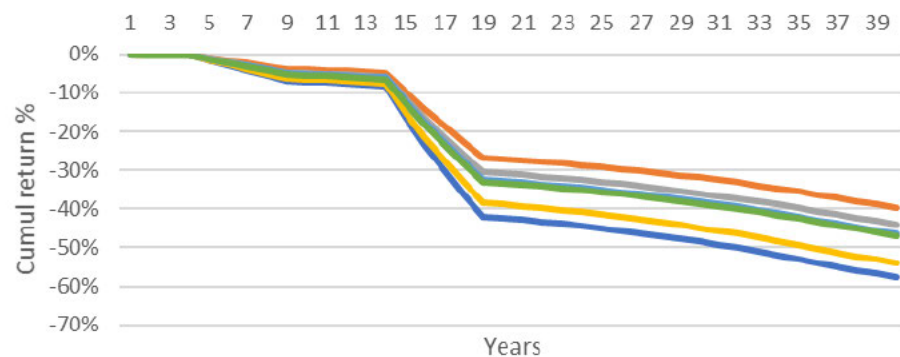
10y orderly transition outlook		Sector average quintile			
		1.00	1.00	1.33	2.15
Region average quintile	ACTIVE WEIGHT	Coal and synth fuels	Fossil based utilitiies	Oil and gas	Consumer discr
2.00	Norway	0.00%	0.00%	-0.03%	0.00%
2.06	Australia	-0.04%	0.03%	-0.04%	0.15%
2.11	Canada	-0.13%	-0.03%	-0.11%	0.04%
2.18	Switzerland	0.00%	0.00%	0.24%	-0.10%
2.44	US	-0.82%	0.38%	0.17%	-0.72%
2.47	Malaysia	0.00%	-0.01%	0.08%	-0.02%

Exhibit 1 p. 17

Sector line charts for most material sector/regions

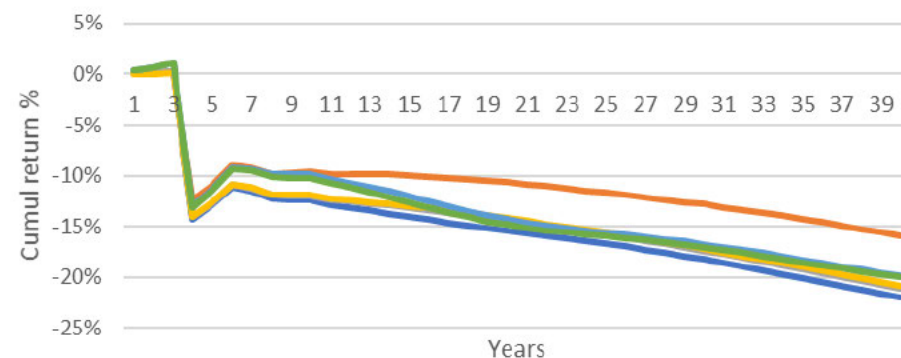
The six most material sectors show a reasonable spread of impacts. These sectors are in the “sectors of concern” for physical risk, but are less significant for transition risk.

FT - Cumul return DELTA - Top six sector/regions

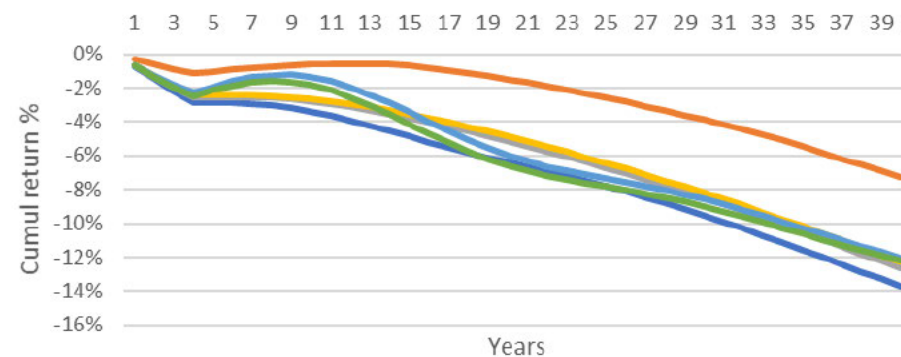


US - Consumer discr US - Consumer staples US - Financials
US - Health US - Industrials US - IT

PD - Cumul return DELTA - Top six sector/regions



PO - Cumul return DELTA - Top six sector/regions



US - Consumer discr US - Consumer staples US - Financials
US - Health US - Industrials US - IT

The most material region/sector allocations in the public equity portfolio are:

Region - Sector	Allocation (as % of public equity)
US - IT	13.9%
US - Health	7.5%
US - Consumer discr	6.3%
US - Financials	5.8%
US - Industrials	5.2%
US - Consumer staples	4.3%

Private equity



Mapping for PE sector allocations

- To facilitate the mapping, we collapsed the data provided to us:

STRATEGY		SECURITY		REGION		Actual Weight	TMT	INDUSTRIAL	BUS SERV	CONSUMER	HEALTHCARE	FIG
Venture/Growth	16%	Equity - non-control	100%	North America	37%	5.8%	44%	3%	3%	21%	17%	12%
				Europe	14%	2.2%	37%	1%	9%	13%	21%	19%
				Asia	47%	7.4%	26%	2%	2%	44%	21%	5%
				Latin America	2%	0.3%	30%	3%	3%	22%	23%	18%
Buyout	78%	Equity - control	100%	North America	68%	52.7%	31%	16%	13%	15%	15%	11%
				Europe	26%	20.2%	20%	15%	16%	21%	12%	16%
				Asia	4%	3.1%	18%	18%	10%	32%	11%	11%
				Latin America	2%	1.6%	11%	20%	11%	35%	12%	12%
Distressed Debt	7%	Distressed debt	100%	North America	70%	4.7%	20%	20%	7%	20%	20%	13%
				Europe	25%	1.7%	20%	20%	8%	20%	20%	13%
				Asia	5%	0.3%	20%	20%	10%	20%	20%	10%
				Latin America	0%	0.0%	0%	0%	0%	0%	0%	0%

- To a format that is consistent with input grid for our sector analysis tool:

	Telecom	Industrials	Consumer discretionary	Consumer staples	Health	Financials
US	19.9%	9.4%	12.2%	4.9%	9.6%	7.3%
Europe	5.2%	3.3%	6.0%	2.4%	3.2%	3.8%
China	2.5%	0.8%	2.6%	2.2%	2.0%	0.8%
Brazil	0.3%	0.3%	0.5%	0.3%	0.3%	0.2%

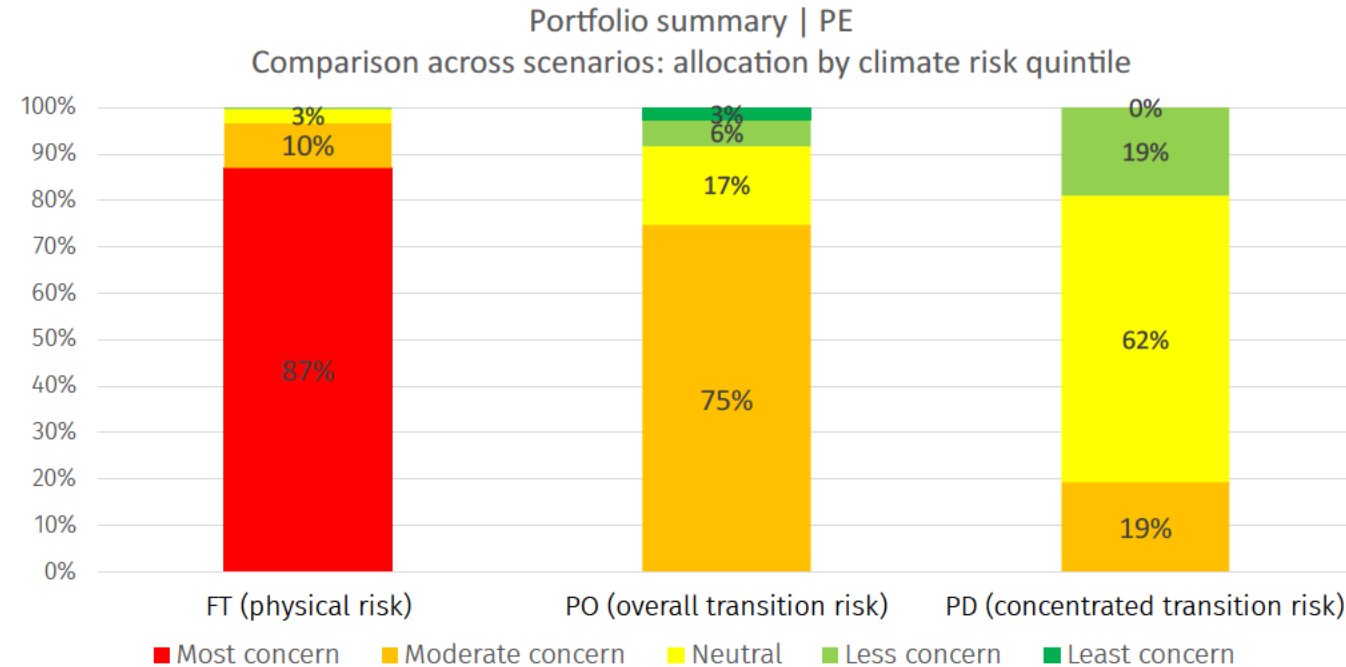
PE | High-level Risk MAP insights

Significant physical risk exposure, moderate overall transition risk.

More so than for listed equity, the failed transition (FT) scenario highlights the physical risk exposures of the PE portfolio. The sectors mapped to the top 2 quintile are typically either operationally exposed to gradual physical risk (rising temperatures, changing weather patterns), extreme weather, or both. The other physical risk factor is the length and complexity of supply/value chains.

Whilst transition risk is undoubtedly more proximate. These result suggest that physical risk (and the uncertain time when it could be materially priced-in) is significant for this portfolio.

The illiquidity of this asset class suggest that climate risk should be considered as part of deal due diligence, since exiting positions can take significant time.



Using these results

We suggest that the sector-level insights from this analysis is used to “triage”/focus deep-dives into the climate-readiness of individual holdings by the asset managers and their analysts; who are best placed to make an “on the ground” assessment of the appropriateness of these holdings given your other investment objectives.

Risk MAP high climate materiality insights| PE

Zooming in on the more climate exposed parts of region/sector grids, we see where portfolio allocations arise in areas that could be more systemically exposed to climate risk.

FT

20y Physical risk outlook		Sector average quintile				
		1.12	1.76	2.09	2.30	2.27
Region average quintile	PORTFOLIO weights	Consumer discr	Industrials	Health	Telecom	IT
1.50	China	2.6%	0.8%	2.0%	2.5%	0.0%
1.76	Australia	0.0%	0.0%	0.0%	0.0%	0.0%
1.78	India	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	Malaysia	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	US	12.2%	9.4%	9.6%	19.9%	0.0%
2.06	Rest of World	0.0%	0.0%	0.0%	0.0%	0.0%
2.09	Philippines	0.0%	0.0%	0.0%	0.0%	0.0%
2.33	Indonesia	0.0%	0.0%	0.0%	0.0%	0.0%
2.42	Netherlands	0.0%	0.0%	0.0%	0.0%	0.0%

Through this more detailed view, we can see the sector/region holding that are driving the quintile 1 and 2 allocations in the previous slide.

Note on conditional formatting:

Zero allocation = grey cell background

Otherwise graded yellow (low allocation) to blue (max blue hue shaded cells show the top 10% region/sector pairs across the whole portfolio.)

To highlight the top 10% of sector/regions TEXT is shown in white. Aa blue cell with black text isn't quite in the top 10%)

PD

5y disorderly transition outlook		Sector average quintile			
		1.00	1.00	1.48	2.58
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilitires	Oil and gas	Consumer discr
1.57	Norway	0.0%	0.0%	0.0%	0.0%
1.67	Finland	0.0%	0.0%	0.0%	0.0%
2.00	France	0.0%	0.0%	0.0%	0.0%
2.00	Russia	0.0%	0.0%	0.0%	0.0%
2.14	Italy	0.0%	0.0%	0.0%	0.0%
2.17	Netherlands	0.0%	0.0%	0.0%	0.0%
2.22	China	0.0%	0.0%	0.0%	2.6%
2.38	Germany	0.0%	0.0%	0.0%	0.0%
2.45	Sweden	0.0%	0.0%	0.0%	0.0%

PO

10y orderly transition outlook		Sector average quintile			
		1.00	1.00	1.33	2.15
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilitires	Oil and gas	Consumer discr
2.00	Norway	0.0%	0.0%	0.0%	0.0%
2.06	Australia	0.0%	0.0%	0.0%	0.0%
2.11	Canada	0.0%	0.0%	0.0%	0.0%
2.18	Switzerland	0.0%	0.0%	0.0%	0.0%
2.44	US	0.0%	0.0%	0.0%	12.2%
2.47	Malaysia	0.0%	0.0%	0.0%	0.0%

Exhibit 1 p. 22

Real assets



Mapping for Real asset sector allocations

- To facilitate the mapping, we collapsed the data provided to us, aggregated over both equity and debt:

	Utilities	Transport	Renewables	Power	Digital	PPPs	O&G mid	O&G up	Metals & Mining	Timberland	Agriculture
North America	6.3%	4.4%	5.3%	7.0%	5.8%	2.5%	11.7%	15.2%	3.6%	4.1%	3.7%
Europe	2.7%	1.6%	2.1%	1.3%	4.5%	0.2%	1.8%	0.1%	0.5%	0.0%	0.2%
Asia	1.2%	0.8%	0.9%	0.3%	1.2%	0.0%	0.9%	0.0%	2.8%	0.0%	0.0%
Brazil	0.5%	0.6%	0.8%	0.0%	1.0%	0.0%	0.5%	0.0%	1.0%	0.0%	0.2%
World	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	0.0%

- Into a format that is consistent with input grid for our sector analysis tool*:

	Fossil based utilities	Nuclear	Other Low carbon and biobased electricity	Wind and solar	Industrials	IT	Public admin and defence	Oil and gas	Materials	Forestry	Consumer staples
US	7.9%	0.9%	0.5%	5.9%	4.4%	5.3%	5.8%	2.5%	26.9%	3.6%	4.1%
Europe	1.7%	0.2%	0.5%	3.0%	1.6%	2.1%	4.5%	0.2%	1.9%	0.5%	0.0%
China	0.9%	0.0%	0.2%	1.1%	0.8%	0.9%	1.2%	0.0%	0.9%	2.8%	0.0%
Brazil	0.1%	0.0%	0.6%	0.9%	0.6%	0.8%	1.0%	0.0%	0.5%	1.0%	0.0%
World	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%

*this included "respredding" the power and utilities allocation as described on slide 5

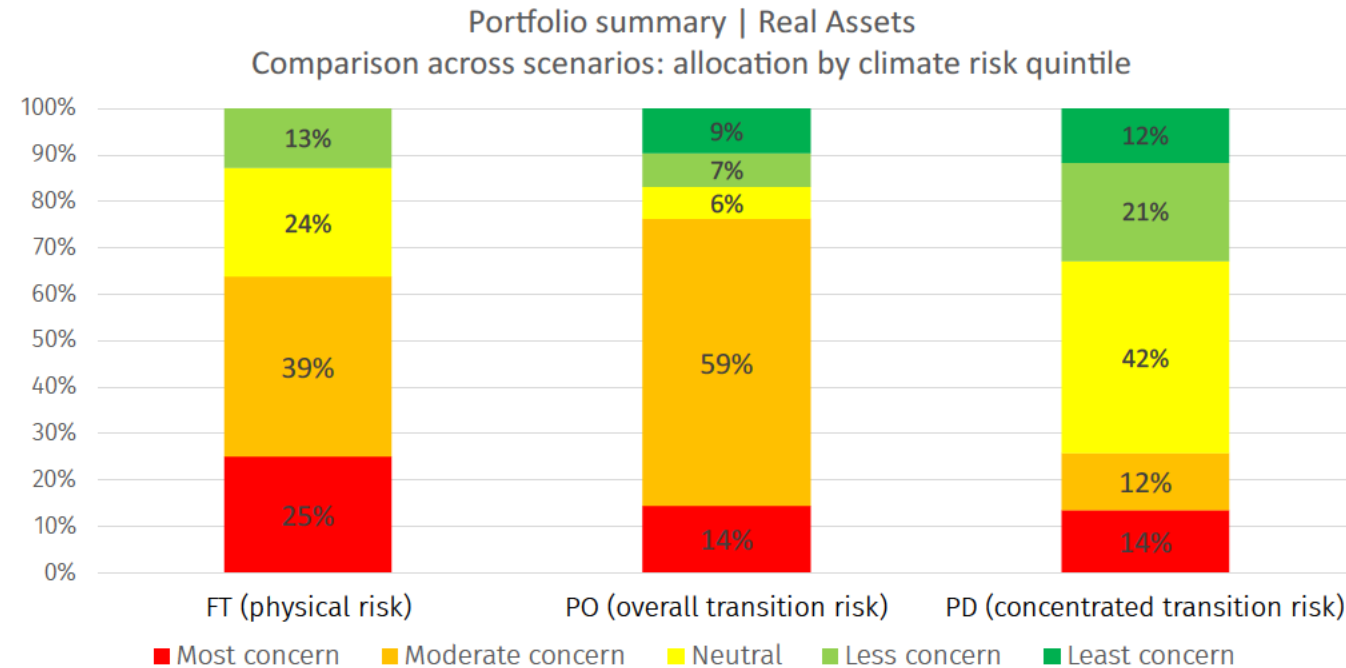
Real assets | High-level Risk MAP insights

Moderate physical risk exposure, moderate overall transition risk.

Compared to the other two portfolios, the risk profile distribution is more balanced across physical and transition risk, and with less extreme allocations to “concerning” sectors.

There remains, however c.60% (physical risk) and c.75% (transition risk) of holdings falling in the upper two quintiles. Perhaps indicating valuable areas to focus any more detailed assessments.

The illiquidity of this asset class suggest that climate risk should be considered as part of deal due diligence, since exiting positions can take significant time.



Using these results

We suggest that the sector-level insights from this analysis is used to “triage”/focus deep-dives into the climate-readiness of individual holdings by the asset managers and their analysts; who are best placed to make an “on the ground” assessment of the appropriateness of these holdings given your other investment objectives.

Risk MAP high climate materiality insights | Real assets

Zooming in on the more climate exposed parts of region/sector grids, we see where portfolio allocations arise in areas that could be more systemically exposed to climate risk.

FT

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		1.12	1.76	2.09	2.30	2.27
Region average quintile	PORTFOLIO weights	Consumer discr	Industrials	Health	Telecom	IT
1.50	China	0.0%	0.8%	0.0%	0.0%	0.9%
1.76	Australia	0.0%	0.0%	0.0%	0.0%	0.0%
1.78	India	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	Malaysia	0.0%	0.0%	0.0%	0.0%	0.0%
2.00	US	0.0%	4.4%	0.0%	0.0%	5.3%
2.06	Rest of World	0.0%	0.0%	0.0%	0.0%	0.0%
2.09	Philippines	0.0%	0.0%	0.0%	0.0%	0.0%
2.33	Indonesia	0.0%	0.0%	0.0%	0.0%	0.0%
2.42	Netherlands	0.0%	0.0%	0.0%	0.0%	0.0%

Through this more detailed view, we can see the sector/region holding that are driving the quintile 1 and 2 allocations in the previous slide.

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PD

5y disorderly transition outlook		Sector average quintile			
		1.00	1.00	1.48	2.58
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
1.57	Norway	0.0%	0.0%	0.0%	0.0%
1.67	Finland	0.0%	0.0%	0.0%	0.0%
2.00	France	0.0%	0.0%	0.0%	0.0%
2.00	Russia	0.0%	0.0%	0.0%	0.0%
2.14	Italy	0.0%	0.0%	0.0%	0.0%
2.17	Netherlands	0.0%	0.0%	0.0%	0.0%
2.22	China	0.0%	0.0%	0.0%	2.6%
2.38	Germany	0.0%	0.0%	0.0%	0.0%
2.45	Sweden	0.0%	0.0%	0.0%	0.0%

PO

10y orderly transition outlook		Sector average quintile			
		1.00	1.00	1.33	2.15
Region average quintile	PORTFOLIO weights	Coal and synth fuels	Fossil based utilities	Oil and gas	Consumer discr
2.00	Norway	0.0%	0.0%	0.0%	0.0%
2.06	Australia	0.0%	0.0%	0.0%	0.0%
2.11	Canada	0.0%	0.0%	0.0%	0.0%
2.18	Switzerland	0.0%	0.0%	0.0%	0.0%
2.44	US	0.0%	0.0%	0.0%	0.0%
2.47	Malaysia	0.0%	0.0%	0.0%	0.0%

Exhibit 1 p.226



Disclaimer

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Oregon Investment Council

Update on Environmental, Social, Governance Initiatives

September 8, 2021



OREGON
STATE
TREASURY

Agenda:

- Introduction
- Contract with climate consultant for portfolio analysis
- Formal integration of ESG into private equity and other manager due diligence

Climate Consultant Engagement

- Latest step in Treasury's work to better understand climate risks to portfolio and formalize ESG factors into our investment decision-making
- Climate work in ESG space is continuously evolving
 - Improved tools to identify stranded assets, evaluate portfolio carbon footprint, model potential outcomes based on application of transition risks
- Climate risk as systematic risk could have broad economic impact
 - Staff already works with investment managers and consultants to better understand climate risk at the individual asset level
 - Understanding climate risk at the **total portfolio level**, with an emphasis on forward-looking metrics, requires outside help offering complex tools & econometric analyses that account for uncertainty and interconnectivity of factors being modeled



New Consultants: Manifest Climate & Ortec Finance

Manifest Climate (“Manifest”)

- Toronto-based, interdisciplinary climate strategy firm
- Provides educational services and bespoke consulting services, such as helping clients to define and implement a climate governance & risk management framework

Ortec Finance (“Ortec”)

- Headquartered in Rotterdam
- Designs and applies modeling solutions for asset-liability management, risk management, and climate risk
- Has partnered with Cambridge Econometrics and uses their global, macro-econometric model as input

Climate Impact Analysis: Project Phases

1. **Education sessions.** Manifest is facilitating three Climate Change Education sessions with Investment Division and other Treasury staff (syllabus on slide 6).
2. **Scenario modeling.** Ortec modeling will use indices based on OPERF's investment allocations. The proxy mix will run through Ortec's analytic engine to generate estimated scenario outcomes (see slides 7-8 for info on Ortec's analysis and illustrative output).
3. **Output interpretation.** Assisted by Ortec, Manifest will help Treasury interpret output from the modeling, specifically the prospective risks & opportunities for OPERF due to physical and transition responses to climate change.

Climate Consultant

Education: Learning Objectives



- Explore what climate change is and its importance to financial markets
- Understand the global climate policy drivers and ecosystem of international bodies
- Understand action on climate change by financial markets and regulators
- Introduction to climate scenario analysis
- Begin to understand how climate change poses risks and opportunities for asset owners
- Recognize the difference between and need for climate adaptation and mitigation
- Explore risk and opportunity exposure pathways in industry context
- Begin to identify information needs between asset owner and asset manager
- Different types of climate scenarios and scenario analyses used today
- How financial and non-financial companies can use climate scenario analysis

Climate Consultant Analysis

ORTEC
FINANCE

ORTEC – E3ME

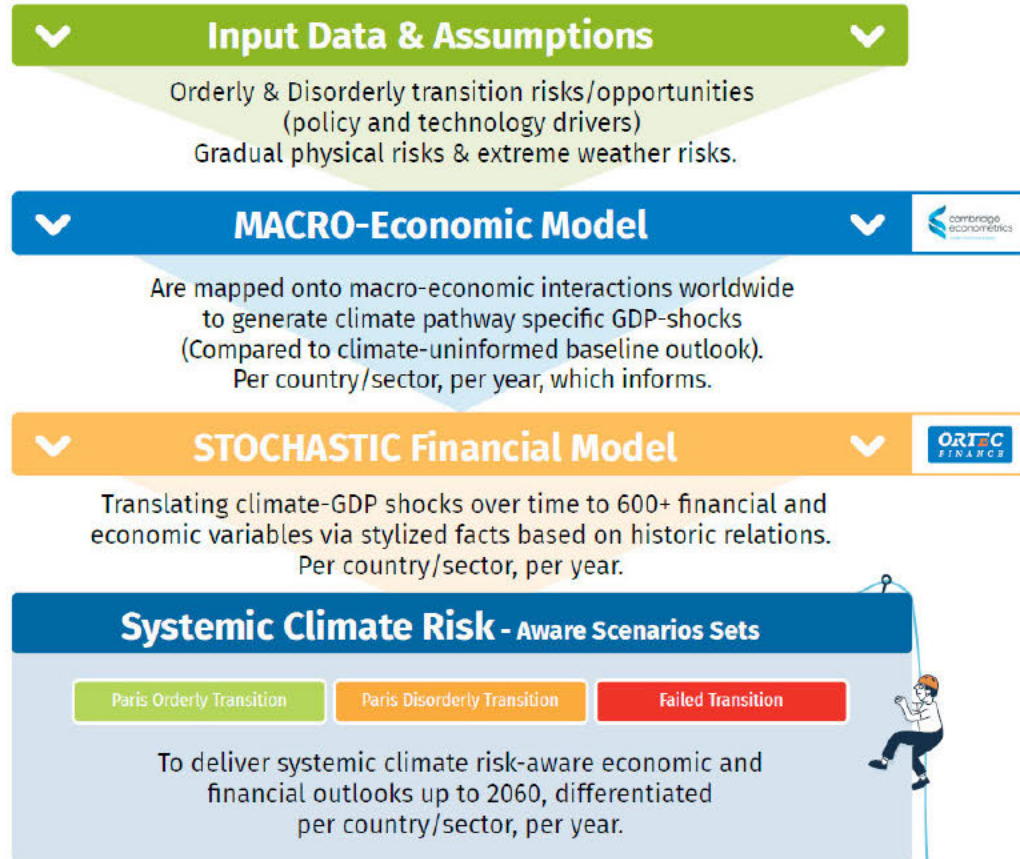
EXAMPLE INPUT POLICIES

- Carbon/energy tax, emission trading schemes
- Renewables subsidies, feed-in tariffs
- Technology investment subsidies
- *And many other policy levers*

EXAMPLE OUTPUTS

- GDP
- Sector output
- Inflation and prices
- CO2 emissions
- Electricity generation mix
- Technology mix by emissions intensive sector
- Employment
- Oil and gas prices
- *And many others indicators, available on request*

Combining well-established climate science with respected econometric and financial modelling

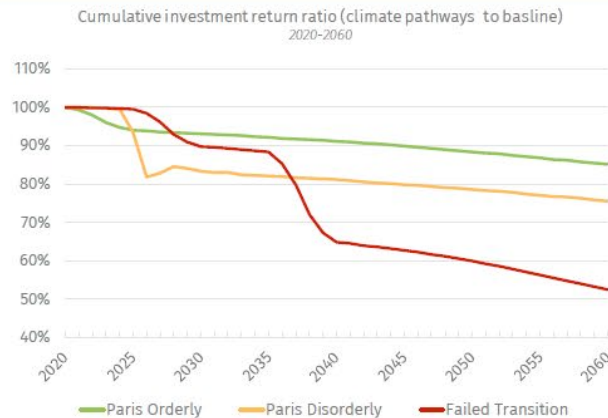


OREGON
STATE
TREASURY

Climate Consultant

Illustrative Output, Portfolio-Specific Financial Projections

Total Portfolio Impacts



Sector-Region Heatmaps: Cumulative Returns - Public Equities

	20Y	Total	Cons. Staples	Industrials	Telecom	Energy	IT	Materials	Health	Real Estate	Other utilities	Cons Disc	Low carbon electricity	Financials
World	8.1%	7.7%	7.0%	6.0%	13.2%	8.2%	7.0%	6.5%	6.5%	7.0%	7.0%	7.0%	7.0%	7.0%
Dev. Markets	6.1%	5.9%	5.9%	5.5%	12.6%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Em. Markets	8.0%	10.7%	7.7%	12.1%	16.7%	9.4%	8.6%	11.7%	10.7%	7.5%	7.7%	7.7%	7.7%	7.7%
Malaysia	3.4%	0.2%	0.2%	0.2%	-18.4%	-1.6%	0.3%	2.7%	-2.8%	-19.2%	-2.5%	-19.6%	-19.6%	-19.6%
Japan	1.7%	8.0%	0.9%	6.1%	-18.5%	-0.1%	0.1%	-1.0%	5.7%	-13.9%	0.3%	17.4%	17.4%	17.4%
Singapore	0.9%	-0.8%	-1.6%	1.7%	-19.6%	-1.4%	-0.9%	9.2%	-2.3%	-22.6%	-1.8%	5.84%	5.84%	5.84%
Sweden	-0.8%	1.2%	-1.2%	1.1%	-19.2%	0.7%	-1.8%	0.8%	0.2%	-11.0%	-1.7%	9.6%	9.6%	9.6%
Denmark	-1.6%	-2.6%	-1.1%	-1.2%	-17.1%	-1.2%	-1.2%	-0.5%	0.7%	-14.1%	-2.9%	9.5%	9.5%	9.5%
Brazil	-11.1%	-2.3%	-2.9%	-2.3%	-55.9%	-5.0%	-5.6%	-2.3%	6.1%	-36.6%	-7.6%	11.5%	11.5%	11.5%
Norway	-12.4%	-4.9%	-6.4%	-7.3%	-33.6%	-16.3%	5.0%	-1.7%	-6.4%	-11.8%	-2.0%	5.2%	5.2%	5.2%
Italy	-15.3%	-0.9%	-3.8%	-1.7%	-19.0%	-2.9%	-3.4%	-1.5%	-2.9%	-36.6%	-4.6%	15.04%	15.04%	15.04%
Russia	-10.0%	13.9%	2.0%	20.3%	-19.9%	10.7%	1.8%	3.0%	2.9%	-43.8%	-0.5%	23.1%	23.1%	23.1%
Canada	-20.1%	-11.5%	-14.1%	-17.8%	-40.9%	-10.8%	-13.6%	-12.2%	-12.8%	-55.7%	-10.2%	8.2%	8.2%	8.2%

* Low carbon electricity is separated from other utilities using the share of low carbon electricity generation in total electricity supply. ROCE sectors (consistent with ESRI classification) are mapped to broad ROCE sectors.
** Indonesia's low carbon electricity sector is currently very small, therefore the relative growth in this sector is extremely large. Given that this sector is currently very small, the impact shown is extremely sensitive to the assumptions made, which may influence accuracy.

Disaggregation to climate risk factors

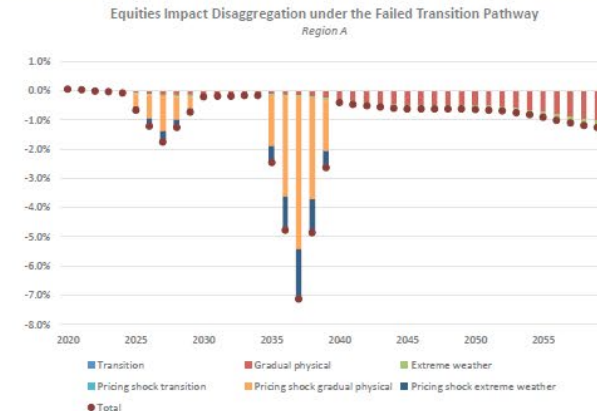
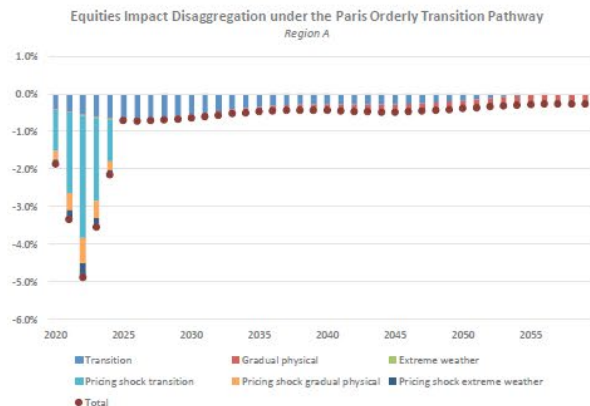


Exhibit A

Statement of Work

A. Consultant's Services. The Consultant will provide expert guidance to Client, and the Oregon Investment Council (which sets investment policy for the Fund), as further described below. Specifically, Consultant shall, with respect to OPERF:

- 1) Assess physical and transition risks of climate change and the impact on the investment portfolio;
- 2) Provide scenario modeling and stress testing to identify total portfolio risk, identify asset class vulnerability to physical & transition risks, and assess the impact on investment return expectations;
- 3) Identify outsized risks and recommend opportunities to reduce portfolio risk;
- 4) Provide trustee and staff education on the topic and engage with asset class teams for more targeted and specific assessments of portfolio holdings;
- 5) Provide iterative what-if analysis that can address and highlight the significance of individualized terms of investments; and
- 6) Provide near and long-term risk assessment under varying climate and transition scenarios.
- 7) A complete recommendation and analysis presentation to the Client staff shall be conducted.
- 8) Provide such other related consulting services as reasonably requested by Client.

Deliverables:

	Description	Fee	Consultant party anticipated to provide the Deliverable	Due By Date
1	Education for Oregon Investment Council members and Client staff	\$14,200.00	Manifest Climate	December 31, 2021
2	Modelling to assess physical and transition risks	\$79,600.00	Ortec Finance	December 31, 2021
3	Further scenario and "what if" work	\$16,000.00	Ortec Finance	December 31, 2021
4	Workshops to develop use cases	\$22,000.00	Manifest Climate	December 31, 2021
5	Logistics and project support	\$13,000.00	Manifest Climate	December 31, 2021

View Message

Subject: Public Records Request :: R000209-011222

Body:



Request for Public Records

REQUESTER	Rick Pope
DATE	July 12, 2022
REFERENCE NO.	R000209-011222

You submitted the following request for public records:

"Any documents in the possession of the Oregon Investment Council and the Oregon State Treasury that relate to assessments of or responses to climate-related financial risk to assets held in investment funds as defined in ORS 293.701

"Climate-related financial risk" means material financial risk posed by the effects of climate change, including intense storms, rising sea levels, higher global temperatures, economic damages from carbon emissions, and other effects due to public policy on climate change, shifting consumer attitudes or changing economics of traditional carbon-intense industries.

Please note the request includes materials, working papers and emails of members of the Oregon Investment Council as well as of employees of the Oregon State Treasury.

I would like to consult in advance about the reasonable parameters of word searches for responsive electronic documents."

Hi Rick,

Thanks for your patience with this request and the approach we have taken to focus on the deliverable from the consulting company. We have conferred with the contractor that produced the report. This contractor has certified that the information summarized below constitutes contractor trade secrets. Trade secrets are exempt from disclosure under ORS 192.345(2). In this case, the contractor is asserting the exemption due to the

particular formulas/methodology used that separate its work product from competitors. The trade secret information has been redacted from the report, which is now available to you with the redactions in our Public Records Center.

Please also note that there was some inadvertent misnumbering in the contractor's final report. Specifically, the final report did not include the following slide numbers (the numbers on the lower left of the page): 3, 6, 10, 14, 18, 27, 28, 29. Also, two slides are numbered 39.

- Slide 12: Page deleted [The Impact of Climate risk on OPERF's portfolio]
- Slide 32: Removed data from table, color-coding of cells retained, retained total fund impact data
- Slide 33: Removed data from table, color-coding of cells retained, retained total fund impact data
- Slide 34: Removed data from table, color-coding of cells retained, retained total fund impact data
- Slide 35: Removed data from table, color-coding of cells retained, retained total fund impact data
- Slide 37: Removed y-axis labels
- Slide 40: Removed data from table, color-coding of cells retained, retained top line World impact data
- Slides 41-43: Pages Deleted [Paris Orderly, Cumulative Return – Public Equities, 10, 20 & 40 years, respectively]
- Slide 44: Removed data from table, color-coding of cells retained, retained top line World impact data
- Slide 45-47: Pages Deleted [Paris Disorderly, Cumulative Return – Public Equities, 10, 20 & 40 years, respectively]
- Slides 48-49: Pages Deleted [Failed Transition, Cumulative Return – Public Equities, 5 & 10 years, respectively]
- Slide 50: Removed data from table, color-coding of cells retained, retained top line World impact data
- Slide 51: Page Deleted [Failed Transition, Cumulative Return – Public Equities, 40 years]
- Slide 52: Page Deleted [Sector Insights...]
- Slide 55: Page Deleted [Focusing on companies with well-aligned business practices....]
- Slide 60: Deleted bottom chart [2] investigate composition of portfolio if optimized...]
- Slide 74: Page Deleted [Risk/return analysis of portfolio constituents...]
- Slide 75-78: Pages Deleted [Sectorial impacts – Paris Orderly...]
- Slide 82: Page Deleted [Risk/return analysis of portfolio constituents...]
- Slide 83-86: Pages Deleted [Sectorial impacts – Paris Disorderly...]
- Slide 90: Page Deleted [Risk/return analysis of portfolio constituents...]
- Slide 91-94: Pages Deleted [Sectorial impacts – Failed Transition...]

If you have any questions or need additional information, please feel free to contact us. If you disagree with Treasury's redactions, you may contact the Oregon Public Records

Advocate at 503-378-5228. The Advocate provides mediation services related to public records requests. You may also petition a circuit court to review Treasury's decision as provided in ORS 192.427.

Sincerely,

Treasury Public Records Team

A solid black rectangular box used to redact the signature of the Treasury Public Records Team.



CLIMATE MAPS

Oregon Treasury

Climate Scan Report

October 2021

1.5°C

2°C

4+°C



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The annex presents a detailed review of our methodology and final comments

Climate risk exposure | OPERF investment portfolio



The view from 10,000 feet

1. Lower return expectations across all assets due to negative climate impact over time.

Over the next 20 years, all three climate scenarios see lower growth expectations compared to a baseline. This poses a material risk to both scheme balance sheets and future contribution/funding needs.

2. Worst outcomes come in a Failed Transition due to physical risks.

Globally, the physical risks experienced when transition to a greener economy fails, have the most significant impacts (63% lower US GDP by 2100). Notably, by 2037 OPERF's portfolio value in the Failed Transition scenario is significantly down compared to an orderly low-carbon transition. In a Failed transition, by 2060 your asset portfolio value is expected to c.20% lower than baseline.

3. Transition risk impacts may occur sooner than most expect.

On the other hand, a transition scenario – even a disorderly one – enables global economies to stabilize once the transition has been completed. There is hope, and this demonstrates the need for investors to engage with companies and sovereigns on the transition whilst also positioning their portfolios well in the interim.

In the near future, transition impacts are generally positive in Europe. In contrast, the US is more negatively impacted than many other countries due to fossil fuels exports and other high-emitting activity currently being a significant contributor to GDP. Relative to the baseline, in a **disorderly transition** scenario, high exposure to the US economy contributes to OPERF's portfolio reducing in value by roughly 8% over the next 5 years.

4. Climate risk changes the Strategic Asset Allocation (SAA) landscape as climate impacts affect long-term expectations.

Risk-adjusted returns vary across assets, pathways and time horizons. In general, cash & corporate bonds are more resilient whereas the least resilient asset classes are listed/private equities and properties due to their sensitivity to pricing-in shocks and market over-reaction.

Compared to a typical globally-exposed pension scheme, your portfolio's current climate risk exposure is relatively more vulnerable due to a exposure to sensitive regions, sectors, and asset classes.

Climate change is likely to see strongly differentiated risk/return at a sector level. As such, future SAA/ALM decisions may benefit from sector-level differences being captured in the analysis.

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Key Takeaways | Both short-term and long-term risk is material

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Outlook

In the near future, the portfolio could suffer in particular from losses if a disorderly climate transition transpires.

The longer it takes for coordinated policy action on climate, the more radical and disruptive it is likely to be for markets.

The pricing-in of physical risk is likely to come many years or decades ahead of direct impacts. The Failed transition scenario shows your current portfolio experiences significant impacts from a failed transition by the middle of the 2030's as inevitable future physical damage is priced-in.

US

The US represents c.70% of OPERF's allocation exposure (using data received and proxies agreed with you and noting that allocation exposure is not the same as economic exposure). The US economy is negatively exposed to both physical and transition-related climate risks under all pathways. The country's position as a net fossil fuel exporter, with low energy efficiency, low carbon pricing and high sensitivity to market sentiment shocks make it highly exposed to transition risks. At the same time it is already experiencing severe extreme weather challenges (both "wet" and "dry") which will only worsen with increasing temperatures, even under the transition scenarios.

So what?

Across all pathways, there is significant differentiation between the likely experiences of different countries, sectors and asset classes. We recommend that using this analysis, you could work with your fund managers and advisors further integrating climate into your investment process. For example:

- Identify the "hotspots" of risk, for closer inspection by risk- and asset-managers
- Consider SAA/ALM actions to balance de-risking, scheme investment objectives and budgetary considerations
 - For example a "climate-informed" SAA exercise
 - Consider rotation away from transition-sensitive sectors/geographies whilst resilience testing asset de-risking in mitigating climate risk
 - Careful, climate-risk informed choice of longer term, illiquid assets
- Consider if fund benchmarks are incentivizing fund managers to align their funds with your objectives/risk appetites in the light of this study?
- Where segregated mandates are used, then careful mandate design will be crucial to appropriately managing climate risk and taking risk-conscious advantage of the coming economic shifts. For example maturity caps on debt issued by climate-exposed sectors and climate-aware KPIs for total return funds.
- Potential next steps are expanded upon later in this report with suggestions for different elements of the investment process.

The fund's asset allocation

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Below are asset class and geographic summaries of the allocations we modelled. These were based on data provided by OST and then mapped to our model. Where proxies were required these were agreed with the team.

In many ways the allocations are typical of other large pension funds open to members and accruing benefits. The significant domestic bias is also typical of pension funds around the world.

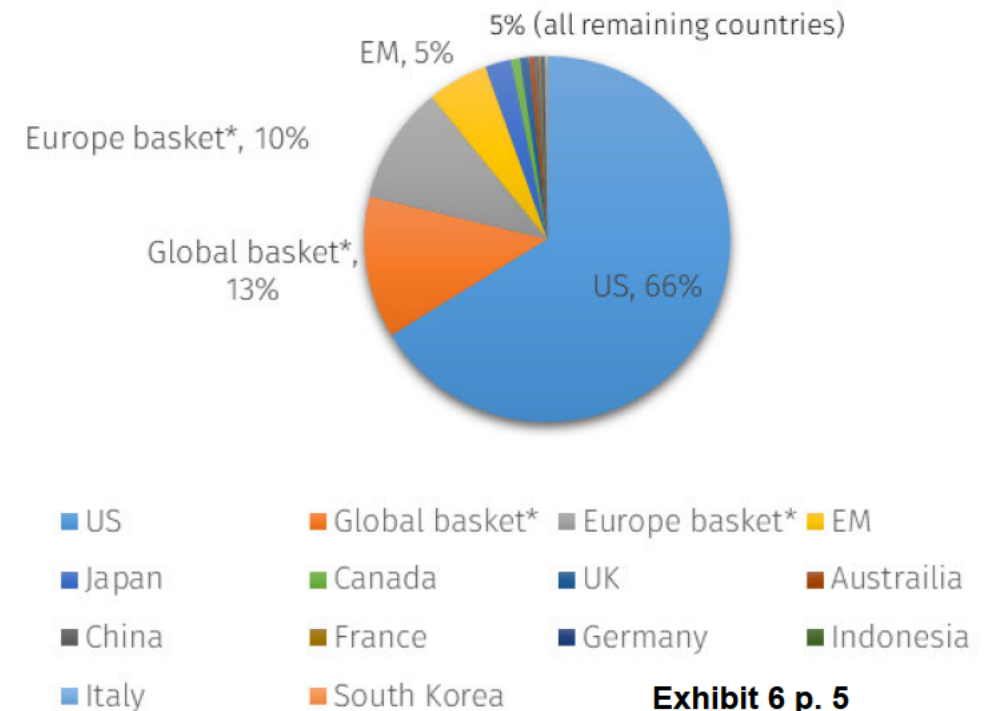
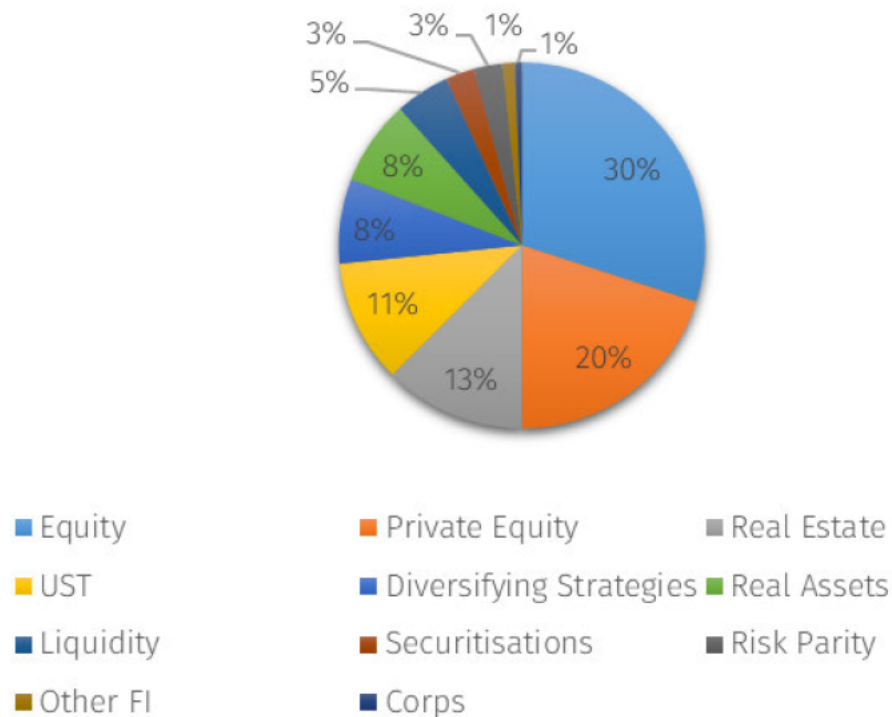


Exhibit 6 p. 5

Climate scenarios at a glance

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We consider **three plausible climate pathways** that explore potential future climate policies, interventions, and consequences of the world failing to mitigate climate change.

Scenarios cannot cover all possible outcomes, and are not mutually exclusive. There is no meaningful or practically useful way to give a probability of a scenario coming to fruition. These scenarios were selected to identify portfolio weak spots that aid decision making to respond to climate risk.

These “what if” climate change scenarios focus on two interdependent climate risk drivers:

- **Transition risk** focuses on the impacts (risks/opportunities) of *policy / technology uptake* towards a low-carbon economy
- **Physical risk** focuses on changes in the natural system attributable to global warming, i.e. sea level rise, frequency and severity of extreme weather events.

Paris Orderly Pathway

- **Large transition impact** due to policy measures & technology drivers
- Transition is assumed to occur as smoothly as possible
- **Market pricing-in** dynamics occur smoothed out over the 2020-2025 period
- **Physical impacts** occur up to 1.5/2°C which are greater than today but still much less than under a Failed Transition

In line with: Emissions ≈ IPCC RCP 2.6
 Average temp increase of 1.6°C by 2100.
 97% probability of limiting warming to 2°C and c.29% probability of limiting to 1.5°C.

Tests exposure to the risks/opportunities from the systemic drivers of an orderly transition and locked-in physical risk

Paris Disorderly Pathway

- **Large transition impact** due to policy measures & technology drivers
- Transition has disruptive effects on financial markets with **repricing** followed by a sudden **sentiment shock** and stranded assets in 2024 / 2025
- **Physical impacts** occur up to 1.5/2°C which are greater than today but still much less than under a failed transition

In line with: Emissions ≈ IPCC RCP 2.6
 Average temp increase of 1.6°C by 2100.
 97% probability of limiting warming to 2°C and c.29% probability of limiting to 1.5°C.

Shows resilience of the portfolio to sudden transition triggering a market dislocation centred on high emitting stocks

Failed Transition Pathway

- **Limited transition impact** - economies follow the business as usual track without **additional** new policy measures
- **Severe physical impacts** occur and continues to increase over time both **gradual physical** changes, as well as more frequent and severe **extreme weather events**
- **Markets price-in physical risks** up to 2050 by end of this decade, and price in post 2050 physical risks from the mid 2030s onwards

In line with: Emissions ≈ IPCC RCP 6.0
 Expected global warming by 2100 3.8°C

The main focus of this scenario is physical risk, results show the exposure to plausible, severe climate change impacts

Some guiding principles for using these results

The modeling was performed using benchmarks, tailored to reflect the asset allocation of the OPERF portfolio.

Unless stated otherwise, results are shown relative to a baseline that does not make an explicit allowance for the paradigm-shifting changes that our scenarios consider. Instead the baseline is conditioned on historic relationships and long-term views based on current market conditions.

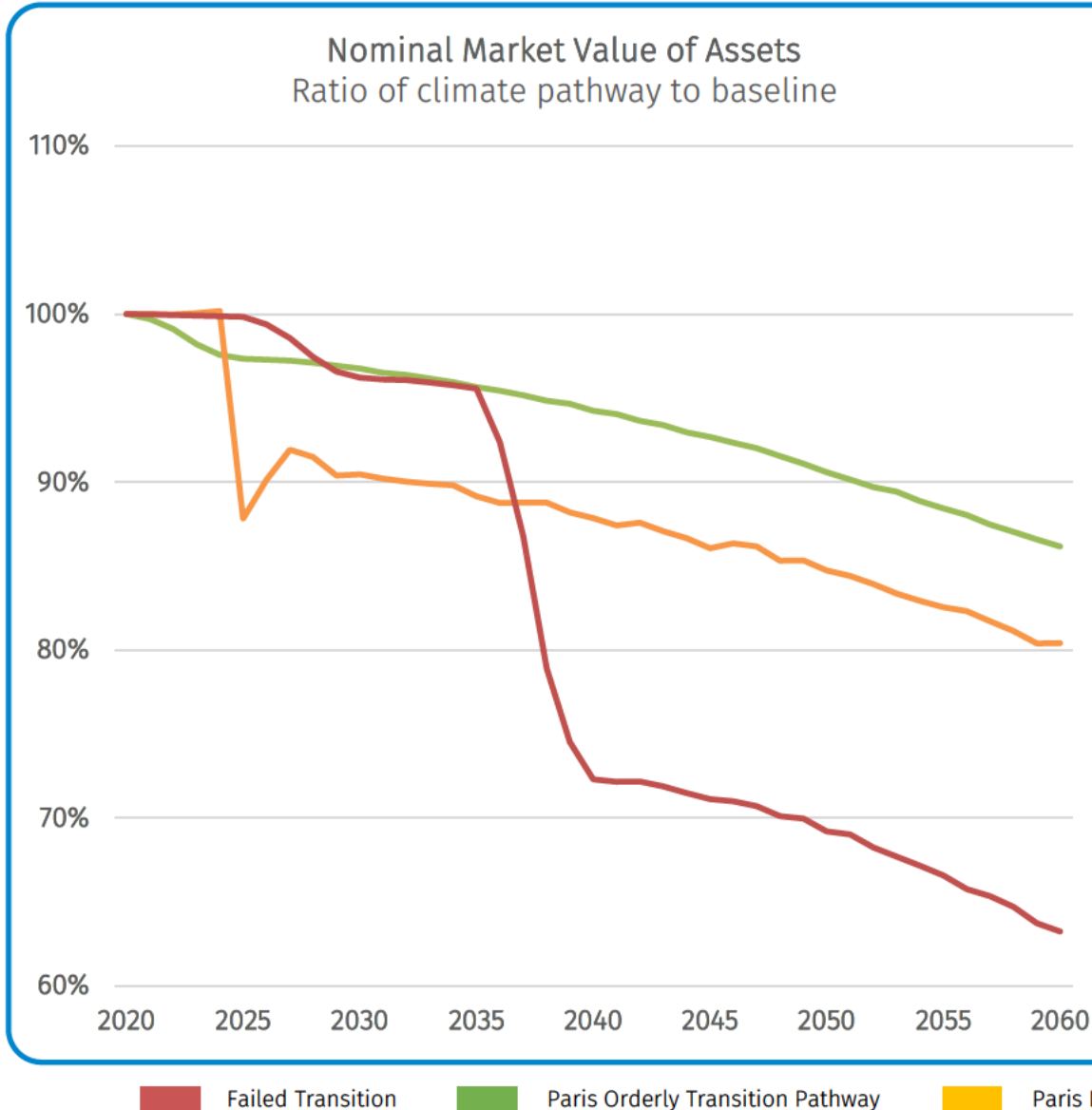
The scenarios have been constructed as diligently as possible. However, climate science is intrinsically subject to significant uncertainties. So scenarios are best viewed as a pressure test for the portfolio, probing for climate-risk weak spots.

Interpretation notes

- Focus on direction and magnitude vs exact numbers
 - Overlay these results on your views/knowledge of individual holdings
 - Results are shown relative to the baseline
- Many climate-financial relationships are non-linear
- Physical risk impacts are likely underestimated
- Climate change scenarios focus on two interdependent climate risk drivers:
 - Transition risk focuses on the impacts (opportunities/risks) of policy/technology uptake towards a low-carbon economy
 - Physical risk focuses on changes in the natural system and impacts on natural catastrophe severity/frequency and resource availability
 - It is entirely plausible that the future holds a mixture of the effects that we model

OPERF investment portfolio performance

The figure below shows the ratio of cumulative impacts relative to baseline over the next 40 years.



Comments

- While the overall performance of the fund remains positive in absolute terms, all scenarios project lower returns and impede the value of assets. The Paris scenarios limit the impacts on the fund mainly thanks to their mitigated **physical risks** exposure.
- In the **short run**, OPERF's assets are vulnerable to **transition risks**. The Paris Disorderly Transition Pathway is particularly impactful in the short term due to the sudden repricing of assets in 2025. The disruptive transition causes financial markets to **overly react and inflict long lasting damage** to the return performance.
- In the **longer run**, **physical risks** are the main contributor of climate related risk. The Failed Transition Pathway is particularly detrimental to the Treasury due to the large exposure to US assets across the different asset classes.

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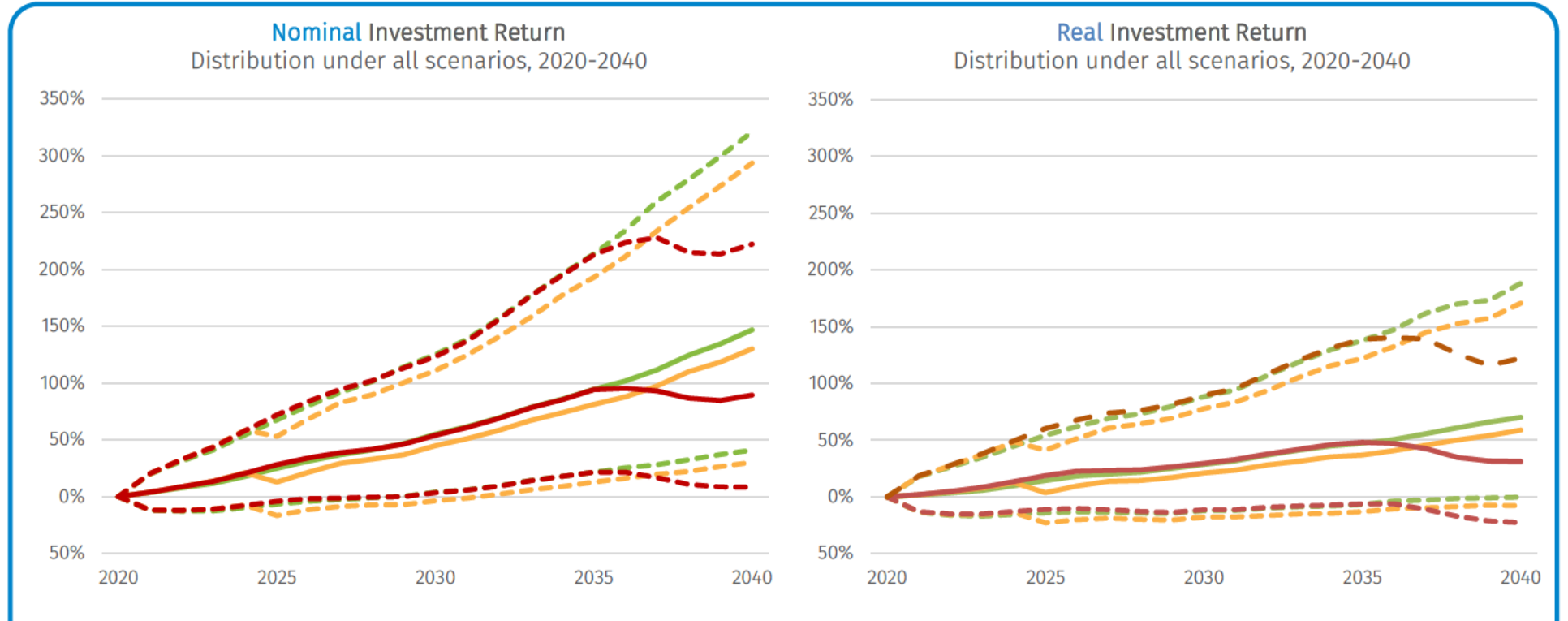
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The impact of climate risk on OPERF's portfolio

The two figures below show the ratio of cumulative climate impacts compared to baseline in the next 20 years



Comments

- While the overall performance of the fund remains positive in absolute terms, all scenarios project lower returns and impede the value of assets. The Paris scenarios limit the impacts on the fund mainly thanks to their mitigated physical risks exposure.
- Comparing results in nominal and real terms, we can infer that inflation has a slight dampening effect on the more extreme moves at some points in our scenarios.

Exhibit 6 p. 9

Geographic exposure – country rankings

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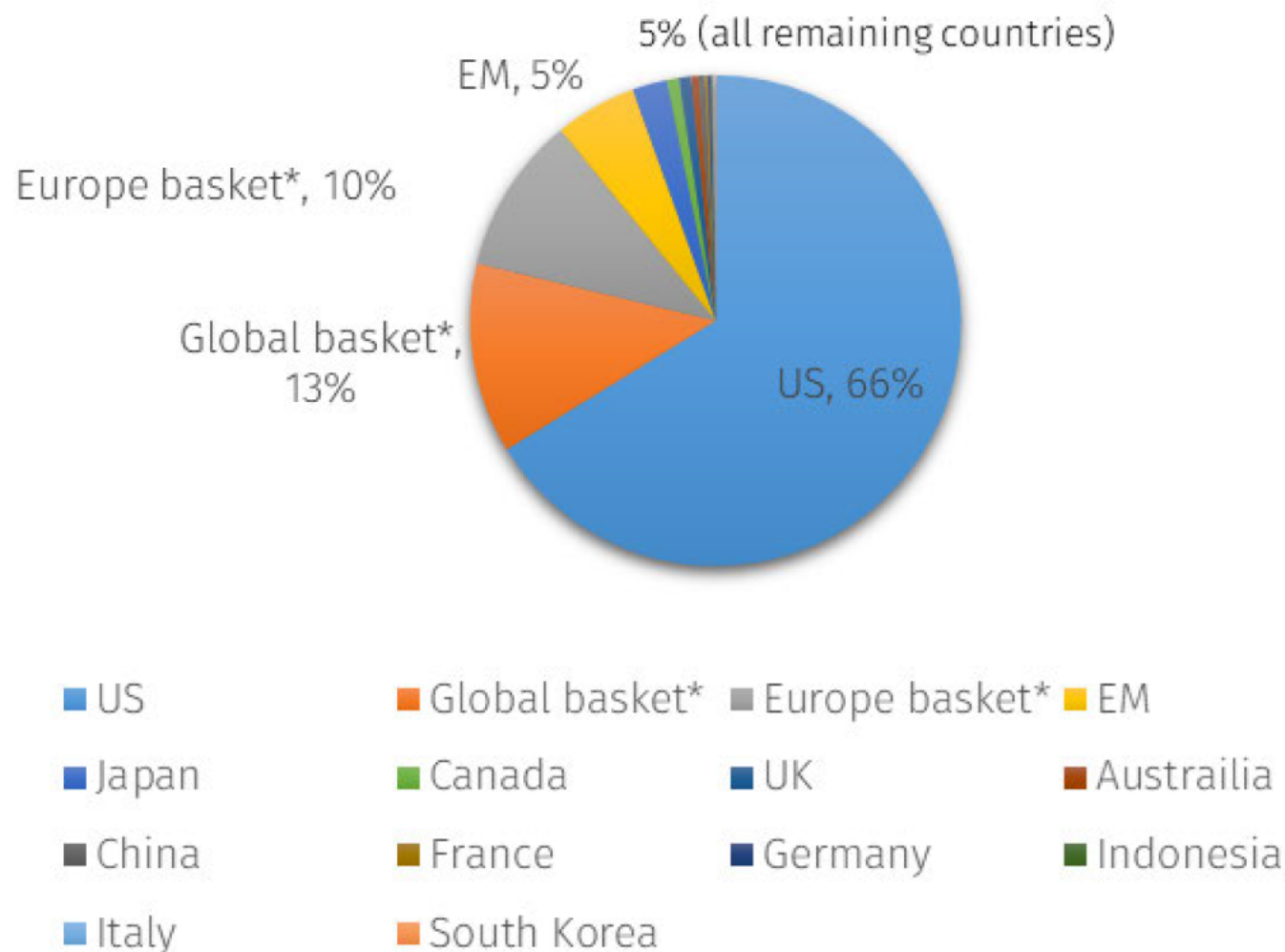
To help us make sense of the drivers for country exposure this section considers the main levers of regional differences before examining our “rankings” of countries by

- Scenario
- Key economic variables
- Equity performance



Portfolio exposure – geographic lens

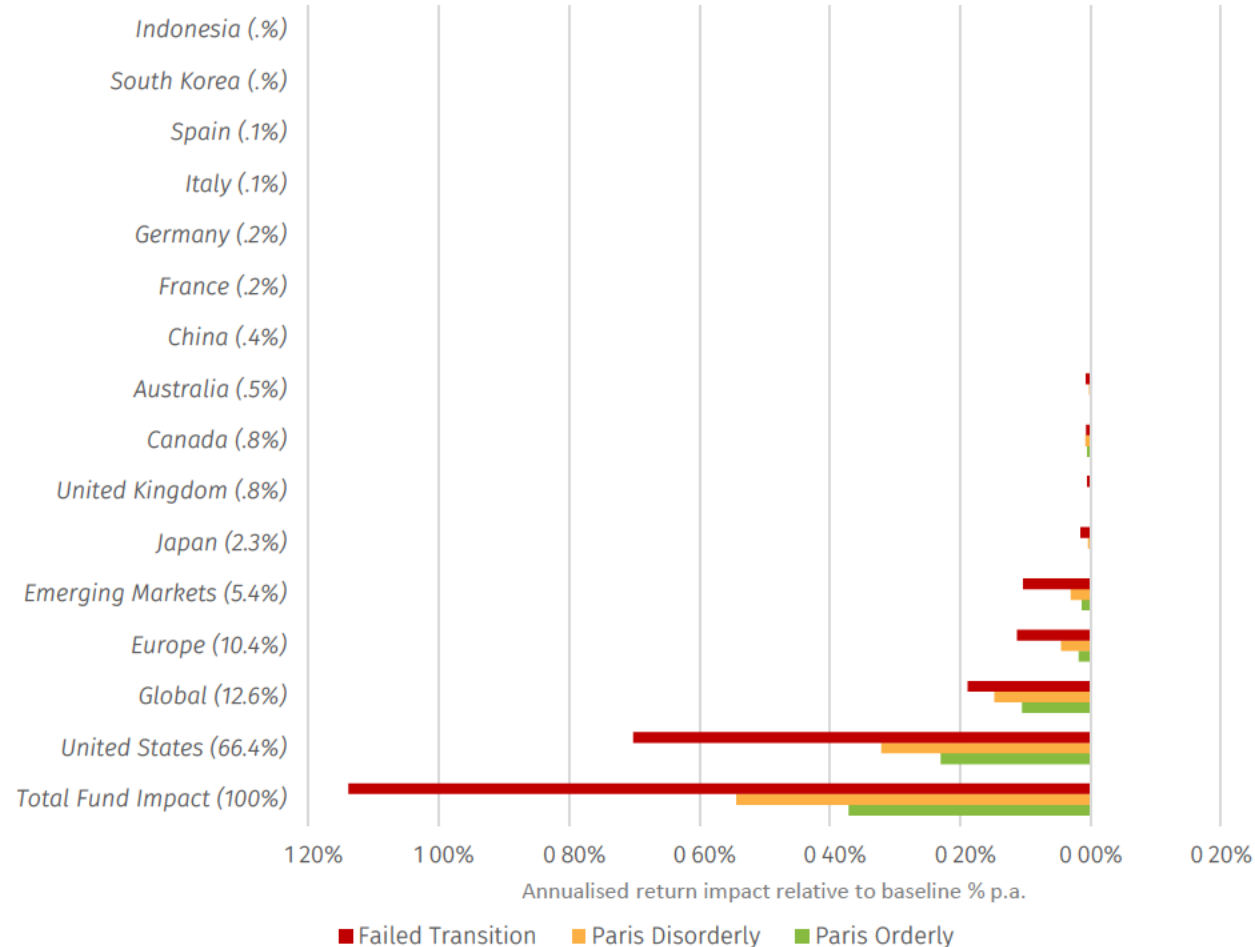
Whilst a strong domestic bias is typical of many pension funds, at a systemic level the US is more exposed to climate risk than many other countries.



Country attribution of total climate risk impacts – all assets

Across all asset classes, US and EM exposures drive total impacts slightly larger than justified by allocations

Total Portfolio Impacts - Geographical Breakdown
Climate impacts shown as difference to baseline
 (Median annualized result, all scenarios, 2021-2060)



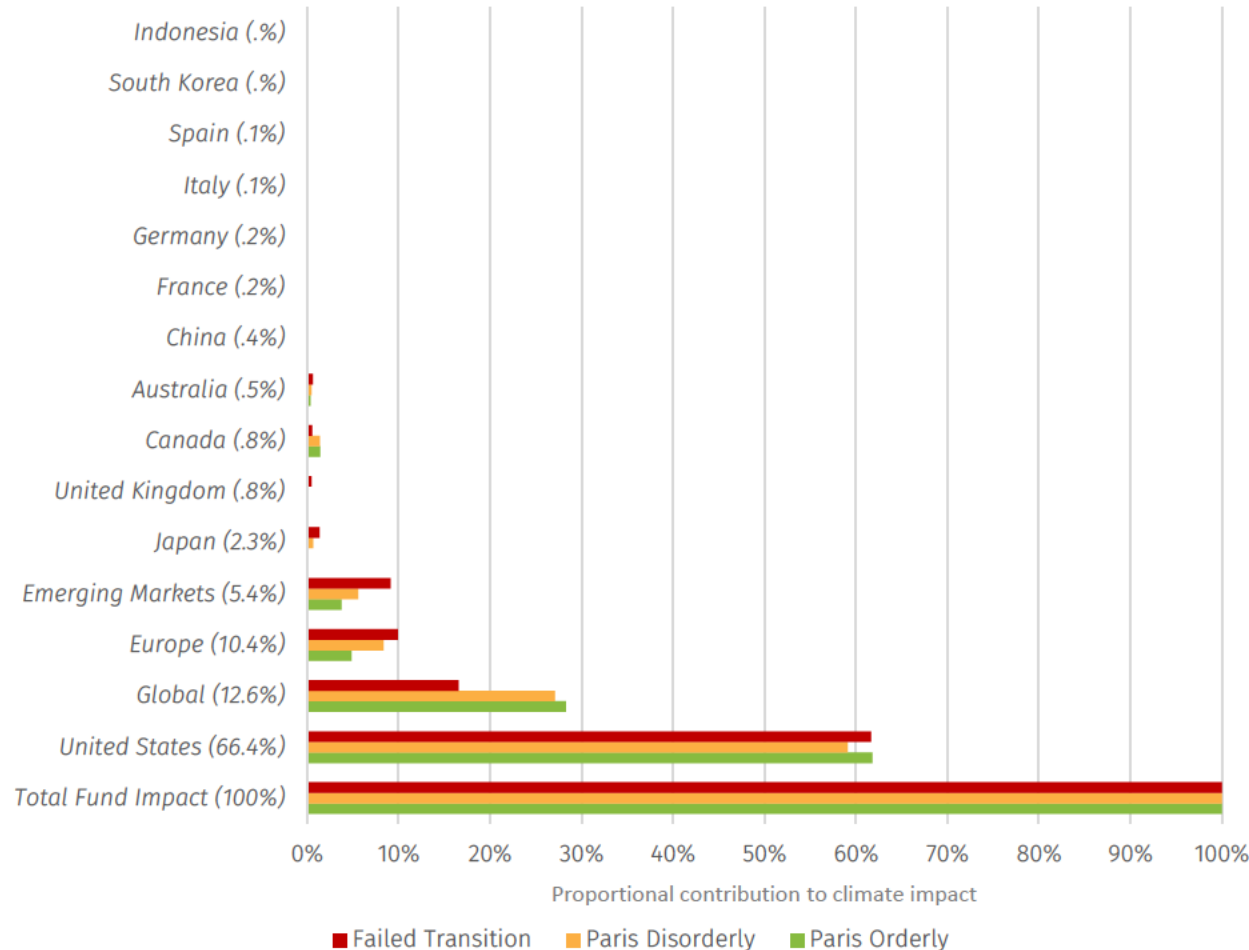
Comments

- Main source of risk comes from the large exposure to US assets.
- The top 3 regions (US, EU, EM) account for most of the risks in the fund across all scenarios.
- Given its unique geographical situation, and allowing for the relative benefits of USTs the US contributes it's fair share of climate risk in the Failed Transition and Disorderly scenario. However, without USTs the picture is very different.
- Despite its much lower allocation, EM is a large contributor of physical risks under a Failed Transition in particular.

Proportional country attribution – all assets

Across all asset classes, US and EM exposures drive total impacts disproportionate to their allocations

Total Portfolio Impacts - Geographical Breakdown
 Proportional contribution (allocation %)
 (Median result, all scenarios, 2021-2060)



Comments

- By re framing the contributions as a % of total and comparing to allocated capital, we can see which regions produce more climate risk than their fair share.
- The most striking here are US (all scenarios), Global basket (transition) and EM (physical risk failed transition).
- Note that if we removed the dampening effect of USTs from the US bucket, it would be contributing c.70% 80% of the risk somewhat in excess of the proportional capital allocated.

Key transition risk drivers explaining regional performance differences

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Key Transition Risk Drivers	Impact Narrative	Example Countries
Level of carbon price	The higher it is, the more the region benefits from investments in low-carbon technologies.	Europe
Net importer/exporter of (high marginal production cost) fossil fuels	Exporters tend to be worse off, importers tend to be better off.	Brazil/Malaysia vs. Canada/US/Saudi Arabia/Norway
Weight of energy sector in local stock market	The higher the weight, the more negatively impacted.	Canada, Norway
Relative energy efficiency of the economy	If energy efficient, then investments in energy efficiency (driven by carbon price) boost economic performance.	Europe
Carbon revenue recycling	The higher the carbon price, the more scope for a lowering of VAT / income tax which boosts household incomes. Households are buffered from increasing energy prices.	Europe
Sensitivity to sentiment shock	Some countries are historically more sensitive than others to market shocks.	USA
Investment stimulus	Positive GDP impact in those countries where transition investments are taking place.	China, Netherlands, Finland, Sweden, Turkey
Consumer spending stimulus	Positive GDP impact in those countries where consumer spending in transition activities is taking place.	UK, Europe, New Zealand
Stimulus combined with debt repayment	Initial positive GDP impacts; then decrease in GDP in later years.	Italy, Switzerland

Key physical risk drivers explaining regional performance differences

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Physical Risk Drivers

Latitude effect

Countries closer to the poles are currently still less exposed, but warming at faster rates. Countries closer to the equator are already more exposed, with temperature having non-linear impact on productivity.

Current temperature

Countries with current average temperatures below $\sim 5^{\circ}\text{C}$ (such as Finland and Russia) experience initial positive GDP growth impacts from warming, while countries with high average temperatures experience large negative impacts on GDP growth (e.g. India and Saudi Arabia).

Sensitivity to physical impacts

Decreasing land, labor and industrial productivity in regions that are relatively more exposed to physical impacts.

Sensitivity to economic amplification

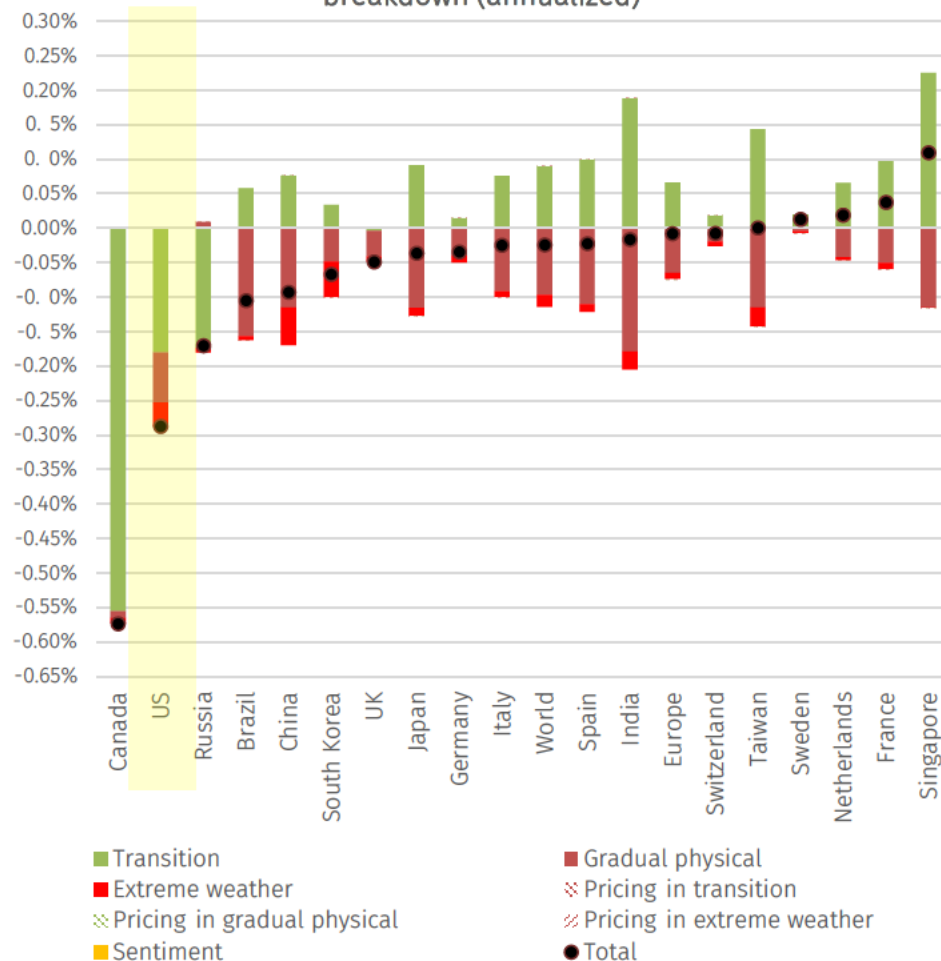
Countries with a lower economic coping capacity to buffer extreme weather losses (if they start to occur more frequently)

How do other countries rank in terms of climate impacts?

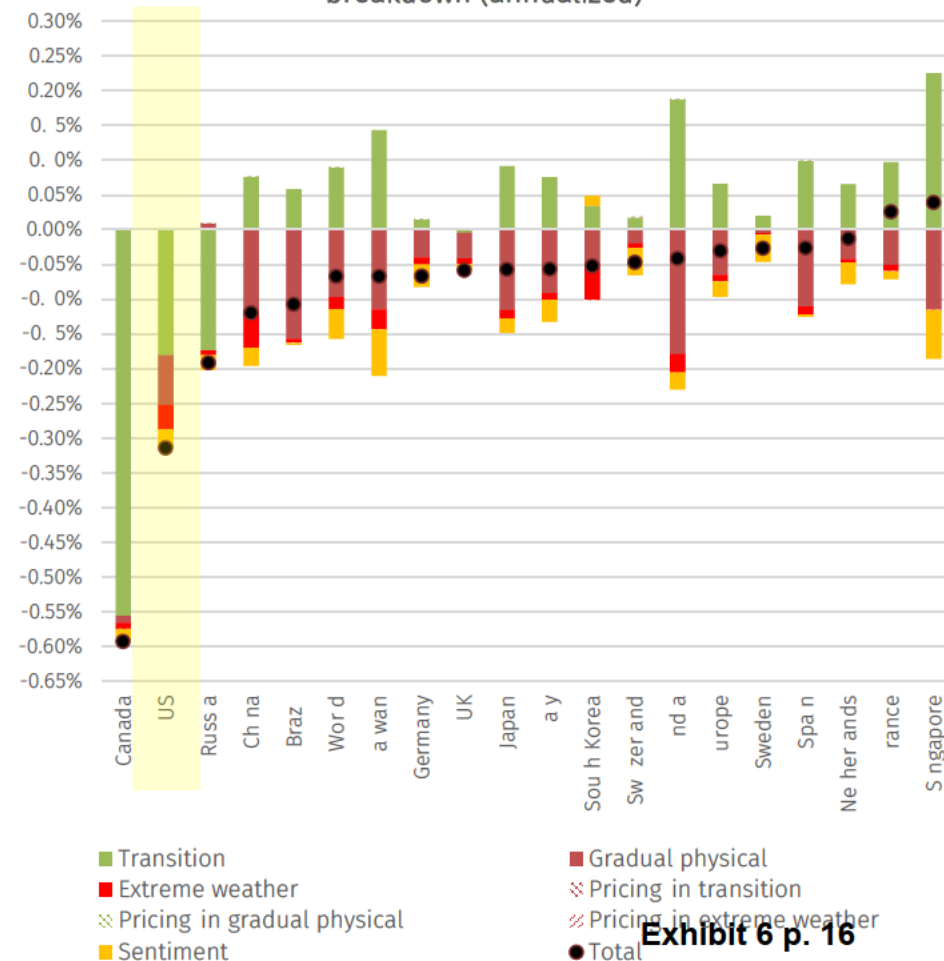
GDP shocks: Transition scenarios expose countries to risks and opportunities.

- After Canada, the US is the most **negatively** impacted country under both transition pathways.
- Singapore, France, the Netherlands, Sweden and Spain are most **positively** impacted under a transition scenario.

Paris Orderly Transition: 20-year GDP growth impact breakdown (annualized)



Paris Disorderly Transition: 20-year GDP growth impact breakdown (annualized)

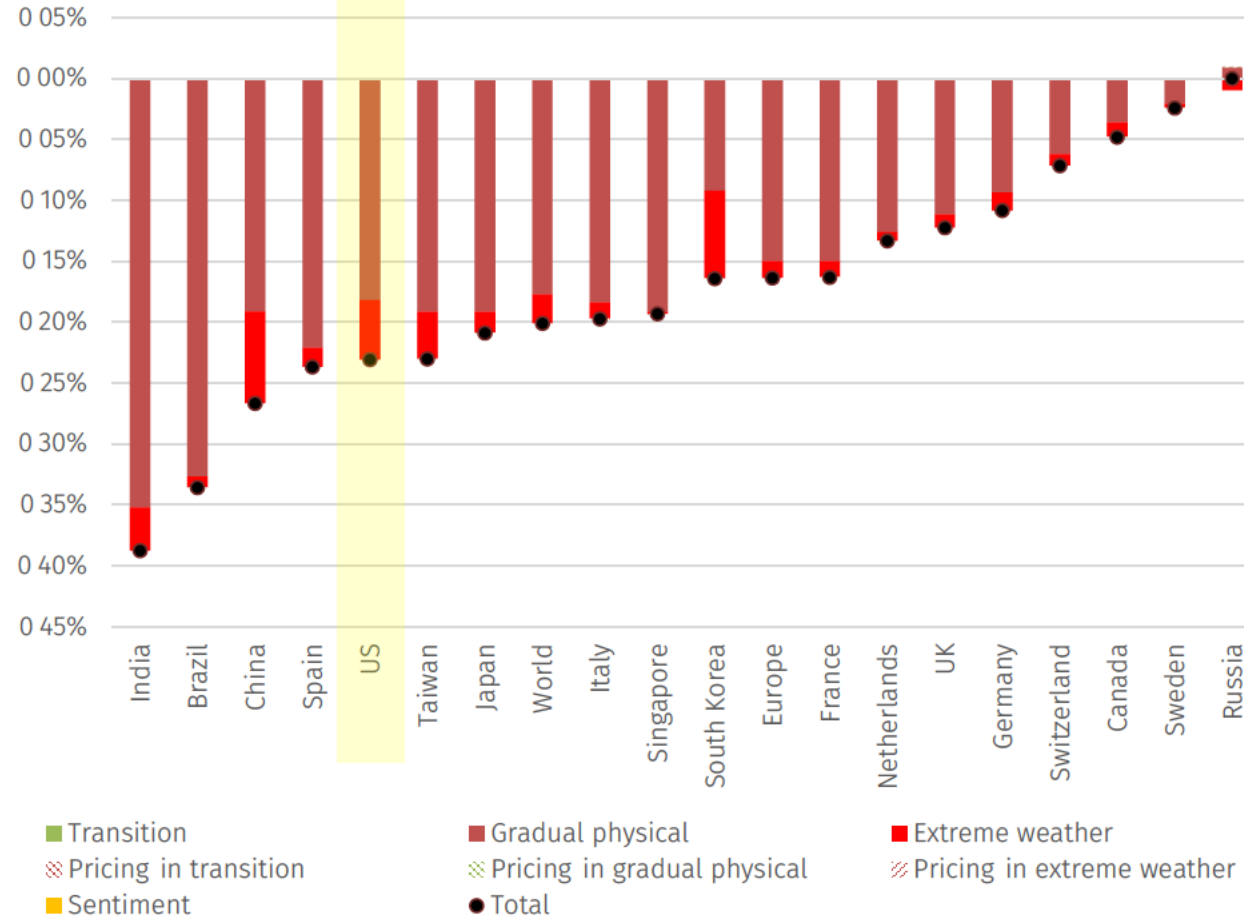


How do other countries rank in terms of climate impacts?

GDP shocks: A Failed Transition has negative impacts on all countries, but to varying degrees.

- The US, together with India, Brazil and China are the most impacted by a Failed Transition.
- Canada and the Nordic countries are least impacted by the Failed Transition thanks to their demographic and geographic situation.

Failed Transition: 20-year GDP growth impact breakdown (annualized)

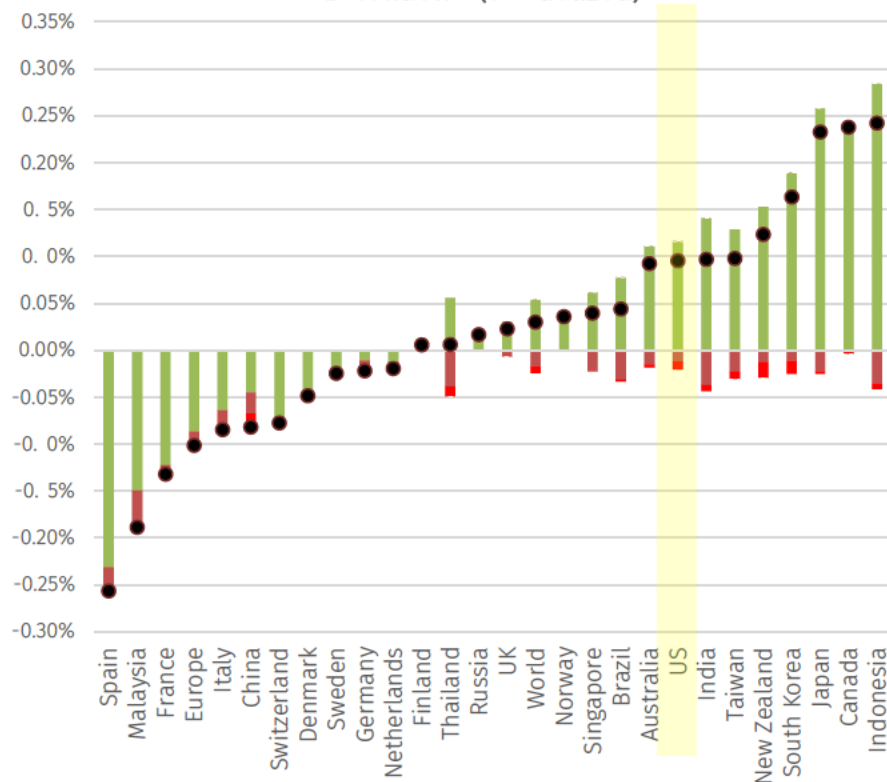


How do other countries rank in terms of climate impacts?

Inflation shocks vary across countries and under each pathway.

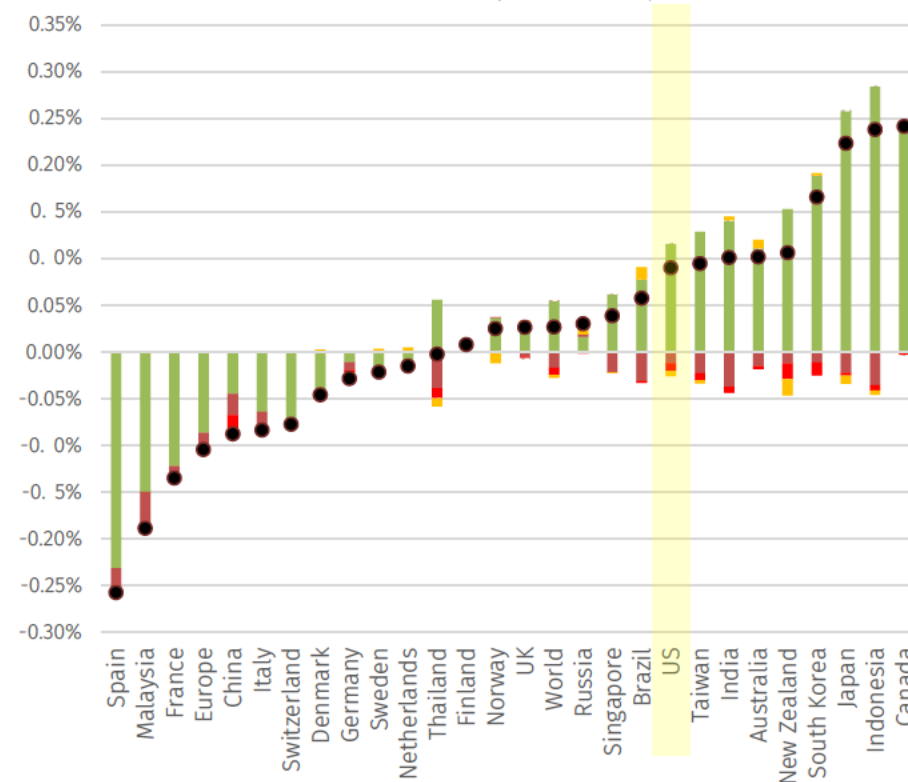
- While for some countries, inflation is relatively unaffected by climate change, others experience either a net positive or a net negative inflation impact under the transition scenarios.
- The US experiences high net positive inflation impacts. This is largely driven by demand-pull inflation from higher fuel and carbon taxes.

Paris Orderly Transition: 20-year inflation impact breakdown (annualized)



■ Transition
 ■ Extreme weather
 ■ Pricing in gradual physical
 ■ Sentiment
 ■ Gradual physical
 ■ Pricing in transition
 ■ Pricing in extreme weather
 ● Total

Paris Disorderly Transition: 20-year inflation impact breakdown (annualized)



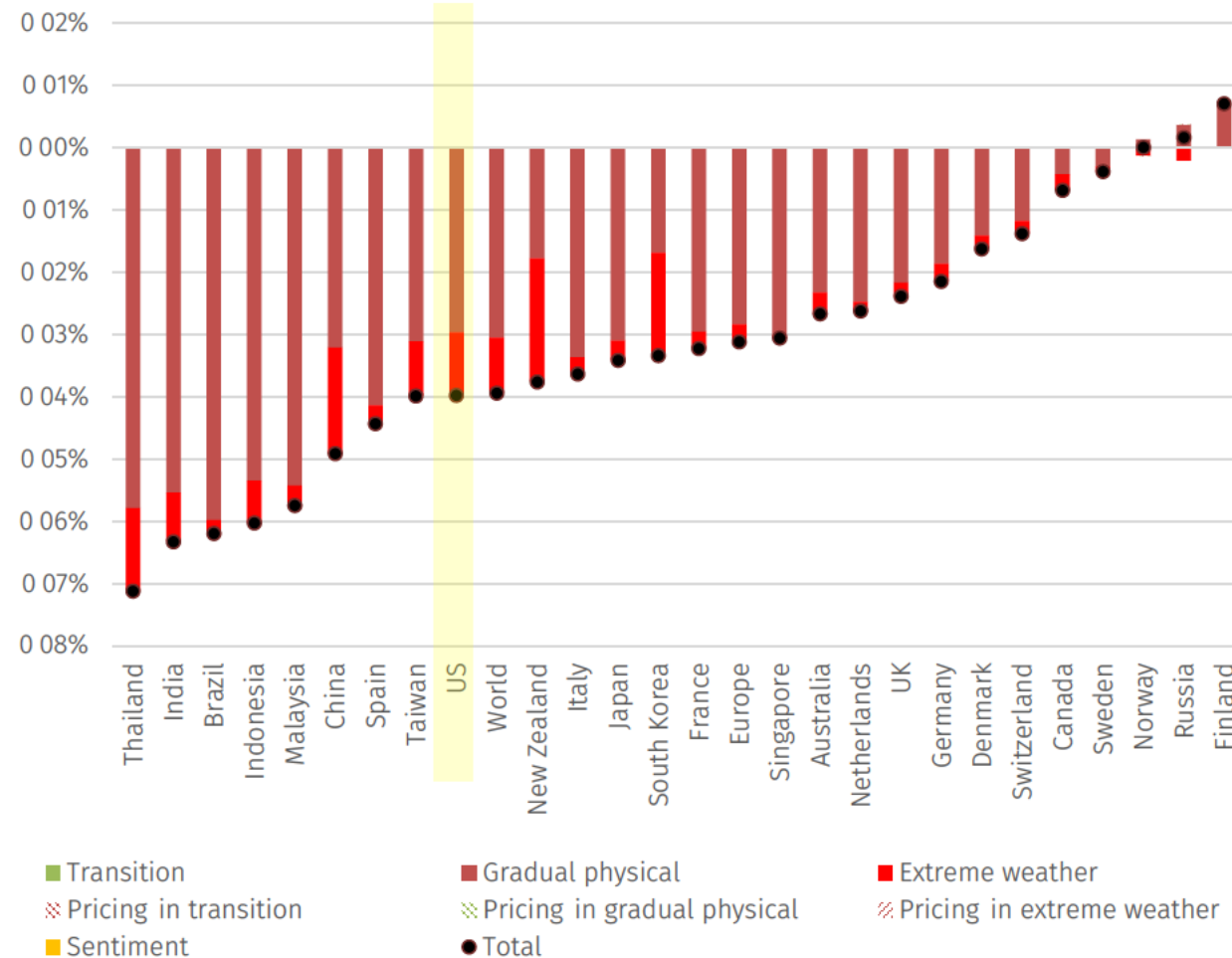
■ Transition
 ■ Extreme weather
 ■ Pricing in gradual physical
 ■ Sentiment
 ■ Gradual physical
 ■ Pricing in transition
 ■ Pricing in extreme weather
 ● Total

How do other countries rank in terms of climate impacts?

Inflation shocks: almost all countries experience negative shock under a Failed Transition.

- Under a Failed Transition scenario pretty much all countries experience a negative inflation impact.
- The US is relatively heavily impacted compared to Europe or Canada.

Failed Transition: 20-year inflation impact breakdown (annualized)

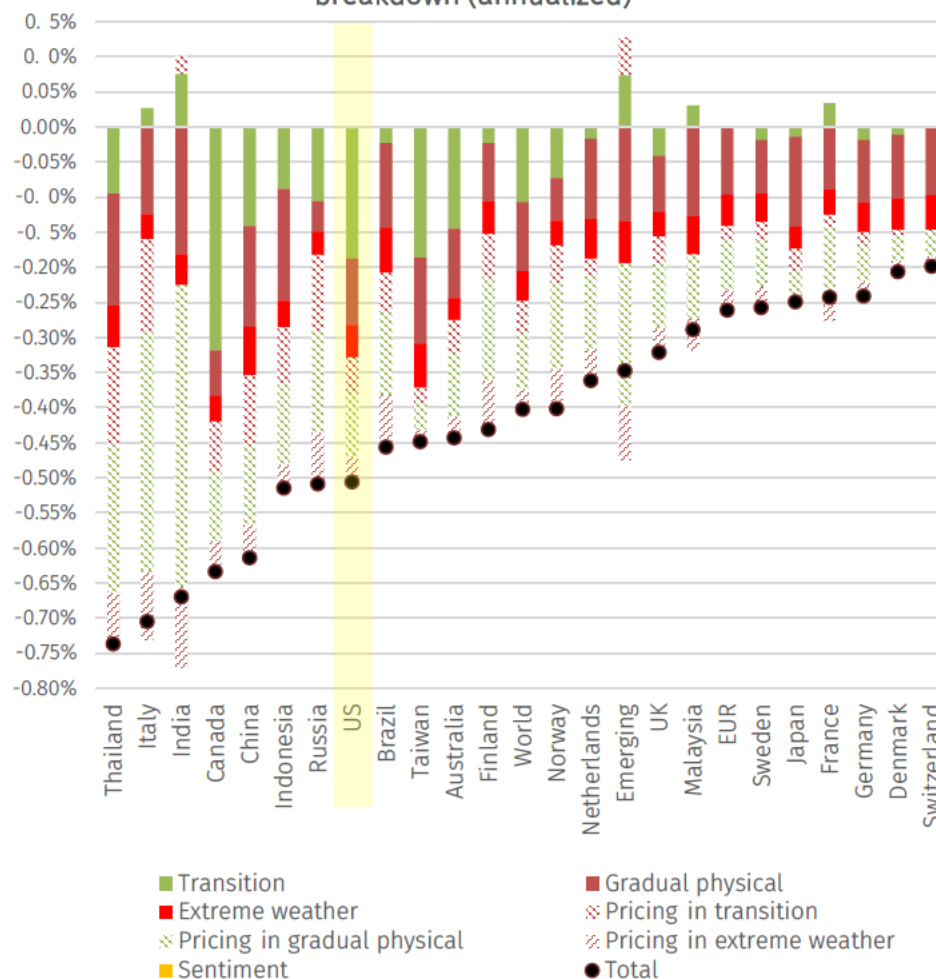


How do other countries rank in terms of climate impacts?

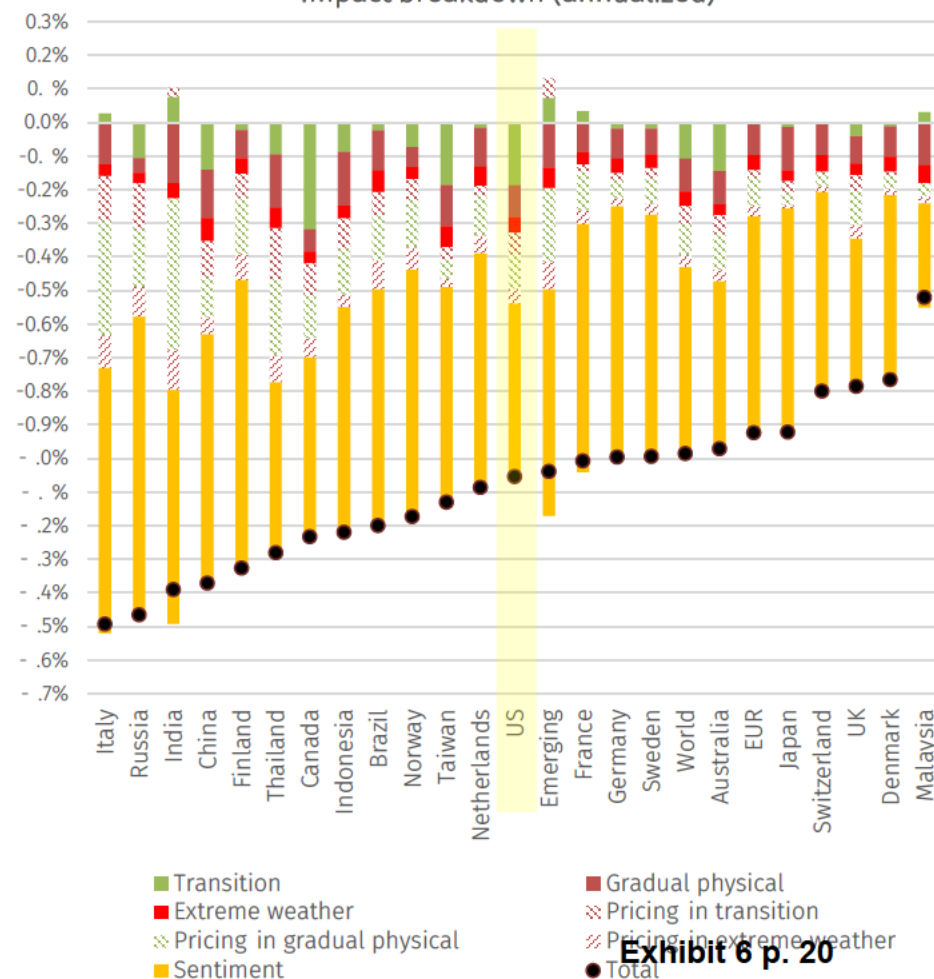
Equity returns are one of the least resilient asset classes and suffer both from transition and physical risk drivers.

- Transition impacts on equity returns are significantly more severe if the transition happens in a disorderly manner.
- Under both transition scenarios, the US ranks among the most impacted regions although not as much as Canada.

Paris Orderly Transition: 20-year global equities impact breakdown (annualized)



Paris Disorderly Transition: 20-year global equities impact breakdown (annualized)

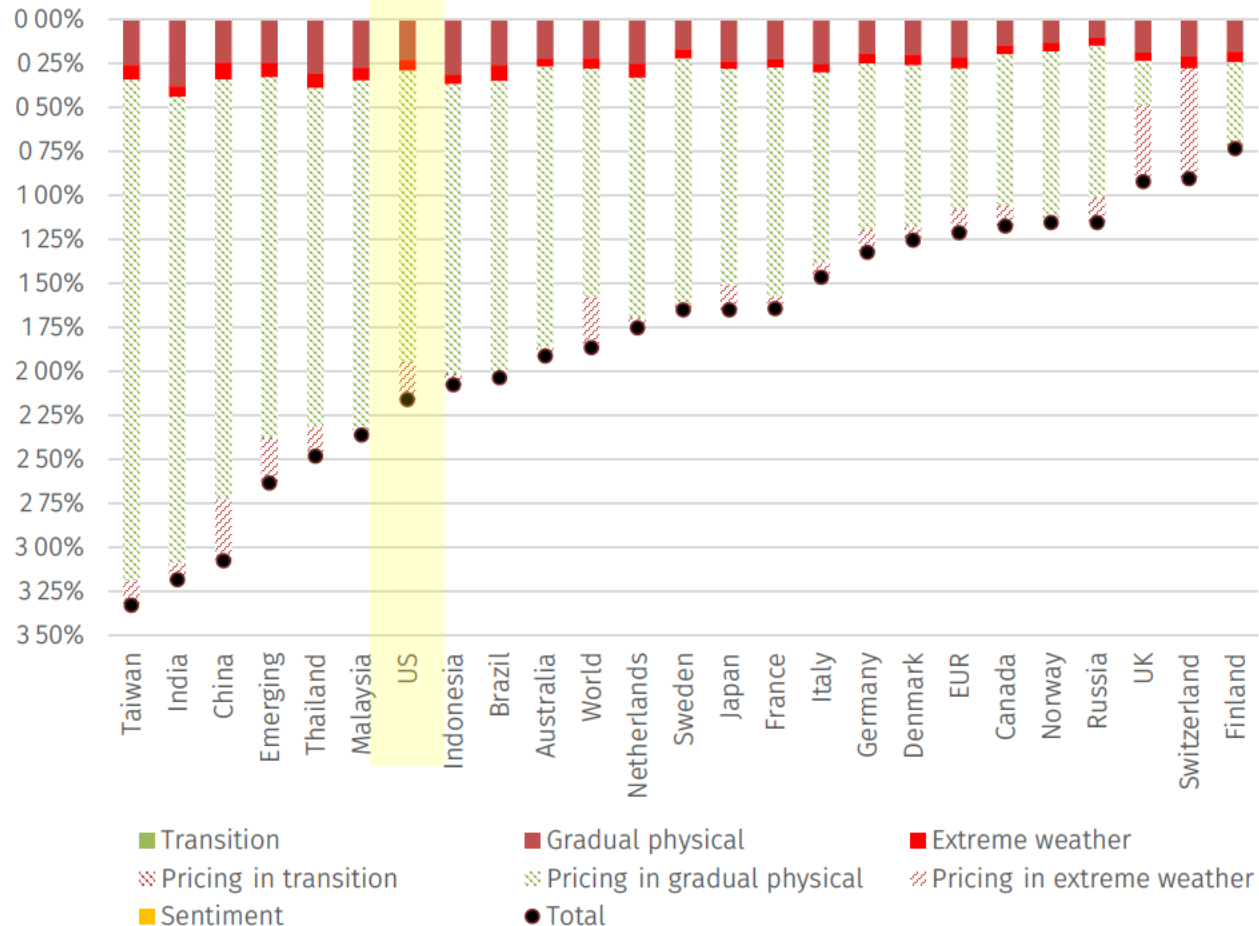


How do other countries rank in terms of climate impacts?

Equity returns vary across countries and under each pathway.

- A Failed Transition impacts equity returns most severely via the markets pricing-in of gradual physical risks.
- While Taiwan, India, China, and other emerging markets are the most negatively impacted nations, the US still leads the way in terms of developed nation facing physical risks (-2.16% in annual losses)

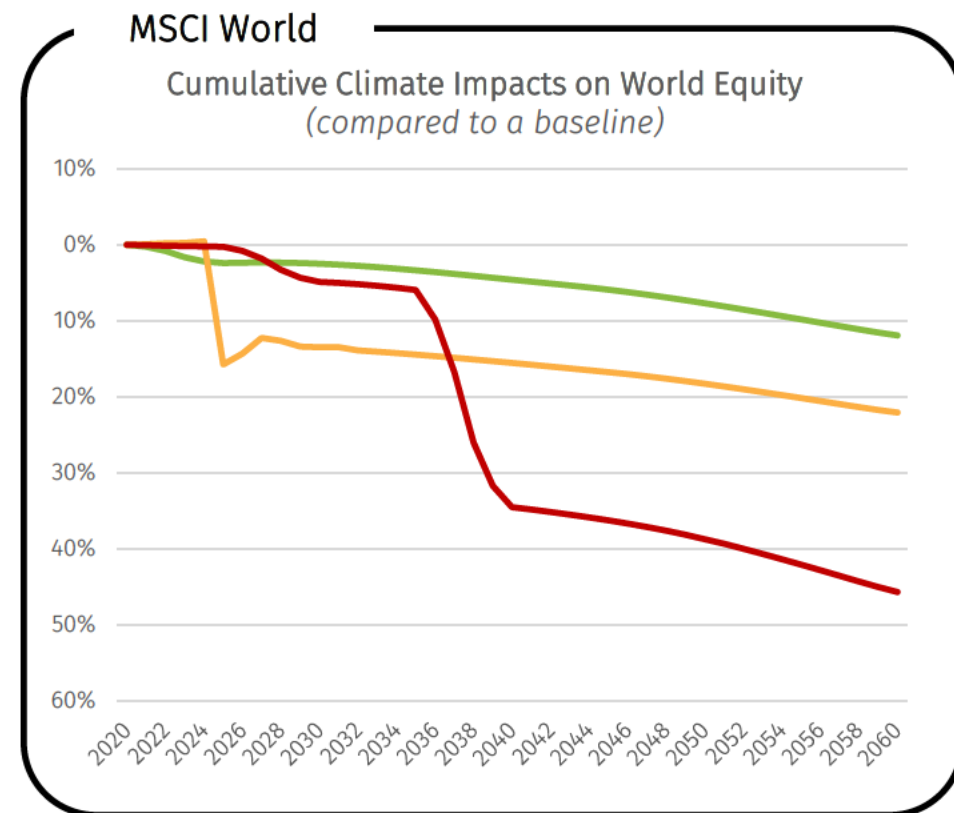
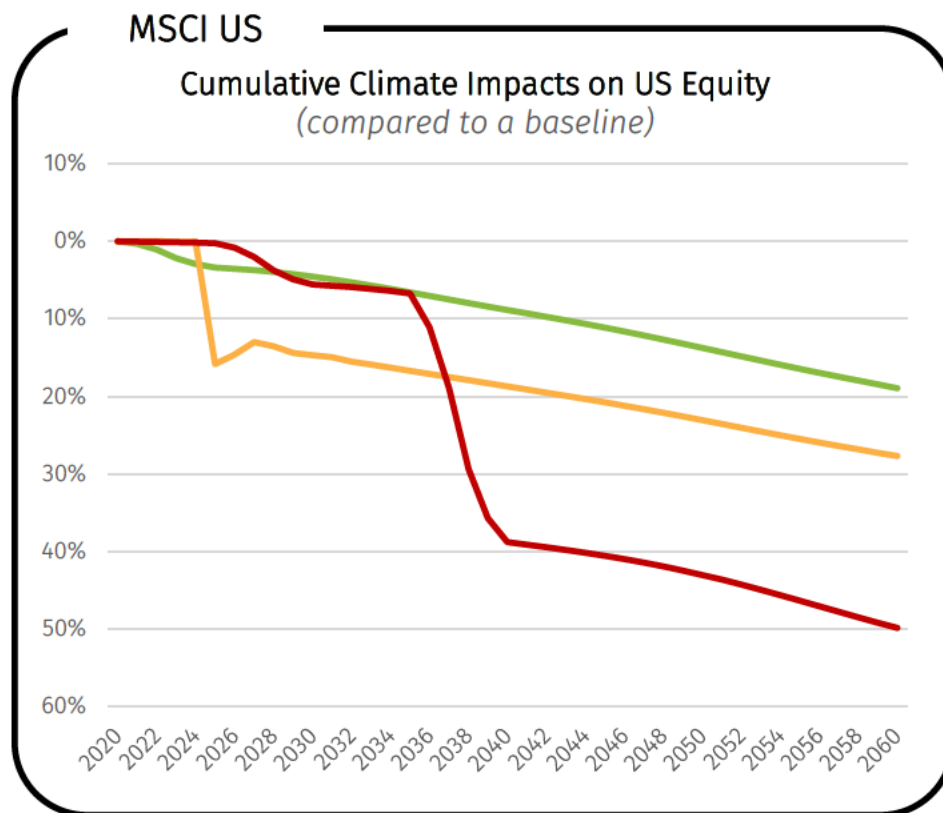
Failed Transition: 20-year global equities impact breakdown (annualized)



Climate impacts on US Equities vs. the World

US equities face higher transition risk, and seem less resilient to physical risk exposure

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Comments

The Paris Orderly and Disorderly Transition Pathways have a large impact on the US economy, due in part by reduced income from oil and gas exports and high emitting sectors. This is reflected in the impacts on US equity. Compared to the rest of the world, transition impacts are expected to be 50% larger under an orderly transition and 20% larger under a disorderly transition by 2060. Unlike its northern neighbor, the US exposure to physical risks renders the country more vulnerable than most countries. Compared to World equities (of which US is c.60% - MSCI ACWI), US equities are expected to be 40% more exposed to physical risks.

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Contribution Analysis: What Types of Risk Affect Your Assets?

A closer look at climate impacts on equities in various markets **Paris Orderly Scenario**

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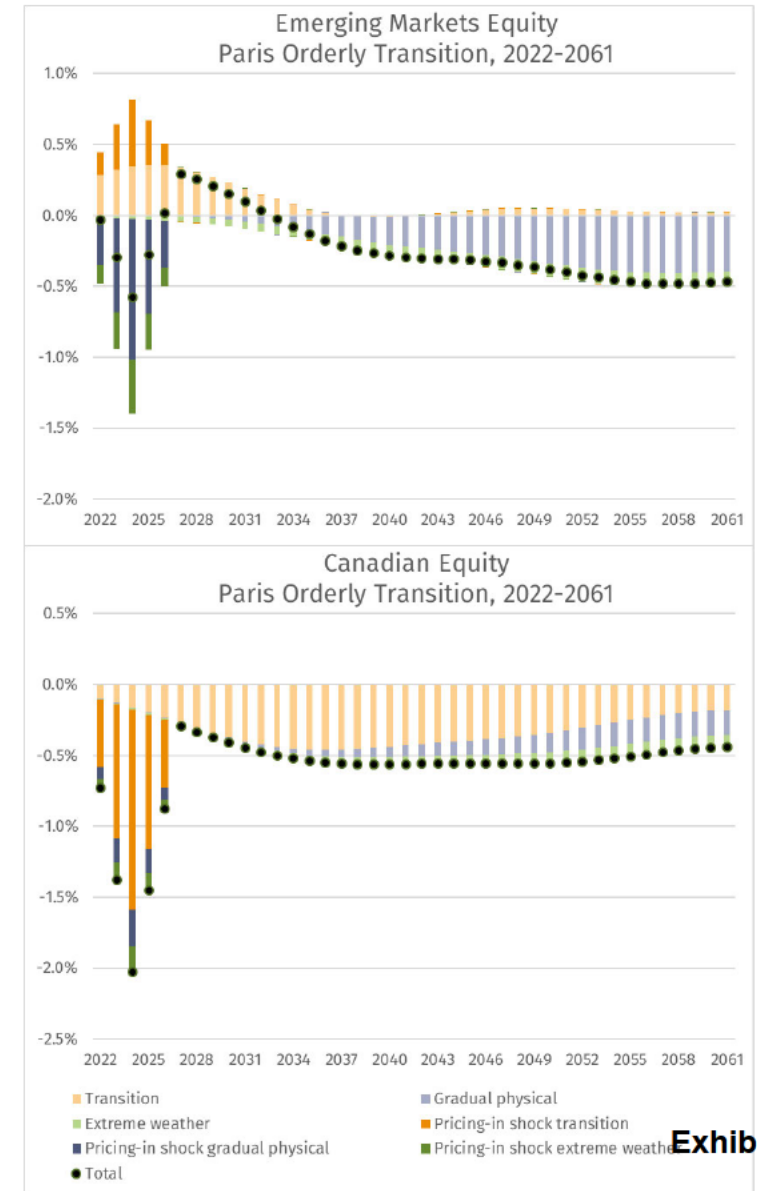
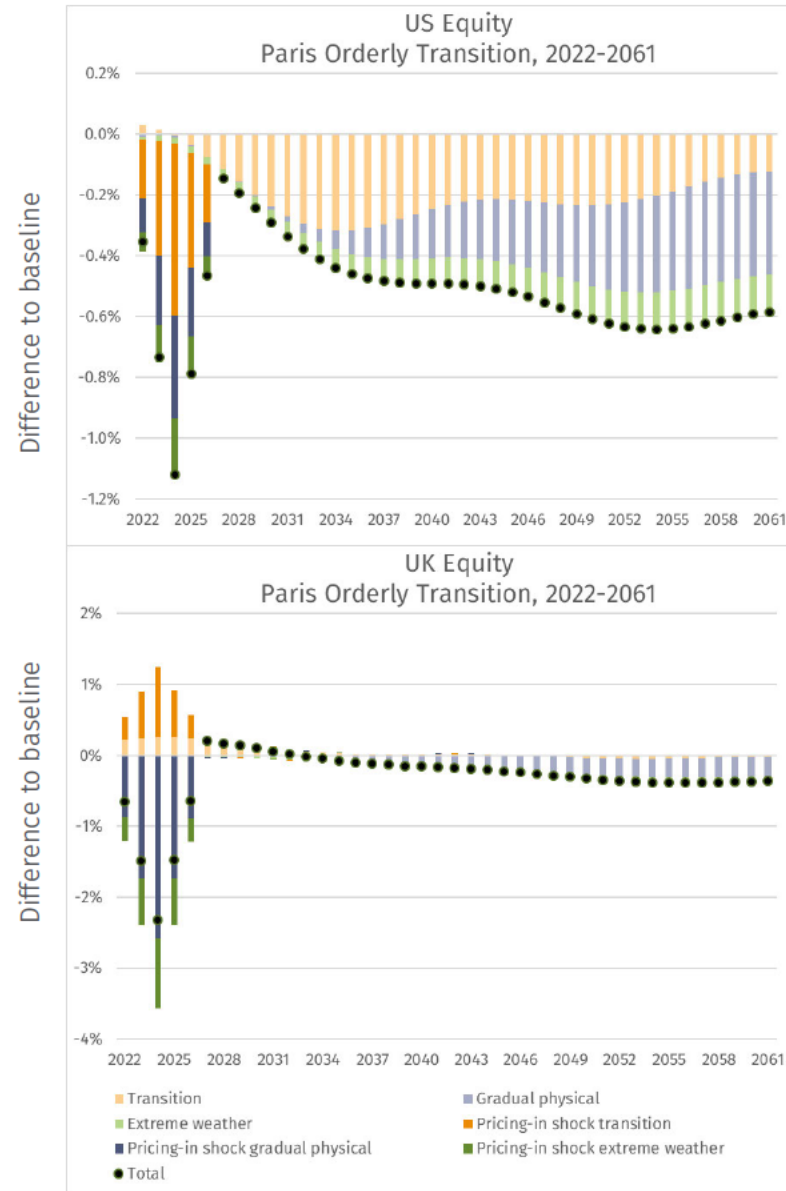
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Contribution Analysis: What Types of Risk Affect Your Assets?

A closer look at climate impacts on equities in various markets **Paris Disorderly Scenario**

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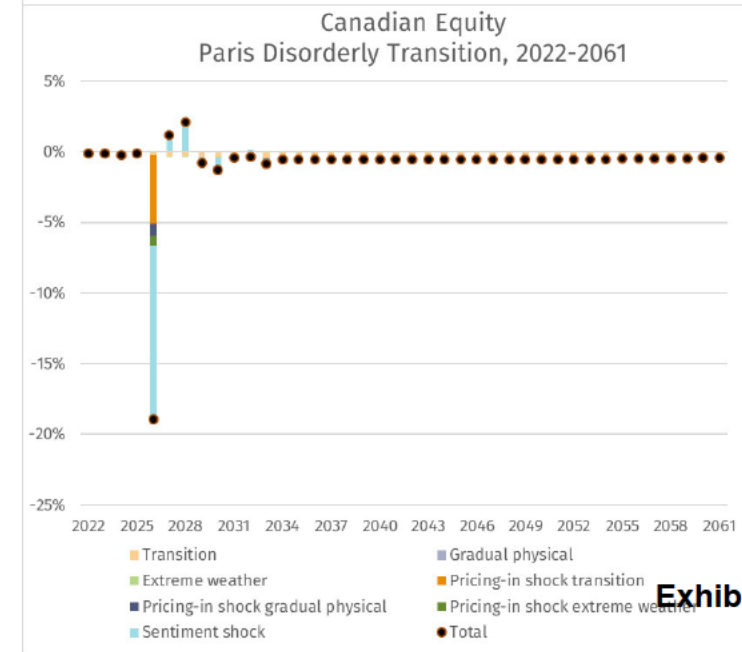
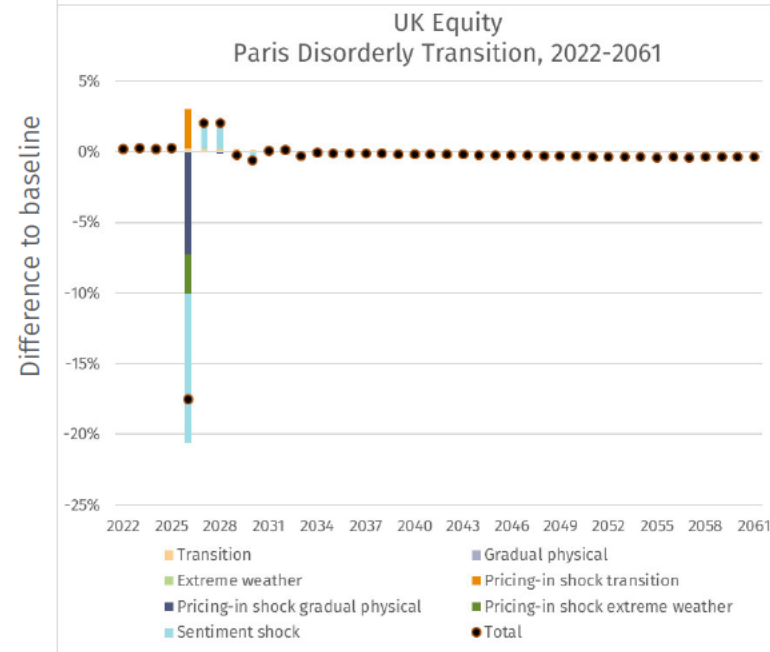
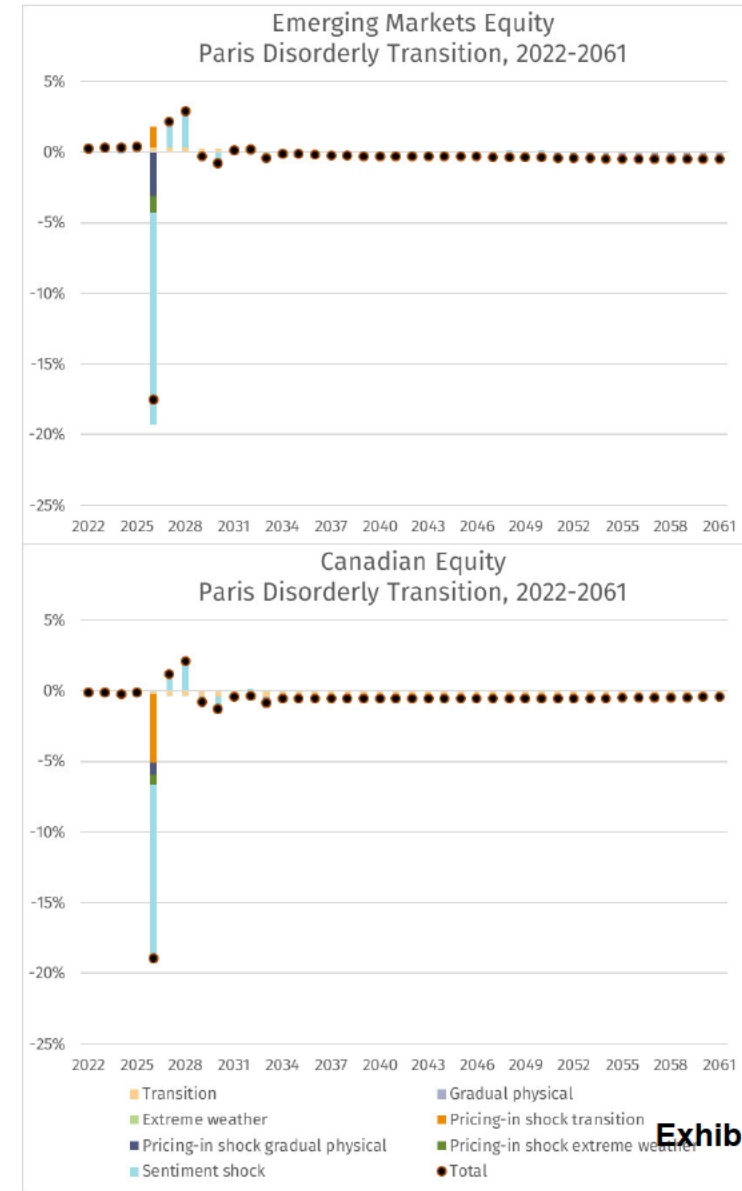
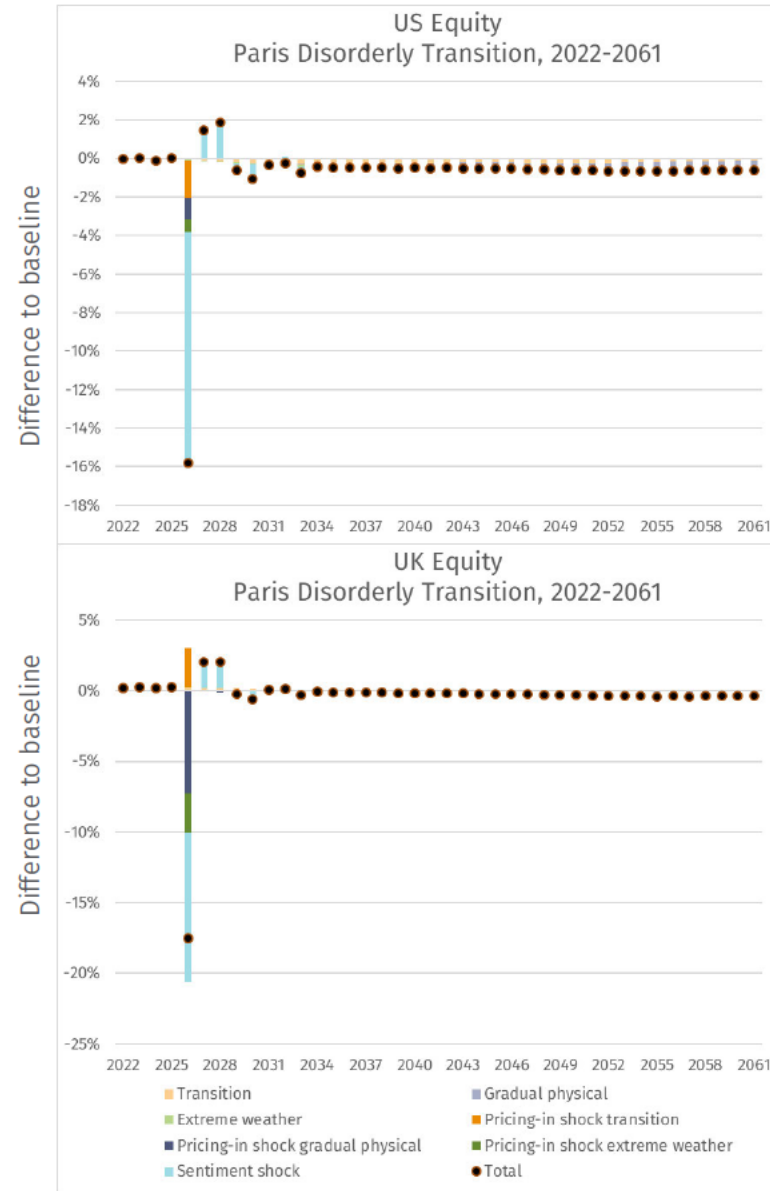
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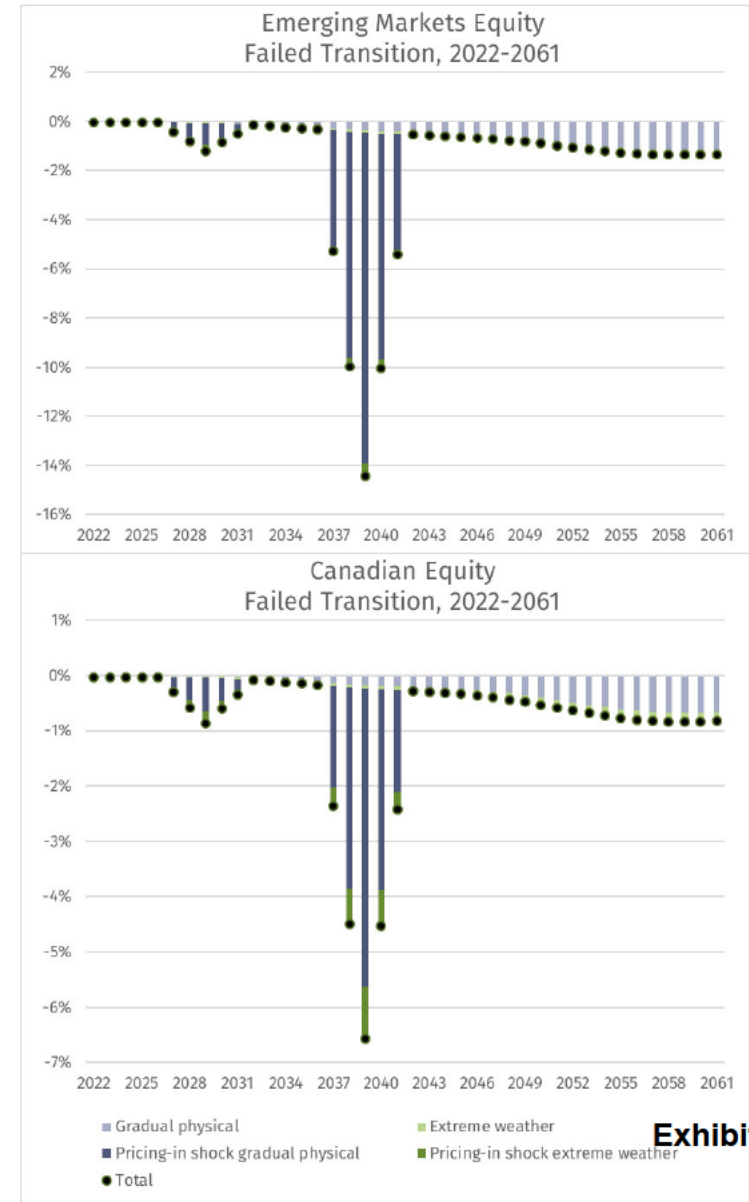
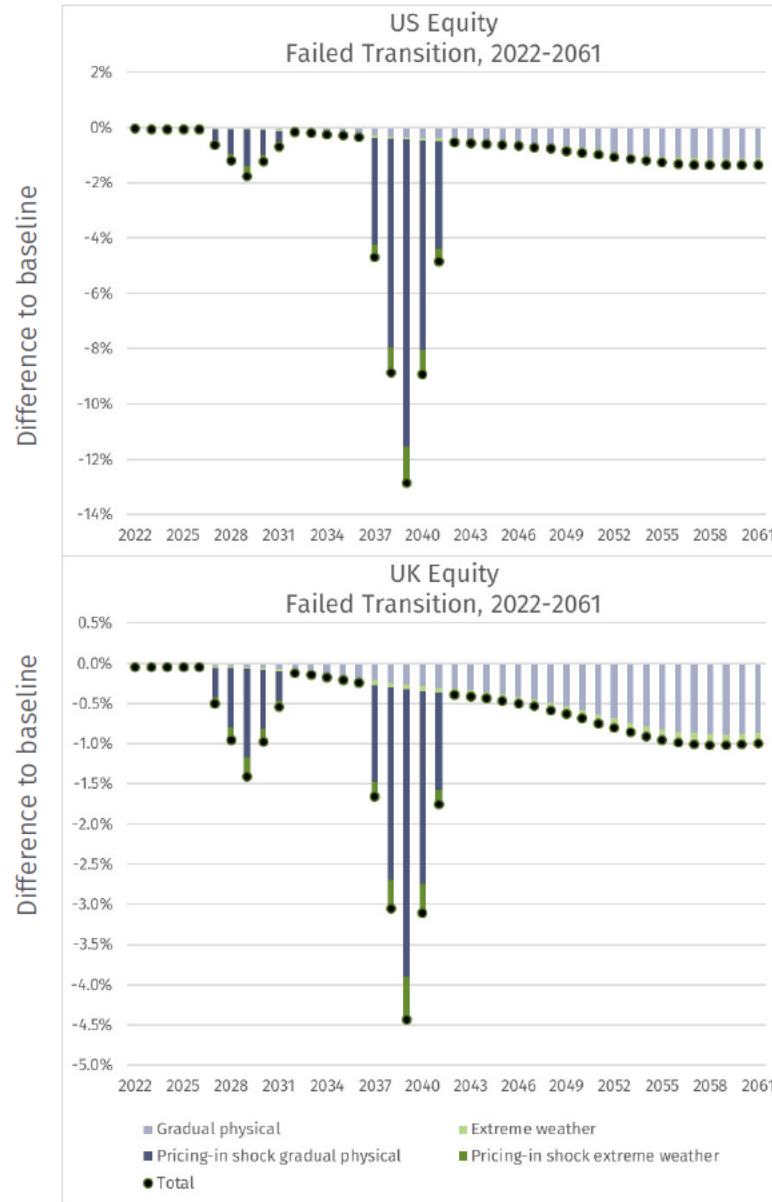
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Contribution Analysis: What Types of Risk Affect Your Assets?

A closer look at climate impacts on equities in various markets **Failed Transition**



Asset class insights

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Having considered regional differences, this section focuses in on the asset classes currently forming the portfolio.

Results are presented in time buckets, showing the median return and the downside 5th percentile.

We show median return for each scenario as a delta to the baseline, so as to give a “climate shock” for that scenario.

For the risk measure, we show the difference in return between the scenario median and the scenario 5% CVaR. This is intended to give you a sense of the downside dispersion of the distribution in that scenario.

By color-coding the tables we can see the hot and cool spots in the portfolio, where it could be most efficient to make deeper investigations into risks and opportunities.

Further granularity is provided in the annex.



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only redacting the
quantified results for
sub-asset classes and
sectors depicted in
tables in the report

FOCUS ON PARIS DISORDERLY TRANSITION RISKS

Fixed Income:

- Less sensitive to climate risks than other asset classes
- Corporate and non-investment grade bonds are more sensitive and sector specific in exposure

Equities and PE

- Global equities very sensitive
- US especially hard hit
- PE mirrors equity sensitivities

Alternatives, Real Estate, Infrastructure:

- Alternatives can offer climate transition protection due to a lower beta
- Real estate and infrastructure follow similar dynamics as public equity especially if strong links to energy and utilities
- Real assets holdings slightly more exposed due to exposure to transition exposed sectors
- Physical risk exposure becomes more critical through time

All of the above should be weighed against the need to meet pension liabilities

More detailed tables (also for the other climate scenarios), with upside and downside 5% VaR are included in the annex

Scenario 2: Paris <i>disorderly</i> transition pathway	2021-2025		2026-2030		2031-2040	
	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR
Fund	2.6%	7.4%	0.6%	8.0%	0.3%	5.0%
Fixed income	0.5%	2.7%	0.8%	3.5%	0.1%	2.9%
US Investment Grade						
US Government Bonds						
US Index Linked						
US High Yield						
EM Debt						
Equity	3.3%	12.2%	0.4%	12.4%	0.3%	8.6%
MSCI World AC						
Small Cap						
Minimum Volatility						
Private Equity	3.5%	14.4%	1.0%	14.8%	0.3%	8.8%
Venture Capital/Growth						
Buyout						
Emerging Market						
Distressed Debt						
Real Estate	2.0%	6.7%	0.3%	6.8%	0.3%	4.6%
Direct Real Estate						
REITs						
Real Assets	4.9%	10.3%	0.1%	11.0%	1.1%	6.0%
Real Asset Portfolio						
Opportunity Portfolio						
Diversifying Strategies	1.3%	5.1%	0.7%	5.0%	0.1%	3.9%
HF Fund of Funds						
Risk Parity	2.3%	10.6%	1.0%	10.8%	0.1%	6.3%
Global Sovereign Rates						
Inflation Linked Bonds						
Corporate Credits						
Listed Equities						
Commodities						

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Scenario 1: Paris orderly transition pathway	2021-2025		2026-2030		2031-2040		2041-2050		2051-2060		2021-2060	
	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR
Fund	-0.5%	-7.2%	-0.1%	-7.9%	-0.3%	-5.0%	-0.5%	-5.2%	-0.5%	-5.2%	-0.4%	-2.7%
Fixed income	0.0%	-2.5%	0.1%	-3.3%	0.1%	-2.9%	-0.3%	-3.4%	-0.3%	-3.4%	-0.1%	-1.4%
US Investment Grade												
US Government Bonds												
US Index Linked												
US High Yield												
EM Debt												
Equity	-0.5%	-11.5%	-0.1%	-12.2%	-0.3%	-8.6%	-0.5%	-8.8%	-0.5%	-8.8%	-0.4%	-4.6%
MSCI World AC												
Small Cap												
Minimum Volatility												
Private Equity	-0.7%	-14.4%	-0.1%	-14.7%	-0.3%	-8.8%	-0.5%	-9.4%	-0.5%	-9.4%	-0.4%	-4.6%
Venture Capital/Growth												
Buyout												
Emerging Market												
Distressed Debt												
Real Estate	-0.6%	-6.7%	-0.1%	-6.7%	-0.3%	-4.6%	-0.6%	-4.7%	-0.6%	-4.7%	-0.4%	-2.5%
Direct Real Estate												
REITs												
Real Assets	-2.0%	-10.3%	-1.0%	-11.0%	-1.1%	-6.0%	-1.0%	-6.3%	-1.0%	-6.3%	-1.2%	-3.1%
Real Asset Portfolio												
Opportunity Portfolio												
Diversifying Strategies	-0.1%	-5.1%	0.0%	-4.9%	-0.1%	-3.9%	-0.1%	-3.8%	-0.1%	-3.8%	-0.1%	-2.0%
HF Fund of Funds												
Risk Parity	-0.2%	-10.1%	0.0%	-10.7%	0.2%	-6.3%	-0.2%	-6.7%	-0.2%	-6.7%	0.0%	-3.4%
Global Sovereign Rates												
Inflation Linked Bonds												
Corporate Credits												
Listed Equities												
Commodities												

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*Additional granularity can be provided upon request

Risk/Return Analysis of portfolio constituents* (annualized results)

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	2021-2025		2026-2030		2031-2040		2041-2050		2051-2060		2021-2060	
	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR
Scenario 2: Paris disorderly transition pathway												
Fund	-2.6%	-7.4%	0.6%	-8.0%	-0.3%	-5.0%	-0.5%	-5.1%	-0.5%	-5.1%	-0.5%	-2.7%
Fixed income	-0.5%	-2.7%	0.8%	-3.5%	0.1%	-2.9%	-0.3%	-3.4%	-0.3%	-3.4%	-0.1%	-1.4%
US Investment Grade												
US Government Bonds												
US Index Linked												
US High Yield												
EM Debt												
Equity	-3.3%	-12.2%	0.4%	-12.4%	-0.3%	-8.6%	-0.5%	-8.8%	-0.5%	-8.8%	-0.7%	-4.6%
MSCI World AC												
Small Cap												
Minimum Volatility												
Private Equity	-3.5%	-14.4%	1.0%	-14.8%	-0.3%	-8.8%	-0.5%	-9.4%	-0.5%	-9.4%	-0.6%	-4.6%
Venture Capital/Growth												
Buyout												
Emerging Market												
Distressed Debt												
Real Estate	-2.0%	-6.7%	0.3%	-6.8%	-0.3%	-4.6%	-0.6%	-4.7%	-0.6%	-4.7%	-0.6%	-2.5%
Direct Real Estate												
REITs												
Real Assets	-4.9%	-10.3%	-0.1%	-11.0%	-1.1%	-6.0%	-1.0%	-6.3%	-1.0%	-6.3%	-1.5%	-3.1%
Real Asset Portfolio												
Opportunity Portfolio												
Diversifying Strategies	-1.3%	-5.1%	0.7%	-5.0%	-0.1%	-3.9%	-0.1%	-3.8%	-0.1%	-3.8%	-0.2%	-1.9%
HF Fund of Funds												
Risk Parity	-2.3%	-10.6%	1.0%	-10.8%	0.1%	-6.3%	-0.2%	-6.8%	-0.2%	-6.8%	-0.1%	-3.4%
Global Sovereign Rates												
Inflation Linked Bonds												
Corporate Credits												
Listed Equities												
Commodities												

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*Additional granularity can be provided upon request

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Scenario 3: Failed transition pathway	2021-2025		2026-2030		2031-2040		2041-2050		2051-2060		2021-2060	
	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR	Median	Bottom 5% VaR
Fund	0.0%	-7.2%	-0.7%	-7.9%	-2.8%	-4.9%	-0.9%	-5.1%	-0.9%	-5.1%	-1.1%	-2.7%
Fixed income	0.0%	-2.5%	0.0%	-3.4%	0.0%	-2.9%	-0.3%	-3.4%	-0.3%	-3.4%	0.0%	-1.4%
US Investment Grade												
US Government Bonds												
US Index Linked												
US High Yield												
EM Debt												
Equity	0.0%	-11.5%	-0.9%	-12.2%	-3.5%	-8.6%	-1.2%	-8.8%	-1.2%	-8.8%	-1.5%	-4.6%
MSCI World AC												
Small Cap												
Minimum Volatility												
Private Equity	0.0%	-14.4%	-1.3%	-14.7%	-5.0%	-8.8%	-1.1%	-9.4%	-1.1%	-9.4%	-1.9%	-4.6%
Venture Capital/Growth												
Buyout												
Emerging Market												
Distressed Debt												
Real Estate	-0.1%	-6.7%	-0.8%	-6.8%	-3.2%	-4.7%	-1.1%	-4.7%	-1.1%	-4.7%	-1.4%	-2.5%
Direct Real Estate												
REITs												
Real Assets	0.0%	-10.3%	-0.8%	-11.1%	-3.4%	-6.0%	-1.2%	-6.3%	-1.2%	-6.3%	-1.4%	-3.1%
Real Asset Portfolio												
Opportunity Portfolio												
Diversifying Strategies	0.0%	-5.1%	-0.3%	-4.9%	-1.1%	-3.9%	-0.3%	-3.8%	-0.3%	-3.8%	-0.4%	-2.0%
HF Fund of Funds												
Risk Parity	0.0%	-10.1%	-0.4%	-10.7%	-1.4%	-6.4%	-0.3%	-6.7%	-0.3%	-6.7%	-0.5%	-3.3%
Global Sovereign Rates												
Inflation Linked Bonds												
Corporate Credits												
Listed Equities												
Commodities												

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*Additional granularity can be provided upon request

Focus on real assets (1/3)

What drives the climate exposure of your real asset portfolio? Zoom in on the main contributing sectors

The real asset portfolio was analyzed on a bespoke basis in Climate MAPS. We analyzed the sector exposure within the portfolio to create the bespoke climate shock. As the portfolio breakdown slides above illustrate, the asset class is quite exposed to climate risks.

To better understand, we created a bespoke calibration for the real assets portfolios. Working with your teams, we agreed on the following mapping to capture the systemic region/sector exposures. Sector allocations were made on the basis of data provided which was assumed to reflect the dominant economic activity of the individual holding.

As with the rest of our analysis, the outputs should be viewed as an overlay to your knowledge of the underlying holdings.

Also note that what are described here as “sectors” are more accurately “economic activities”, and so a more diversified company could (if more granular data were available) be considered a blend of different region/sector pairs.

Cells circled pink denote the sectors highlighted in the charts on the next slide. Some cells show a 0% due to rounding for clarity of presentation, however they were included in the model.

Real asset portfolio allocation %	Fossil fuel utilities	Industrials	Low carbon utility	Energy	IT	Oil & gas	Materials	Forestry	Cons staples
North America	7%	5%	6%	8%	6%	30%	4%	5%	4%
Europe	3%	2%	2%	1%	5%	2%	1%		0%
Asia	1%	1%	1%	0%	1%	1%	3%		

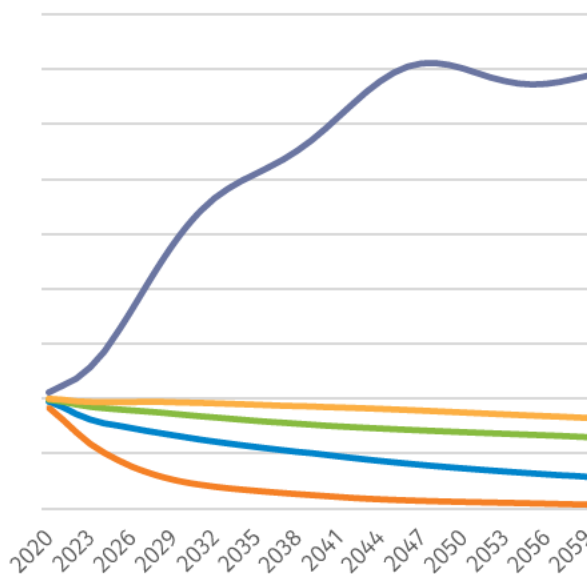
Focus on real assets (2/3)

What drives the climate exposure of your real asset portfolio? Zoom in on the main contributing sectors

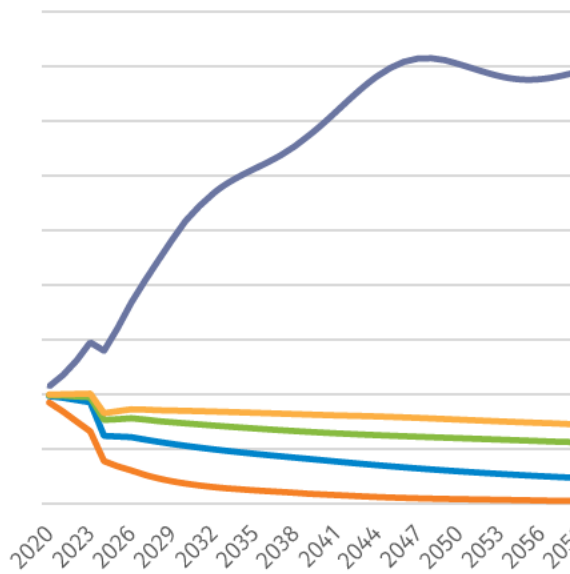
Below, we show the performance of the top 5 equity sector/region combinations in the real asset portfolio. These 5 sectors represent c.55% of the real asset portfolio. The most notable exposure stems from US Oil & Gas that represents c.30% of the portfolio. This sector is expected to suffer significantly during the transition.

In the Failed transition scenario, all sectors are impacted equally by physical risks - there are no safe haven when viewed at this level of granularity. At individual holding/project level there will be considerable difference in resilience to physical client risks.

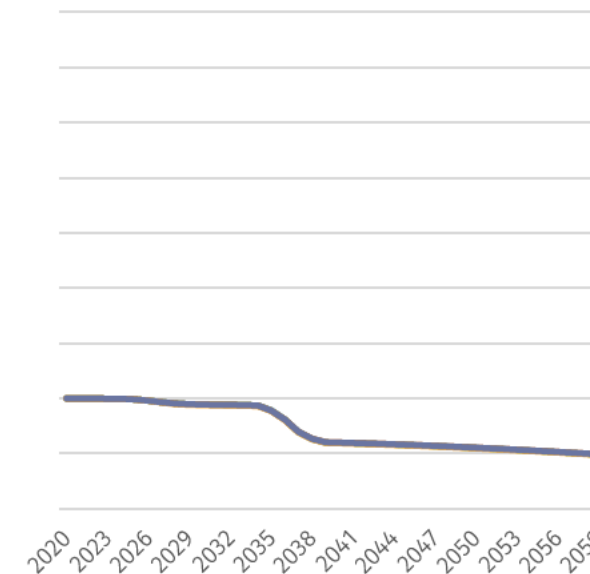
Growth of Selected Equity Sectors
Paris Orderly Scenario



Growth of Selected Equity Sectors
Paris Disorderly Scenario



Growth of Selected Equity Sectors
Failed Transition Scenario



US Oil & Gas US Energy US Utilities
US Materials US Low Carbon

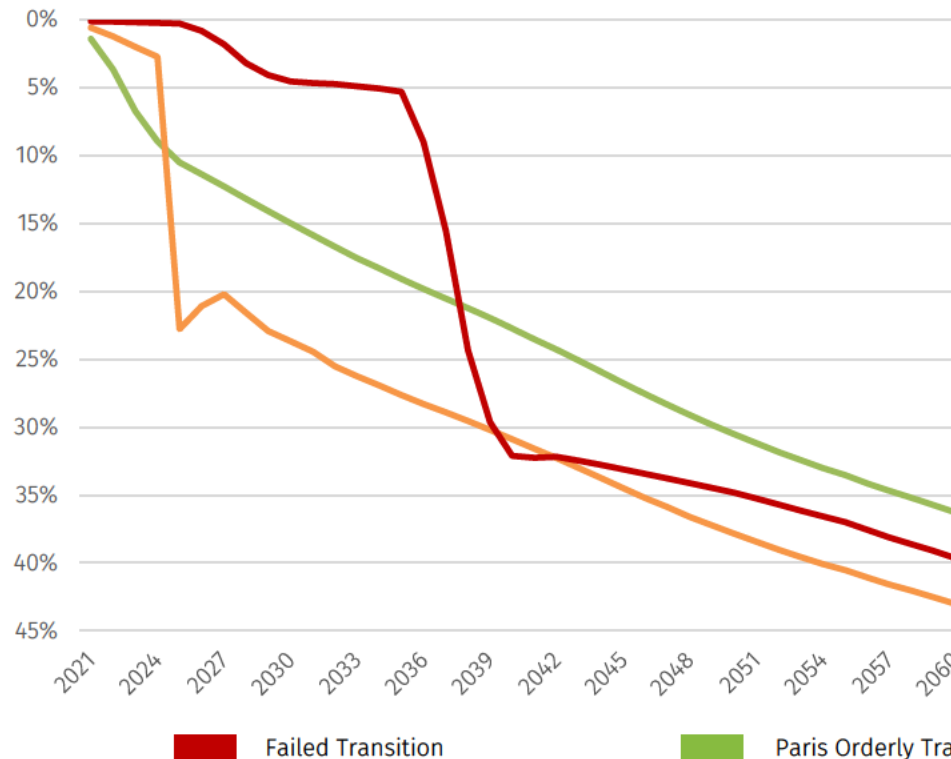
Focus on real assets (3/3)

What drives the climate exposure of your real asset portfolio? Zoom in on the main contributing sectors

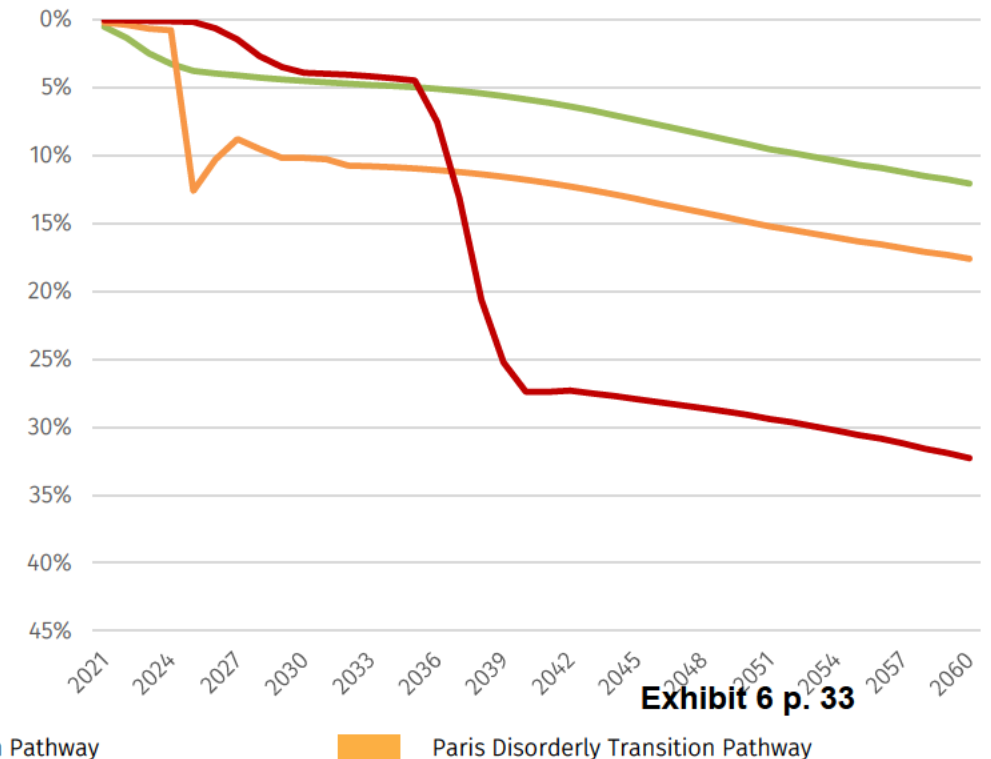
The overall impact on your real asset portfolio is a blended average of the performance of the sectors previously shown as well as the smaller exposures not presented on the previous slide. The picture below details further the underperformance of your real asset portfolio illustrated in the previous tables.

Potential “quick wins” for this portfolio could be to consider carefully exposures to the utility and oil & gas sectors (transition risk) as well as considering diversifying with foreign investments in countries less exposed to climate risk such as in Europe (both physical and transition risks).

Real Asset Portfolio Return
Real Returns, 2020-2060



Total Portfolio Return
Real Returns, 2020-2060



Sector insights

The sector-level impact of climate risk is highly differentiated.

By considering the differences between sectors within countries and between countries, we can start to make sense of the landscape of risks and opportunities.



Sector insights – key findings

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The sector-level impact of climate risk is highly differentiated. Remembering that the sector heatmaps reflect economic activities, it is likely that any one company has exposure to multiple cells in the heatmap – regardless of the sector that company may be allocated to in a system like GICS.

Paris Orderly

Short term, the orderly pricing-in of the transition sees significant “losers” in fossil-exposed sectors such as fossil-based utilities (which need to be substituted, so utility companies shift activities to low-carbon utilities), Other Energy (coal and oil sands) and O&G. Low-carbon energy sees significant upside from both sector growth and revenues transferring from fossil-based energy generation. Within 20 years fossil-based utilities have essentially disappear.

Paris Disorderly

This disorderly shock, which is modelled in the first 5 years, has an epicenter in the high-emission and fossil-exposed sectors. The subsequent recovery is faster in climate-aligned activity sectors such as low-carbon utilities and to a lesser extent in more neutral activity sectors like consumer.

Failed transition

The physical risk impacts central to this scenario do not start to be priced in until after 2025. But after 10y the impacts are marked and in our current modelling most differentiated by region. However, other factors to consider in assessing physical risk at holding level are the length/complexity of supply chains and the resilience of major facilities to extreme weather.

How to use this in your decisions

One potential way to use these tables is in testing portfolio construction resilience, understanding sector-level “what ifs” and their impact on strategy implementation.

Another application could be for fund managers to overlay these “sector views” over their views on individual holding and how they could respond to this systemic impacts.

Sectorial Impacts under the Paris Orderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 5 years

	5Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-1.8%	-11.7%	-8.5%	10.0%	-54.4%	-1.7%	-1.7%	-1.2%	-3.0%	-0.6%	-2.0%	-1.6%	-1.8%	-1.3%	-1.0%	-1.4%	-1.5%
	DM	-2.9%	-19.3%	-9.2%	29.0%	-47.9%	-2.5%	-2.9%	-2.7%	-5.2%	-2.0%	-2.9%	-1.0%	-2.8%	-2.5%	-2.2%	-2.7%	-2.9%
	Europe	-1.5%	-16.6%	-12.3%	5.7%	-44.8%	-0.1%	-0.5%	-0.9%	-1.2%	-0.4%	-1.5%	0.2%	-0.8%	-0.8%	-0.1%	-0.1%	-0.8%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-1.4%	-17.4%	-6.4%	10.8%	-54.2%	-0.9%	-0.9%	-0.4%	-1.0%	-0.2%	-2.1%	-1.0%	-0.9%	0.5%	-0.5%	0.0%	-0.9%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

only redacting the quantified results for sub-asset classes and sectors depicted in tables in the report

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Sectorial Impacts under the Paris Orderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 10 years

	10Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-0.5%	-21.2%	-14.5%	55.3%	-72.8%	-0.2%	-0.9%	1.1%	-3.5%	2.4%	-1.9%	-1.1%	-1.4%	-0.4%	1.7%	-0.2%	-0.4%
	DM	-2.4%	-30.1%	-14.6%	105.5%	-72.4%	-2.0%	-2.6%	-1.8%	-7.0%	-0.4%	-2.7%	-0.6%	-3.2%	-2.5%	-0.8%	-2.4%	-3.0%
	Europe	-0.7%	-33.2%	-21.2%	22.3%	-72.7%	3.0%	0.3%	1.5%	-1.2%	2.6%	-0.8%	1.1%	-0.8%	-0.1%	3.6%	1.9%	0.2%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
EM		0.0%	-26.9%	-10.4%	58.2%	-69.1%	0.2%	0.5%	3.0%	0.1%	3.2%	-2.6%	0.0%	-0.1%	2.8%	1.8%	2.3%	0.7%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

Exhibit 6 p. 37

* Note that some region/sector combinations were originally very small which cause the growth rate to appear particularly large

only redacting the quantified results for sub-asset classes and sectors depicted in tables in the report

Sectoral Impacts under the Paris Orderly Transition Pathway

Cumulative returns (difference to baseline) heat map Public equities 20 years

	20Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-2.2%	-33.6%	-24.2%	81.2%	-94.5%	-1.2%	-2.6%	-1.0%	-6.4%	0.7%	-3.8%	-2.0%	-2.7%	-1.4%	-0.5%	-1.3%	-1.7%
	DM	-4.5%	-45.0%	-24.6%	179.0%	-86.6%	-3.9%	-4.6%	-4.9%	-11.4%	-3.2%	-4.9%	-0.2%	-5.2%	-4.0%	-3.5%	-4.6%	-5.4%
	Europe	-1.5%	-50.2%	-34.5%	25.3%	-88.6%	5.3%	0.1%	0.0%	-1.4%	1.5%	-1.8%	3.4%	-0.4%	-0.4%	1.6%	2.9%	-0.1%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-1.1%	-39.9%	-15.6%	181.7%	-79.9%	-0.1%	-0.3%	1.8%	-0.7%	1.9%	-4.1%	-0.6%	-0.8%	5.1%	0.4%	3.1%	-0.7%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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* Note that some region/sector combinations were originally very small which cause the growth rate to appear particularly large

only redacting the quantified results for sub-asset classes and sectors depicted in tables in the report

Sectorial Impacts under the Paris Orderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 40 years

	40Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-11.3%	-48.0%	-36.3%	83.3%	-100.0%	-12.3%	-11.4%	-10.2%	-17.2%	-7.8%	-12.3%	-10.8%	-12.0%	-9.9%	-9.8%	-10.7%	-10.8%
	DM	-12.8%	-62.1%	-35.1%	206.7%	-95.3%	-12.6%	-13.8%	-14.0%	-22.2%	-11.9%	-13.3%	-5.9%	-13.2%	-11.4%	-12.1%	-13.6%	-14.6%
	Europe	-7.5%	-56.6%	-42.3%	7.5%	-99.0%	-4.8%	-3.6%	-7.0%	-6.6%	-5.4%	-7.4%	-0.8%	-5.2%	-4.7%	-5.5%	-3.9%	-5.6%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-6.3%	-54.9%	-27.6%	588.6%	-97.9%	-6.9%	-5.8%	-4.5%	-7.3%	-4.1%	-11.1%	-7.0%	-6.4%	-1.0%	-4.8%	-5.1%	-6.9%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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* Note that some region/sector combinations were originally very small which cause the growth rate to appear particularly large

only redacting the quantified results for sub-asset classes and sectors depicted in tables in the report

Sectorial Impacts under the Paris Disorderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 5 years

	5Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-15.9%	-26.8%	-23.3%	-2.7%	-67.8%	-15.8%	-15.8%	-15.4%	-17.2%	-14.7%	-16.1%	-15.6%	-15.9%	-15.4%	-15.2%	-15.5%	-15.6%
	DM	-16.6%	-34.3%	-23.5%	23.4%	-59.1%	-16.0%	-16.3%	-16.2%	-19.0%	-15.6%	-16.3%	-14.1%	-16.2%	-15.8%	-15.7%	-16.2%	-16.4%
	Europe	-16.7%	-33.1%	-28.6%	-9.5%	-57.1%	-15.2%	-15.5%	-16.2%	-16.3%	-15.7%	-16.7%	-14.6%	-15.9%	-15.8%	-15.5%	-15.2%	-15.9%
DEVELOPED MARKETS	US																	
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	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-18.0%	-34.4%	-23.1%	-2.7%	-82.9%	-17.0%	-17.0%	-16.8%	-16.3%	-15.6%	-17.7%	-17.3%	-16.1%	-16.3%	-13.8%	-16.9%	-14.8%
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Sectorial Impacts under the Paris Disorderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 10 years

	10Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-12.2%	-32.6%	-26.2%	41.1%	-80.2%	-12.0%	-12.6%	-10.9%	-15.2%	-9.6%	-13.5%	-12.7%	-13.0%	-12.0%	-10.3%	-11.9%	-12.1%
	DM	-13.7%	-41.4%	-25.9%	102.6%	-77.4%	-13.2%	-13.8%	-13.1%	-18.3%	-11.8%	-13.9%	-11.4%	-14.2%	-13.5%	-12.2%	-13.6%	-14.1%
	Europe	-13.2%	-44.6%	-33.7%	8.0%	-78.0%	-9.8%	-12.1%	-11.4%	-13.6%	-10.4%	-13.4%	-11.0%	-13.1%	-12.5%	-9.5%	-10.7%	-12.3%
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	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-13.5%	-39.8%	-23.6%	54.7%	-89.2%	-12.3%	-12.2%	-10.5%	-12.2%	-9.5%	-14.9%	-13.0%	-12.2%	-11.4%	-9.2%	-11.7%	-10.7%
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Sectoral Impacts under the Paris Disorderly Transition Pathway

Cumulative returns (difference to baseline) heat map Public equities 20 years

	20Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-14.0%	-43.4%	-34.8%	64.2%	-96.0%	-13.1%	-14.3%	-12.9%	-18.0%	-11.3%	-15.5%	-13.8%	-14.5%	-13.2%	-12.5%	-13.1%	-13.5%
	DM	-15.7%	-53.9%	-34.7%	175.3%	-88.8%	-15.1%	-15.7%	-16.1%	-22.3%	-14.5%	-16.0%	-11.2%	-16.2%	-15.1%	-14.7%	-15.7%	-16.5%
	Europe	-14.1%	-58.8%	-45.1%	10.2%	-90.8%	-8.0%	-12.5%	-13.0%	-14.0%	-11.5%	-14.5%	-9.3%	-13.0%	-13.0%	-11.5%	-10.0%	-12.8%
DEVELOPED MARKETS	US																	
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	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-14.6%	-50.3%	-29.5%	215.5%	-95.4%	-12.6%	-13.2%	-11.7%	-13.1%	-10.8%	-16.4%	-13.6%	-13.1%	-11.7%	-10.6%	-12.2%	-12.2%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
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Sectorial Impacts under the Paris Disorderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 40 years

	40Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-22.1%	-55.7%	-45.3%	65.9%	-100.0%	-23.0%	-22.2%	-21.1%	-27.5%	-18.9%	-23.0%	-21.6%	-22.7%	-20.7%	-20.8%	-21.5%	-21.6%
	DM	-23.0%	-68.0%	-43.8%	204.1%	-95.8%	-22.8%	-23.8%	-24.0%	-31.8%	-22.2%	-23.4%	-16.3%	-23.2%	-21.6%	-22.3%	-23.7%	-24.6%
	Europe	-19.3%	-64.1%	-51.6%	-5.4%	-99.2%	-16.8%	-15.7%	-19.0%	-18.5%	-17.6%	-19.4%	-13.0%	-17.2%	-16.8%	-17.7%	-16.0%	-17.6%
DEVELOPED MARKETS	US																	
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	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-18.6%	-60.7%	-37.6%	545.3%	-97.9%	-19.0%	-18.1%	-17.1%	-18.7%	-16.1%	-22.4%	-19.2%	-17.8%	-13.7%	-14.9%	-17.7%	-17.3%
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Sectorial Impacts under the Failed Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 5 years

Cumulative climate impact - Failed Transition	5Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
	World	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%
	DM	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
	Europe	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
DEVELOPED MARKETS	US																	
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	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
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Sectorial Impacts under the Failed Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 10 years

	10Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Failed Transition	World	-5.2%	-5.0%	-5.1%	-5.2%	-4.9%	-5.2%	-5.2%	-5.2%	-5.1%	-5.2%	-5.2%	-5.2%	-5.1%	-5.1%	-5.2%	-5.2%	-5.1%
	DM	-5.3%	-4.7%	-4.9%	-4.7%	-4.4%	-5.2%	-5.2%	-5.3%	-4.6%	-5.4%	-5.5%	-5.1%	-4.8%	-5.1%	-5.3%	-4.9%	-4.7%
	Europe	-4.3%	-3.9%	-4.0%	-3.7%	-2.7%	-3.6%	-4.1%	-4.7%	-3.5%	-5.2%	-5.1%	-4.1%	-3.4%	-4.2%	-4.5%	-4.2%	-3.9%
DEVELOPED MARKETS	US																	
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	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-4.0%	-3.8%	-4.0%	-3.8%	-3.7%	-3.7%	-3.8%	-4.0%	-3.8%	-4.4%	-4.4%	-3.9%	-3.8%	-3.9%	-3.2%	-3.8%	-3.6%
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	Brazil																	
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	Taiwan																	

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Sectoral Impacts under the Failed Transition Pathway

Cumulative returns (difference to baseline) heat map Public equities 20 years

	20Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Failed Transition	World	-36.3%	-36.2%	-36.3%	-36.3%	-36.1%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%
	DM	-34.9%	-34.0%	-34.1%	-32.1%	-31.9%	-32.4%	-34.5%	-35.2%	-31.9%	-36.4%	-36.3%	-34.2%	-31.9%	-33.7%	-34.0%	-33.1%	-32.7%
	Europe	-24.1%	-23.8%	-23.9%	-18.5%	-17.7%	-18.5%	-23.5%	-27.4%	-17.6%	-31.4%	-30.6%	-23.0%	-17.6%	-23.1%	-24.5%	-21.9%	-20.1%
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	Singapore																	
	Finland																	
EMERGING MARKETS	Denmark																	
	Norway																	
	EM	-40.6%	-42.4%	-42.5%	-41.0%	-41.0%	-41.0%	-41.6%	-41.4%	-40.9%	-36.8%	-37.4%	-41.7%	-40.3%	-41.8%	-33.3%	-41.3%	-34.3%
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	Taiwan																	

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Sectorial Impacts under the Failed Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 40 years

	40Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Failed Transition	World	-49.7%	-49.6%	-49.7%	-49.8%	-49.6%	-49.7%	-49.8%	-49.7%	-49.7%	-49.7%	-49.7%	-49.8%	-49.7%	-49.7%	-49.8%	-49.7%	-49.7%
	DM	-45.7%	-44.7%	-44.8%	-42.5%	-42.3%	-42.8%	-45.1%	-45.7%	-42.4%	-47.2%	-47.0%	-44.9%	-42.3%	-44.2%	-44.6%	-43.7%	-43.3%
	Europe	-34.2%	-33.9%	-34.0%	-28.2%	-27.5%	-28.2%	-33.5%	-37.6%	-27.3%	-41.7%	-40.9%	-33.0%	-27.2%	-33.1%	-34.6%	-31.8%	-29.9%
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	Netherlands																	
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	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-51.4%	-52.9%	-52.9%	-51.0%	-51.0%	-51.0%	-51.6%	-51.7%	-50.7%	-48.3%	-49.0%	-52.0%	-50.1%	-52.0%	-40.9%	-51.5%	-43.3%
EMERGING MARKETS	China																	
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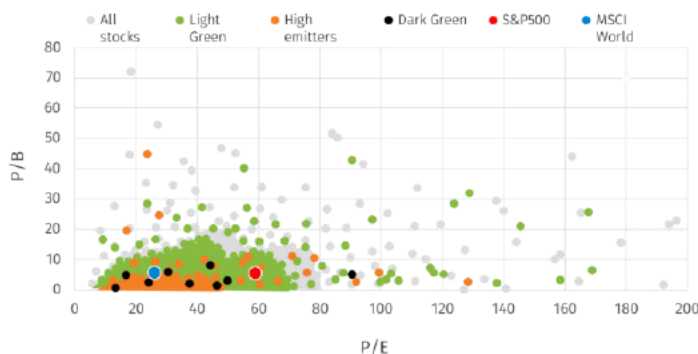
Annex

Sector insights | What is priced in?

- There is some evidence for pricing-in of transition risk in “pure play” stocks. It is plausible this is still not fully priced-in.
- Harder to assess for diversified stocks (lack of data) and physical risk.
- Measurements should improve with better reporting/disclosures

Inspiration: To what extent is climate risk currently “priced in”?

- The evidence is clearer for transition risk (high emitters and dark green)
- Significant issues with green definitions and reporting to enable clear answers



	Mean PE	Median PE
All holdings	32	18
“Light Green” (BBG Green tag = Yes)	26	18
“Others” (BBG Green tag = Yes)	34	18
Dark Green MAPS sectors	27	23
Transition exposed MAPS sectors	16	13

Fair Value estimates – P/E ratios

Where could coal/oil-sands valuations go from here?



Baseline FV

Paris FV

Failed Transition FV

FV earnings multiple

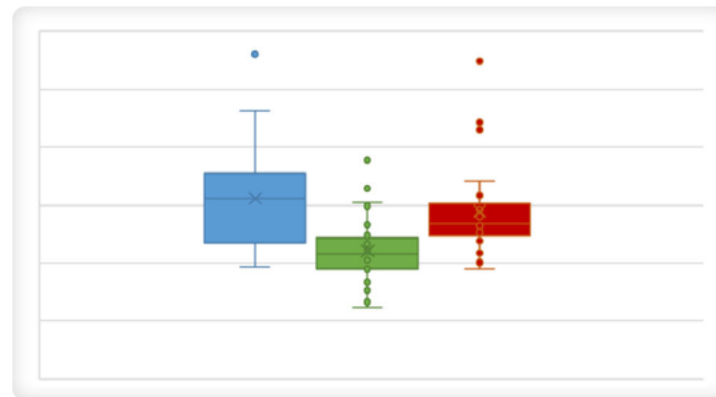

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*Fair value estimates are based modelled estimates produced by Ortec Finance and do not represent advice or an actionable view

**Graph data is from a broad, global equity portfolio, PE ratio figures are historic with categorization based on proprietary classifications (Bloomberg and Ortec Finance)

What-if Analysis: Switch all listed equities to “Paris-aligned” companies

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This section analyzes the impact of switching all investments in listed equities to a low-carbon (Paris-aligned) benchmark. (100% of companies aligned to a world consistent with the goals of the Paris agreement).

The current equity portfolio was simplified and represented by MSC World.

Performance of the fund is compared between the base benchmark and a completely aligned benchmark.



Switching to Paris-aligned benchmarks potentially mitigates downside performance if a disorderly transition scenario unfolds

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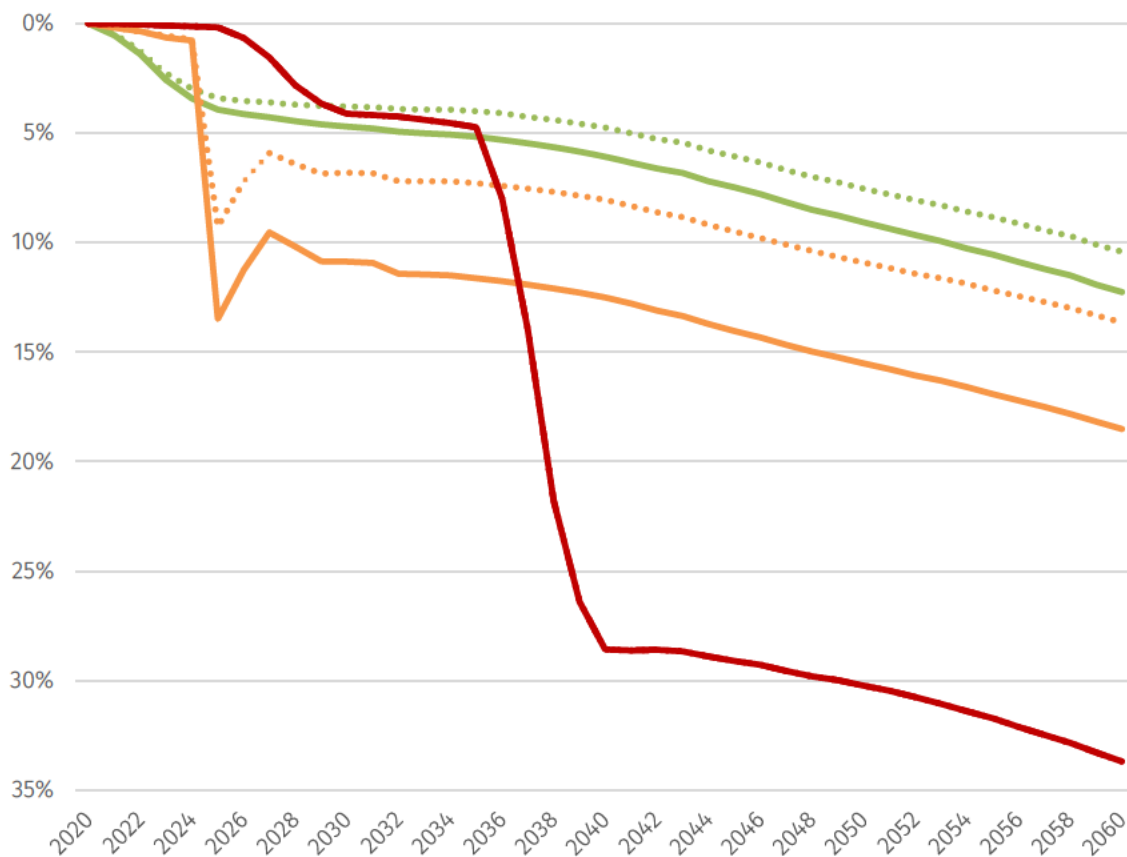
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Fund Performance under our 3 Scenarios
Paris Aligned vs. Traditional Equity Benchmarks, 2020-2060



Failed Transition
Standard MSCI World

Paris Orderly Transition Pathway
MSCI World Paris Aligned (100%)

Paris Disorderly Transition Pathway

“What happens to OPERF’s real returns when equities are allocated to Paris-aligned benchmarks?”

- Started the analysis from the current portfolio and swapped all equities for MSCI World (30% of fund).
- Analyzed two alternatives: standard MSCI World benchmark versus a fully Paris-aligned version of the benchmark
- Switching to an (idealized) 100% Paris aligned benchmark would provide the best hedge from transition risks. However, implementation limitations mean that the real degree of alignment will probably be lower (too few aligned companies to maintain diversification)
- As more companies commit to net-zero, higher degrees of alignment could be achieved.
- It is important to note, however, that Paris alignment does not help for mitigating physical risks.

Focusing on companies with well-aligned business practices and science-based net-zero targets could reduce significantly the exposure to transition risks (cumulative results)

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Fund	2020-2025		2026-2030		2031-2040		2041-2050		2051-2060		2020-2060	
	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR
Fixed income	-0.2%	-0.2%	0.5%	0.5%	1.0%	1.0%	-1.7%	-2.1%	-3.3%	-3.7%	-4.3%	-3.7%
Equity												
MSCI World Paris Aligned (100%)	-0.9%	-1.1%	0.8%	1.2%	-1.7%	-1.6%	-2.5%	-3.0%	-3.8%	-4.7%	-7.1%	-8.3%
MSCI World Standard (No Paris Alignment)	-2.6%	-2.8%	-0.5%	-0.6%	-3.1%	-3.5%	-3.7%	-4.9%	-5.4%	-7.3%	-13.7%	-16.0%
MSCI World Paris Aligned (33%)	-1.7%	-1.9%	0.2%	0.3%	-2.4%	-2.6%	-3.1%	-3.9%	-4.6%	-6.0%	-10.5%	-12.2%
Private Equity	-3.7%	-3.6%	-0.3%	-0.3%	-2.9%	-2.9%	-4.1%	-4.0%	-5.1%	-5.1%	-15.2%	-15.1%
Real Assets	-9.4%	-9.4%	-4.8%	-4.6%	-10.2%	-10.3%	-10.4%	-10.6%	-9.8%	-10.0%	-37.3%	-37.6%
Diversifying Strategies	-0.7%	-0.7%	-0.2%	-0.2%	-1.3%	-1.3%	-1.2%	-1.2%	-1.4%	-1.4%	-4.8%	-4.8%
Risk Parity	-0.9%	-1.0%	0.2%	0.0%	1.7%	1.7%	1.8%	1.3%	-1.8%	-2.3%	1.9%	0.2%

Fund	2020-2025		2026-2030		2031-2040		2041-2050		2051-2060		2020-2060	
	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR	Median	5% CVaR
Fixed income	-2.7%	-3.6%	4.0%	3.4%	0.8%	0.8%	-1.7%	-2.1%	-3.3%	-3.7%	-3.4%	-3.0%
Equity												
MSCI World Paris Aligned (100%)	-1.4%	-1.9%	1.3%	1.1%	-1.4%	-1.6%	-2.6%	-2.9%	-4.0%	-4.7%	-7.2%	-8.4%
MSCI World Standard (No Paris Alignment)	-15.6%	-23.2%	1.8%	-0.7%	-3.1%	-3.8%	-3.7%	-4.8%	-5.6%	-7.2%	-24.7%	-28.7%
MSCI World Paris Aligned (33%)	-8.9%	-12.2%	1.8%	0.3%	-2.2%	-2.7%	-3.2%	-3.9%	-4.8%	-6.0%	-16.4%	-18.8%
Private Equity	-16.3%	-16.3%	4.9%	4.8%	-3.3%	-3.3%	-4.1%	-4.0%	-5.1%	-5.1%	-22.8%	-22.7%
Real Assets	-22.2%	-22.7%	-0.6%	-1.3%	-10.4%	-10.5%	-10.4%	-10.6%	-9.8%	-10.0%	-44.3%	-44.5%
Diversifying Strategies	-6.1%	-7.3%	3.5%	2.8%	-1.4%	-1.3%	-1.2%	-1.2%	-1.4%	-1.4%	-6.9%	-6.8%
Risk Parity	-10.9%	-13.8%	4.9%	4.4%	1.3%	1.3%	1.6%	1.4%	-1.5%	-1.5%	1.1%	-7.3%

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Next steps

We have drawn on our experience with many pension funds globally to provide a brief set of recommendations for OST to consider as “next steps” following this analysis.

The recommendations are, however, just suggestions not advice and we would naturally expect the Treasury to arrive at its own decisions.

Whilst our analysis has been focused on the asset-allocation aspects, our suggestions cover the full gamut of the investment process since that is typically what is required to fully address this huge topic.



Recommendations – observations on best practice Climate Strategy

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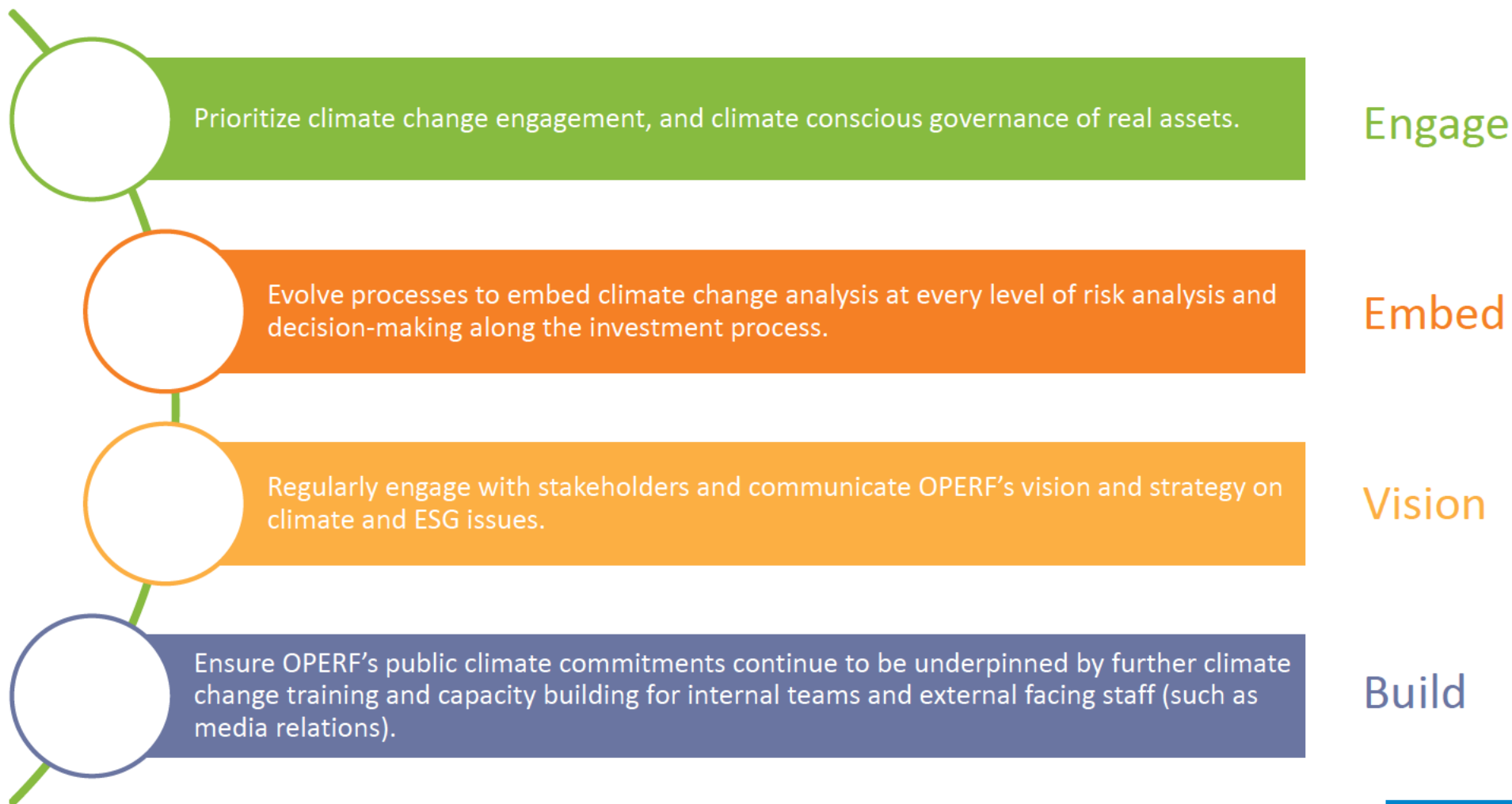
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Recommendations – observations on best practice

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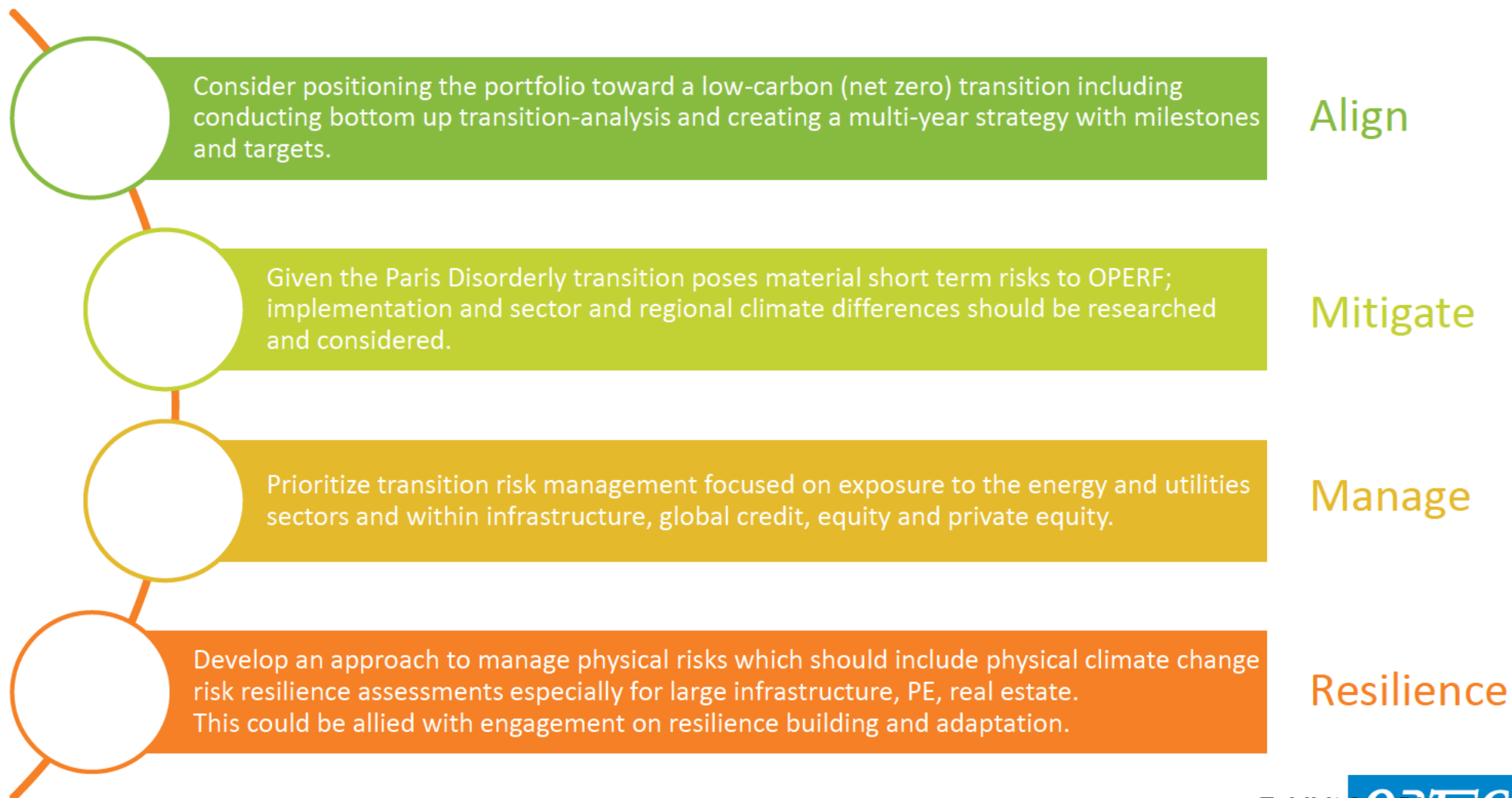
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Recommendations – observations on best practice

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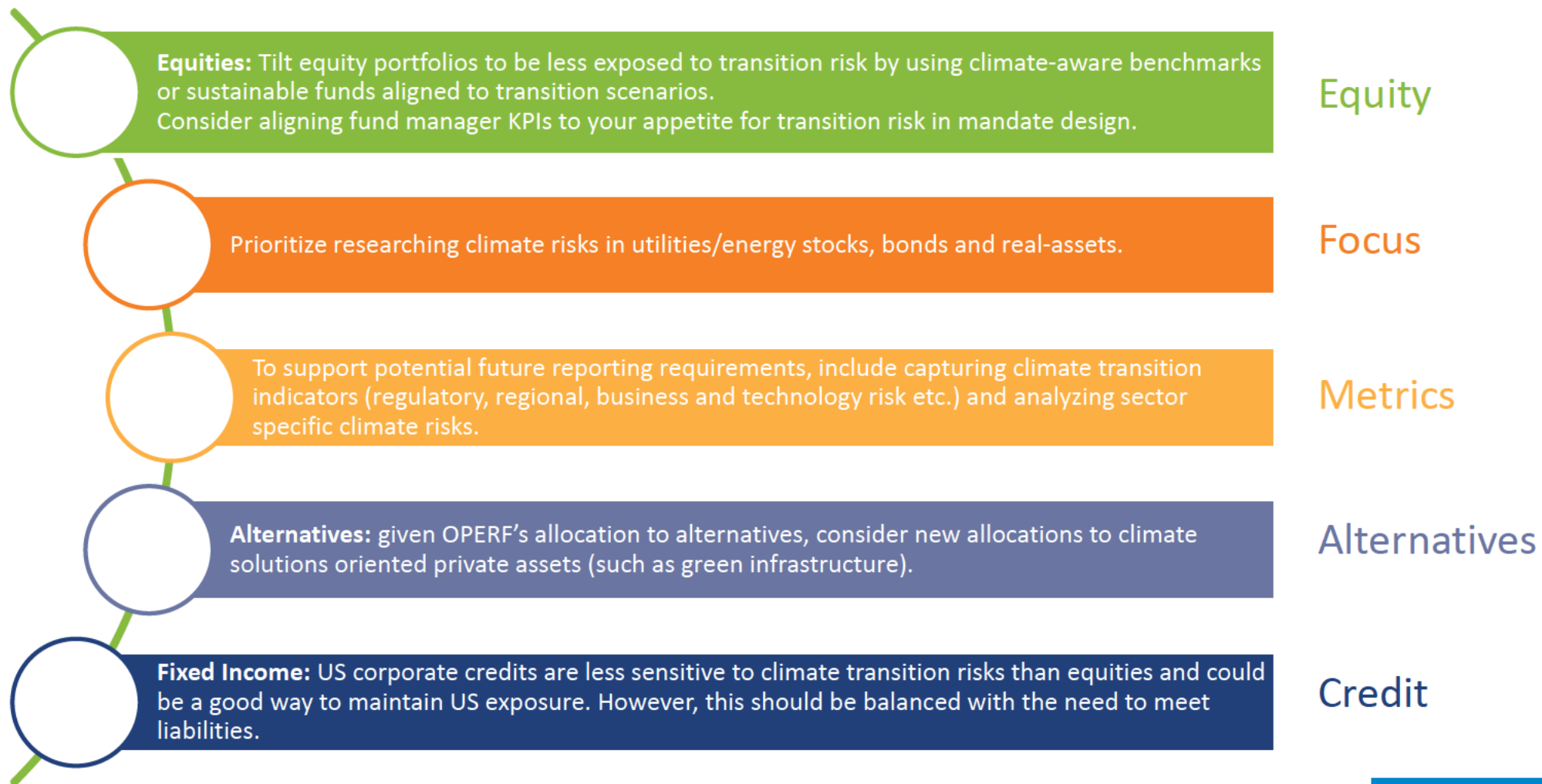
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Next steps – Phase 2: Proposals for insightful “what-if” analysis

- 1) Investigate the potential benefit of geographic diversification by halving US equity and real asset exposure and rebalancing to less climate-exposed regions



- 2) Investigate the composition of the portfolio if optimized to climate scenarios

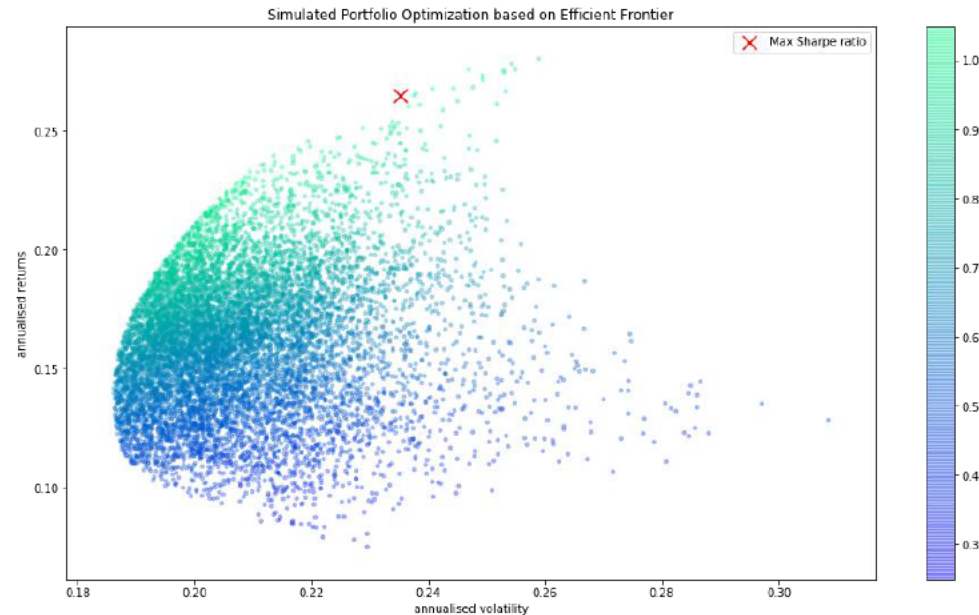


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- Carbon tax
- Investment subsidies for CCS
- Feed-in tariffs for renewables
- Coal-fired electricity fully phased out by 2050
- Biofuel blending requirements
- Policies supporting take up of EVs
- Investments in energy efficiency

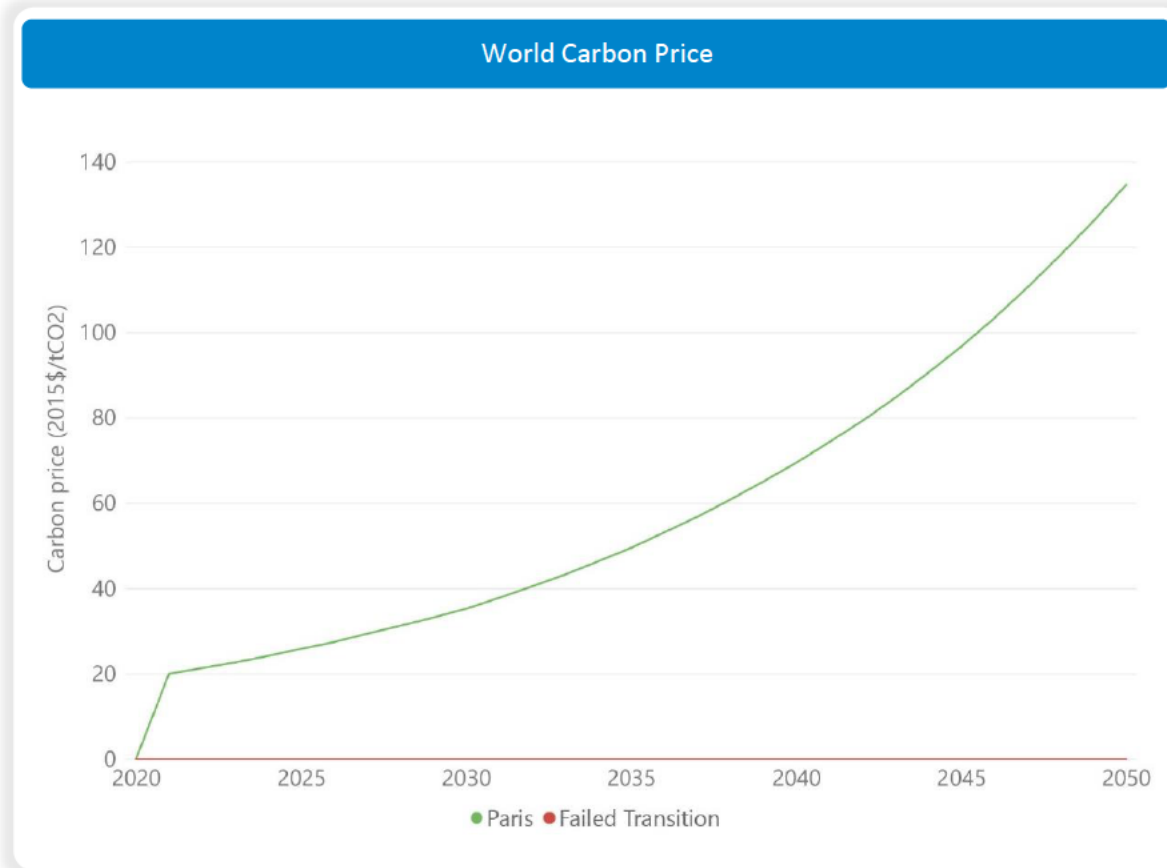


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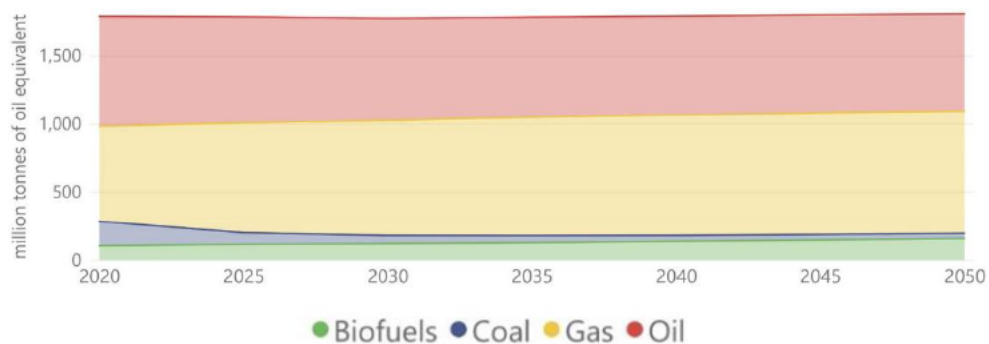
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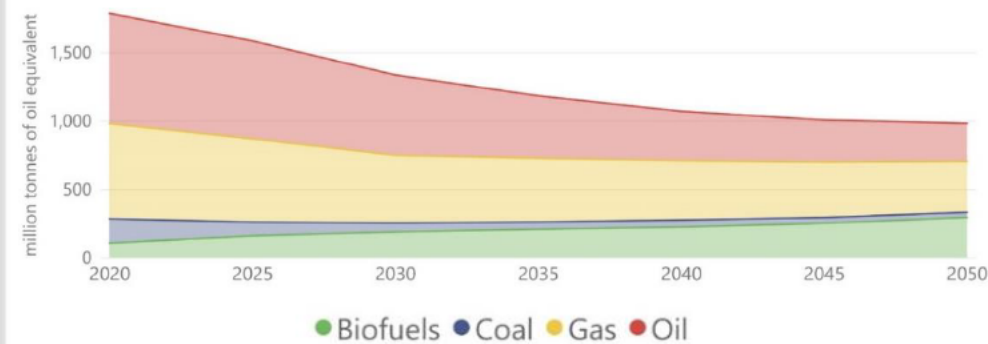
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Failed Transition



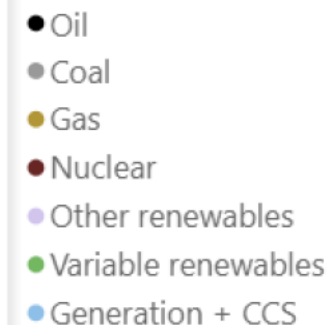
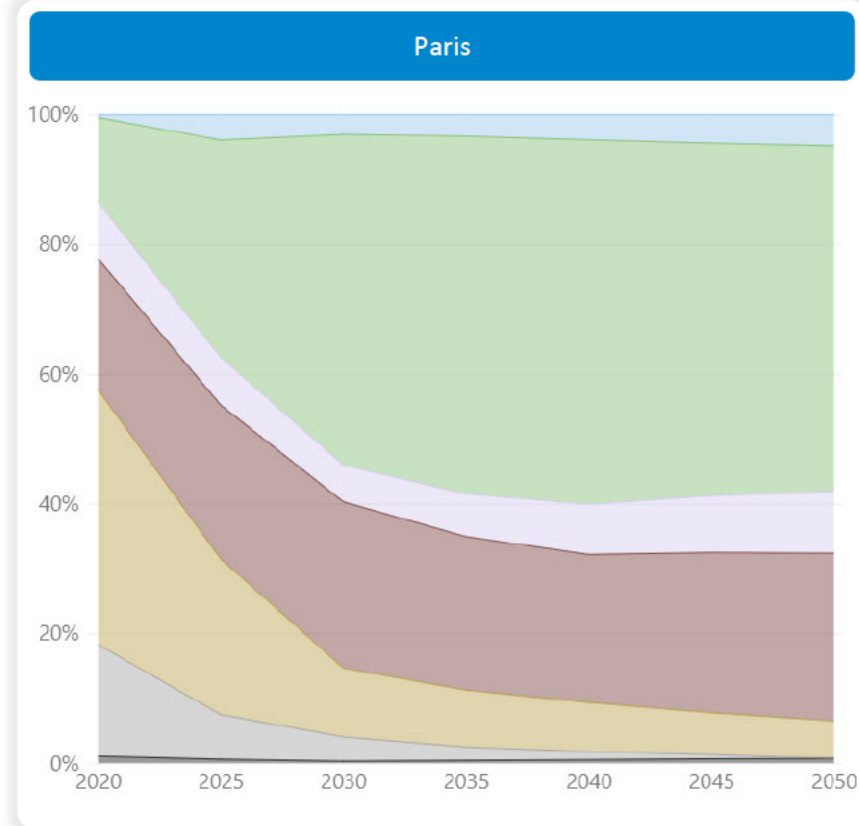
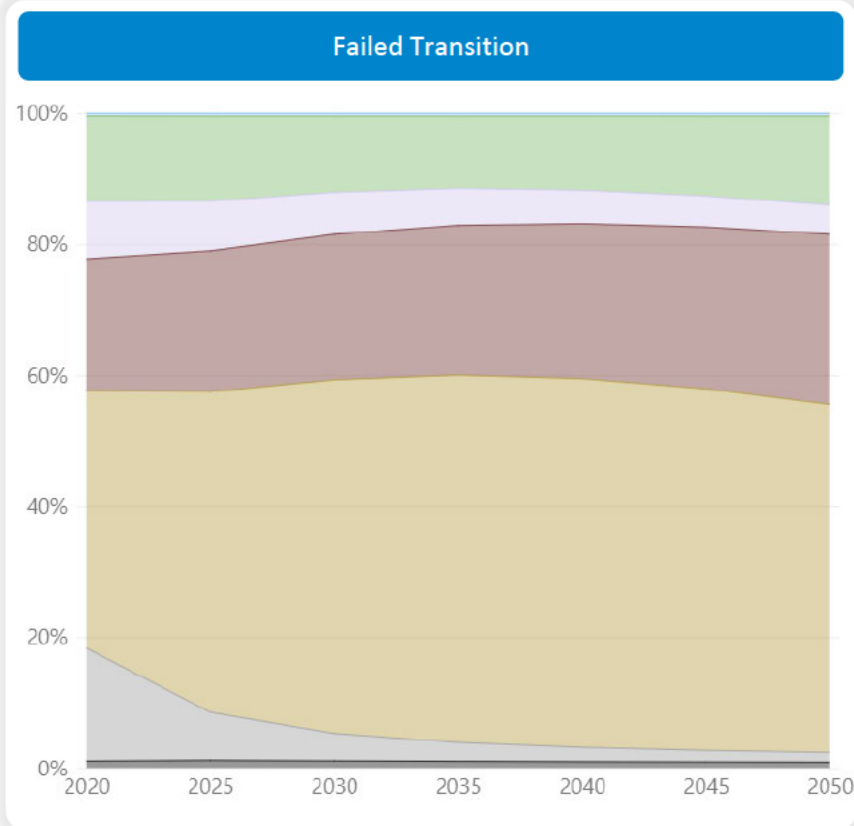
Paris



In Paris Transition Pathways:

- Primary fuel demand decreases 45% by 2050 relative to 2020
- Biofuel use grows more than tenfold
- Proportion of gas stays relatively stable
- Share of oil and coal reduces substantially

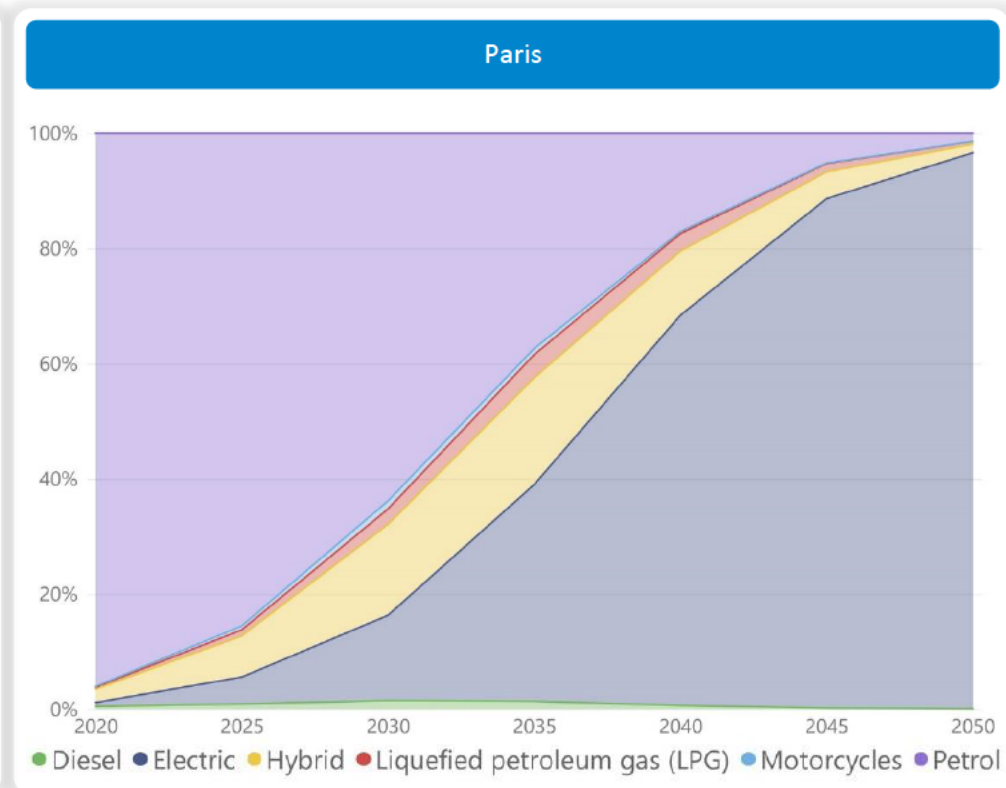
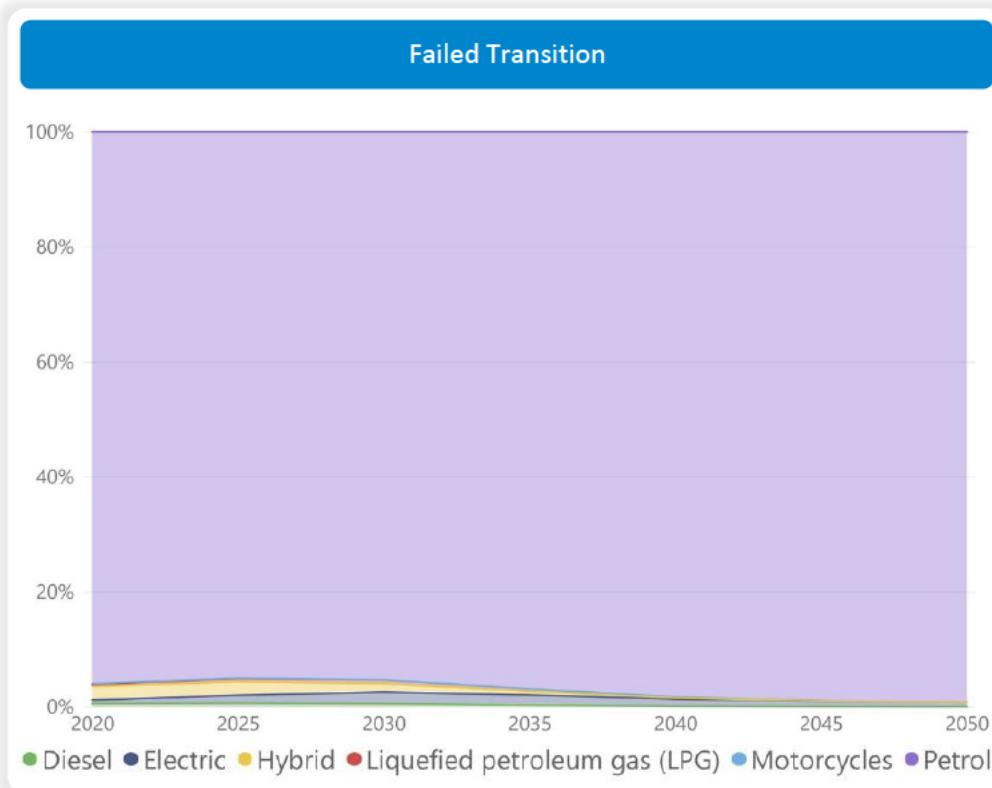
US Electricity Generation



In Paris Transition Pathways:

- Renewables and CCS technologies make up over 70% of the US electricity generation mix in 2050
- Fossil fuel phase out rapidly in the short term and gradually in the long term
- Take up of new technology due to investment in low-carbon technology

US Passenger Transport



In Paris Transition Pathways:

- By 2050 electric vehicles make up 97% of the US passenger transport mix

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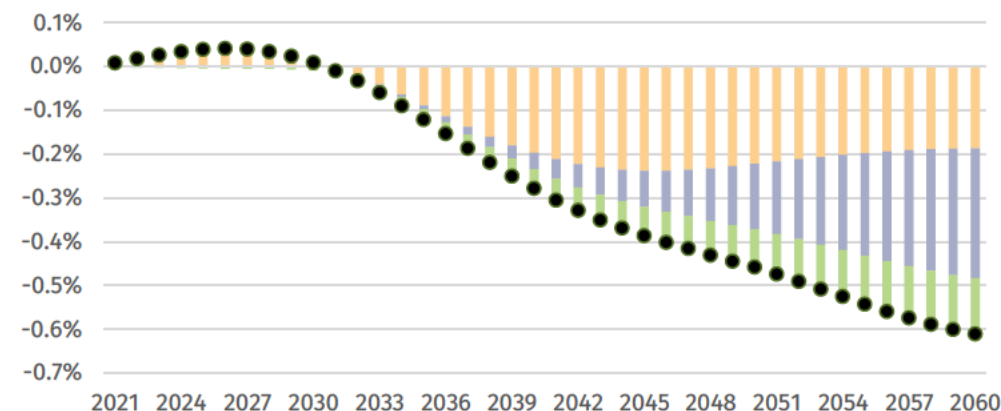
A closer look at the three climate pathways

The impact of orderly climate action

 Scenario 1: **Paris Orderly Transition Pathway**

1. Paris Agreement goals met.
2. Rapid and effective climate action, with smooth market reaction.
3. Ambitious low carbon policies – high investment in low carbon technologies.
4. Major change in global fuel / electricity mix.
5. Average global temperature stabilizes at 1.5°C above pre-industrial levels.
6. Transition has limited positive effect on global GDP and is more than offset by negative physical impacts.
7. Moderate physical impacts, with a much lower increase in extreme weather risks between 2020 and 2100 than under a Failed Transition scenario.
8. The US, compared to other regions, is more negatively impacted by this pathway due to its economy's dependency on fossil fuel exports, its slow progress on energy efficiency and carbon pricing, as well as its high sensitivity to market sentiment.

US Sovereign Bond Yield Levels – 10y



US Listed Equity

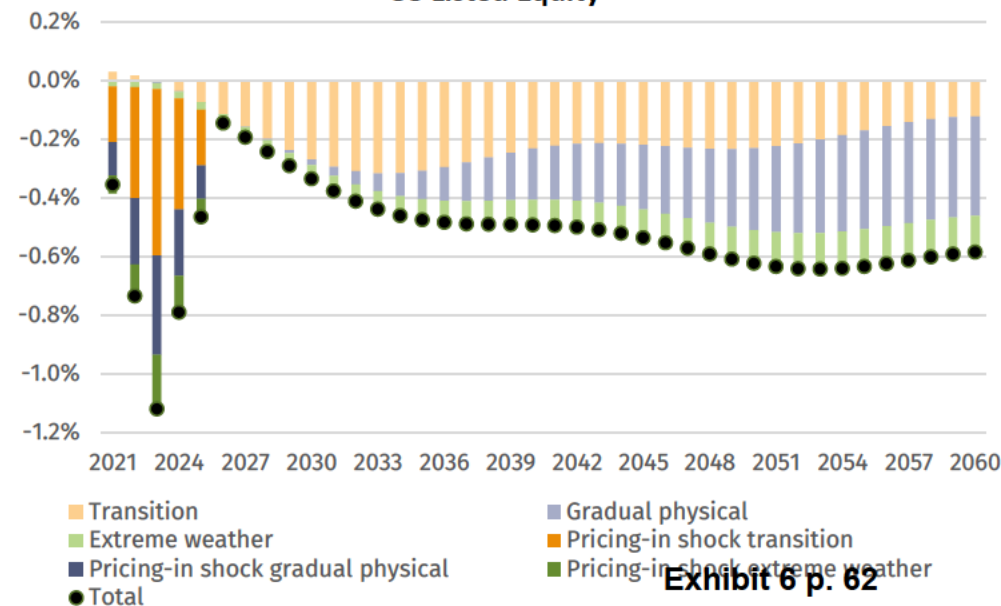


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Note the data presented in the graphs is shown as difference to baseline and are annualized results

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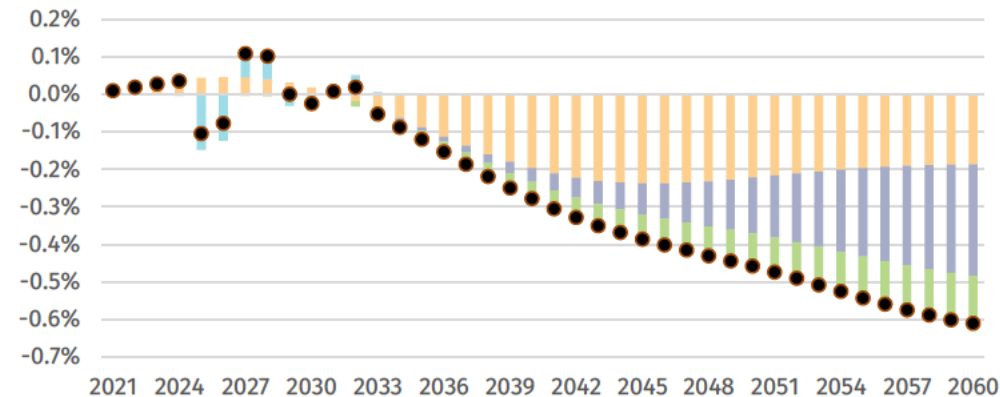
A closer look at the three climate pathways

The impact of a delayed market reaction

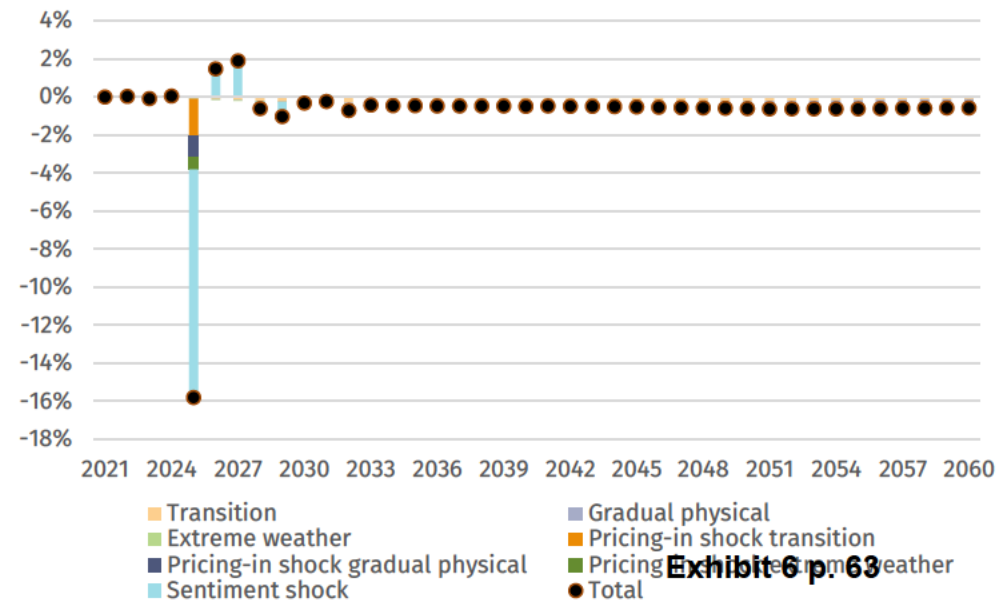
 Scenario 2: **Paris Disorderly Transition Pathway**

1. Paris Agreement goals met.
2. Rapid & effective climate action, but markets slow to react.
3. Ambitious low carbon policies – high investment in low carbon technologies.
4. Major change in global fuel / electricity mix.
5. Average global warming stabilizes at 1.5°C above pre-industrial levels.
6. Transition has limited positive effect on global GDP and is outweighed by negative physical impacts.
7. Abrupt market reaction in 2025 impacts the real economy, for example causing a fall in all major countries' GDP in 2025. In the long term, GDP is slightly lower than in the Paris Orderly scenario as a result of the disorderly transition.
8. Moderate physical impacts, with a much lower increase in extreme weather risks between 2020 and 2100 than under a Failed Transition scenario.
9. The US, compared to other regions, is more impacted due to its sensitivity to transition risks & how these are priced in.

US Sovereign Bond Yield Levels – 10y



US Listed Equity



Note the data presented in the graphs is shown as difference to baseline and are annualized results

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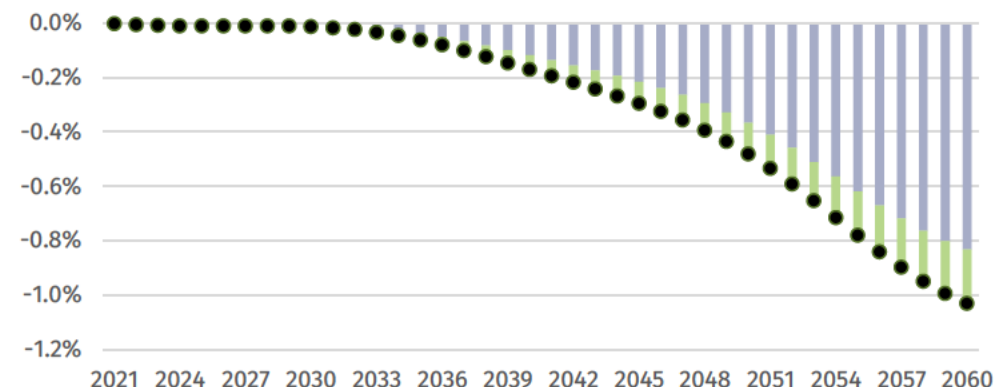
A closer look at the three climate pathways

What might happen if Paris goals are not met?

Scenario 3: Failed Transition Pathway

1. Paris agreement goals not met.
2. Only existing climate policies are implemented.
3. Limited change in global fuel / electricity mix despite significant falls in renewable energy prices.
4. Average global warming is about 2°C by 2050 and 4°C by 2100, compared to pre-industrial levels.
5. Physical impacts have a significant negative impact on global GDP.
6. Extreme weather risks increase significantly between 2020 and 2100 via a combination of increasing event frequency and severity of losses.
7. The physical risks are comparable to the two Paris scenarios for the first 10 years, then increase substantially and irreversibly. Warming makes agriculture impossible in certain areas around the world. Extreme weather events more than double on a global level.
8. Unfortunately, the US demography and geography plays against its favour and exacerbates the adverse effects of global warming (especially at risk from extreme weather events)

US Sovereign Bond Yield Levels – 10y



US Listed Equity

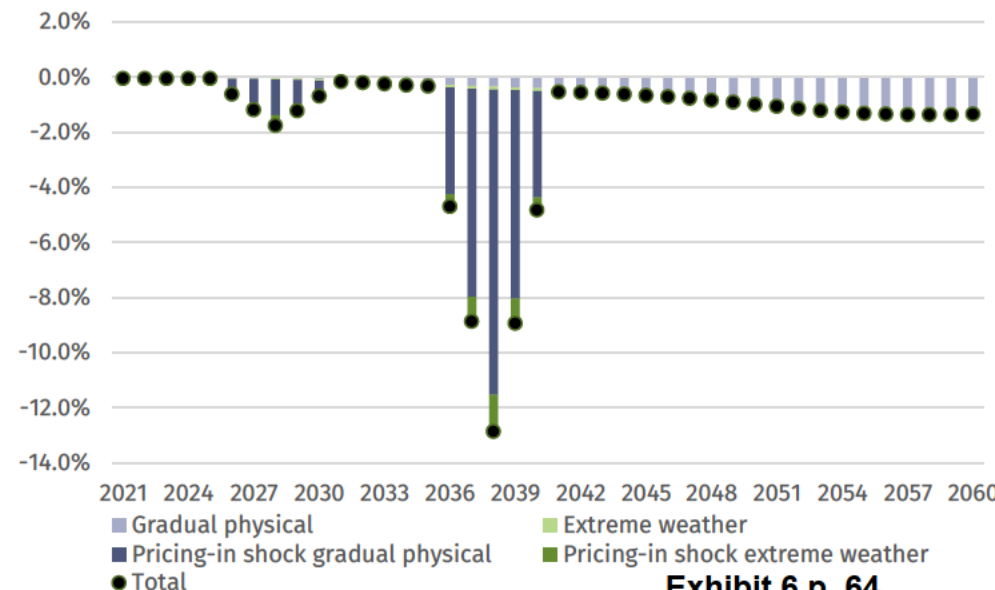


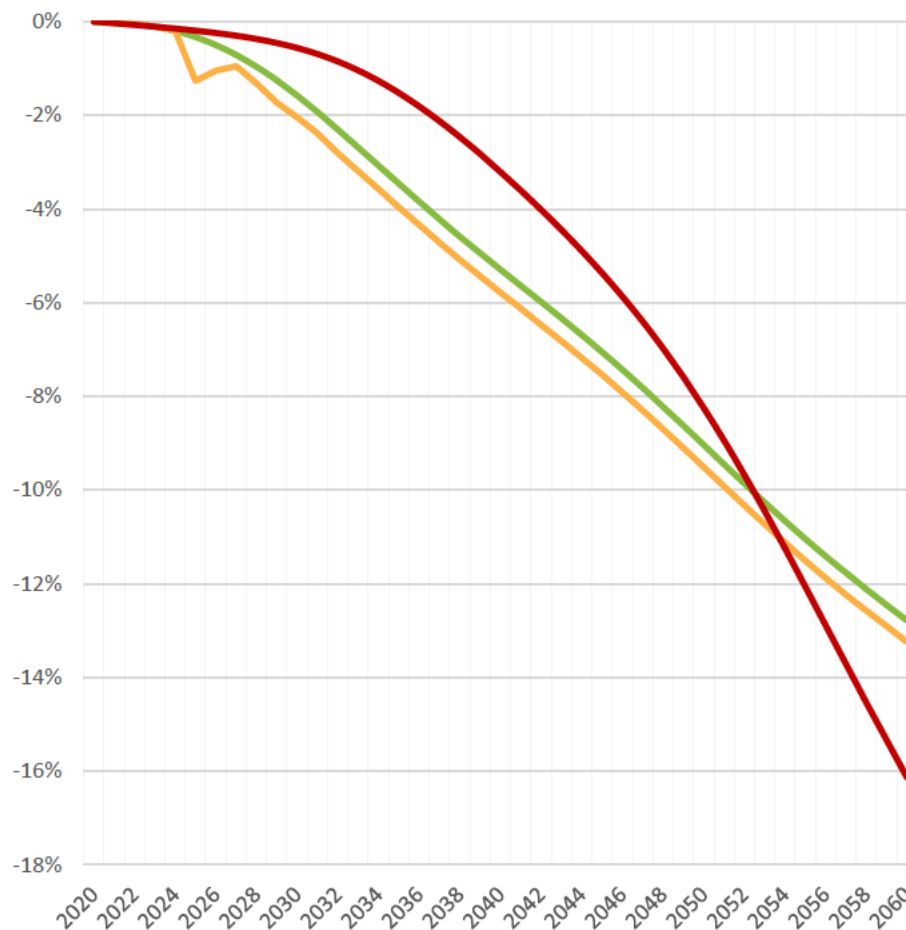
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Note the data presented in the graphs is shown as difference to baseline and are annualized results

How is the economy impacted by climate change?

Cumulative US GDP Projections

2020 – 2060



Paris Transition:

- Over the next 20 years, the US is heavily impacted by the transition pathways due to the economy's dependence on fossil fuel exports. Rapidly declining demand will impact also other related sectors, as well as government royalties, spending, and so on.
- Other regions, such as Europe and China, can even benefit from the low-carbon transition, such as renewable energy technology producers.
- In the second half of this century, transition risks will fade out and lower GDP expectations compared to baseline are due to the locked-in physical impacts of half a degree of further warming compared to today.

Failed Transition:

- Physical risks become more significant over time, which gradually affect GDP growth. These physical risks are particularly impactful for the US unlike other countries such as its neighbor, Canada.
- Due to its demographic and geographic situation, the US is more severely affected in the Failed Transition with GDP projections 16% lower by 2060 under a Failed Transition compared to baseline.



Failed Transition



Paris Orderly Transition Pathway



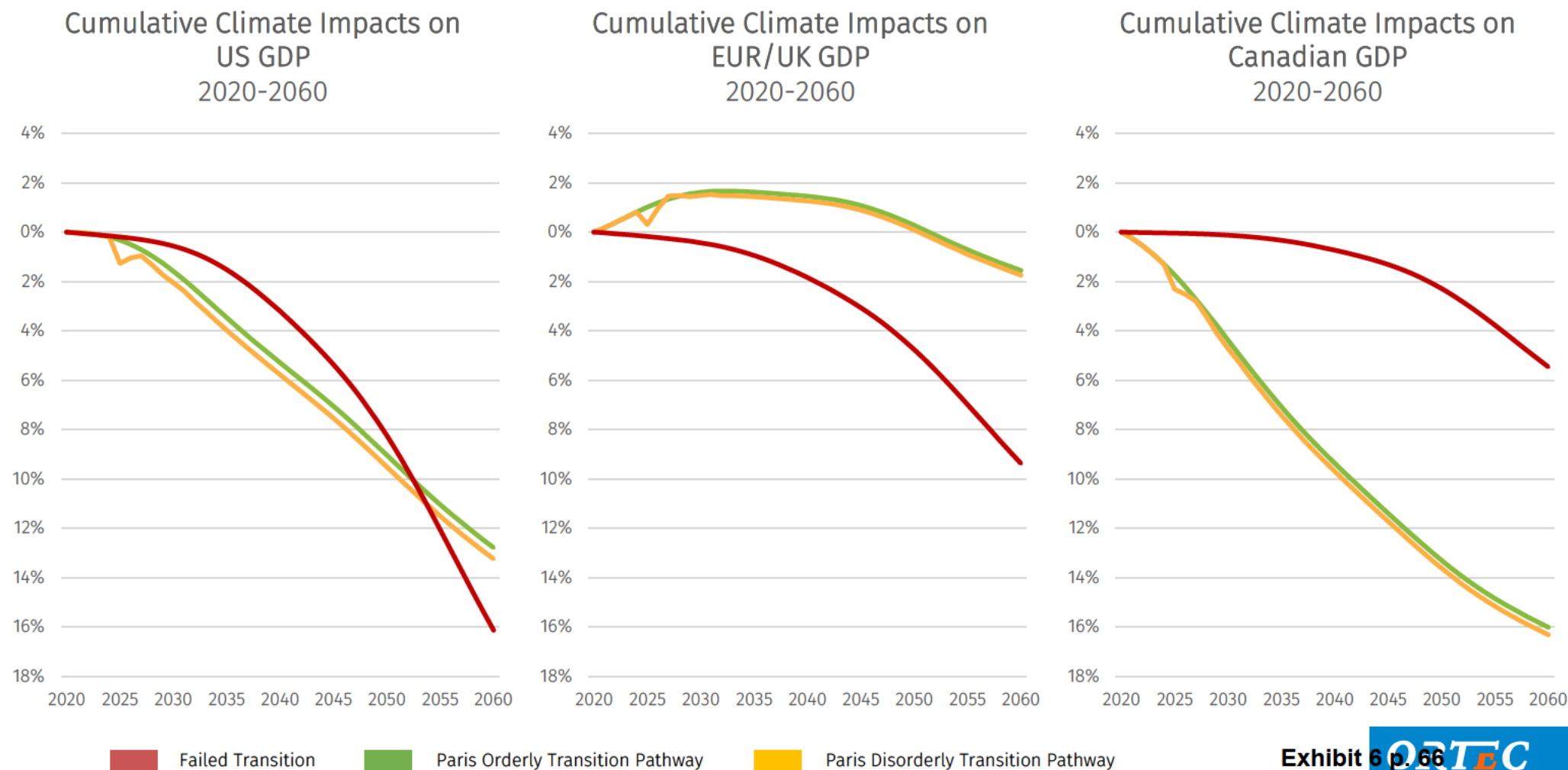
Paris Disorderly Transition Pathway

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*Analyze many more variables using the ClimateMAPS Scenarios Narratives Dashboard

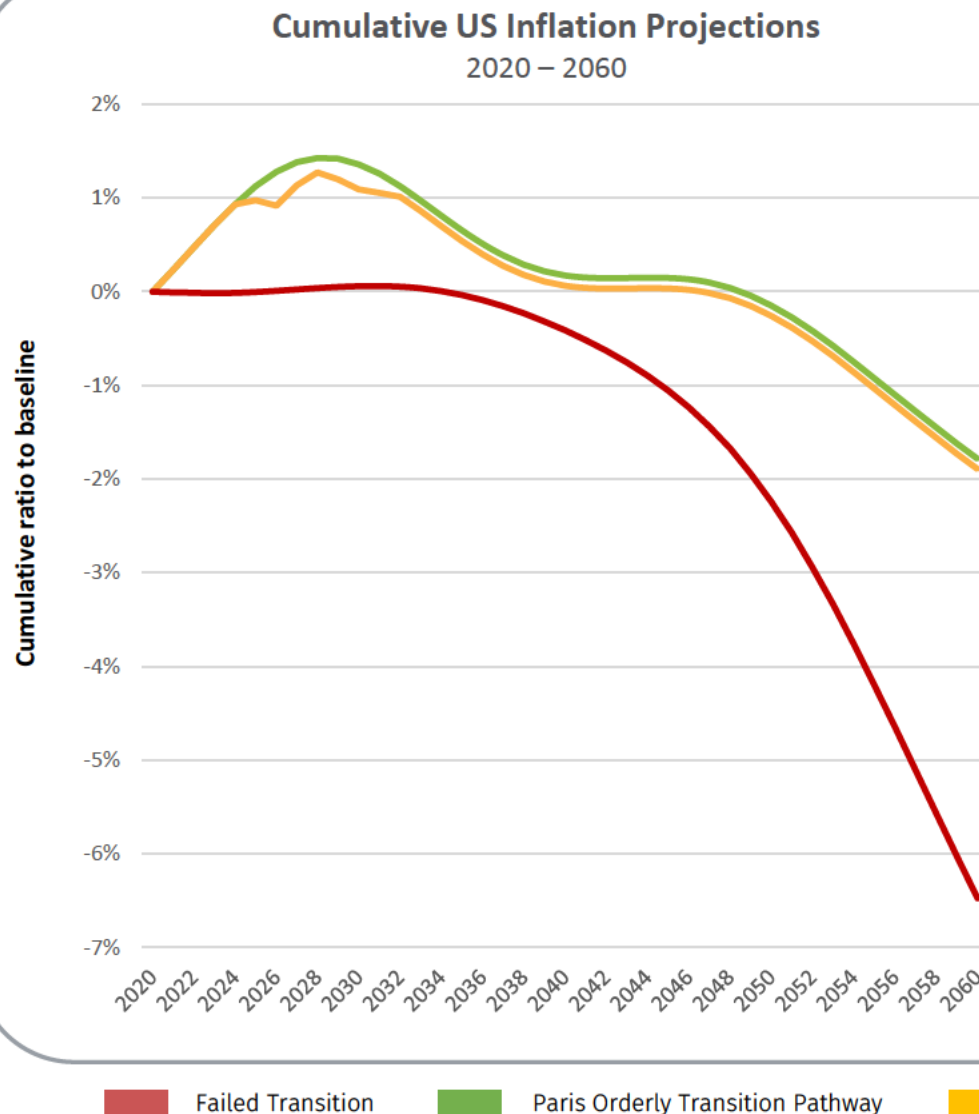
Climate impacts on key economies: GDP considerations

Countries are impacted differently depending on their specific geographic and economic considerations. While the US is severely impacted under our 3 scenarios, Canada for instance suffers particularly from a transition.



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A transition to net zero will increase US inflation



Comments

In the US, under the Paris Orderly and Disorderly transition Pathways, there is an increase in prices in the upcoming years driven by demand-pull inflation effects: the stimulus effects of low-carbon energy and infrastructure investment drive an initial increase in prices.

In the longer term, with the low-carbon regulation put in place (e.g. phase out of fossil fuels) as well as the effect of learning-by-doing, energy product cost is expected to fall. This then drive down the energy/fuel prices. With subsidies and regulation, the cost of renewable technologies decrease overtime which partly affect the electricity price.

Under a Failed transition, prices are not influenced by new policy changes in the short-term. However, mounting physical impacts will impact the economy in the medium and long term which will impose deflationary pressure towards the end of the time horizon. These effects are particularly large for the US.

Climate impacts on key economies: inflation considerations

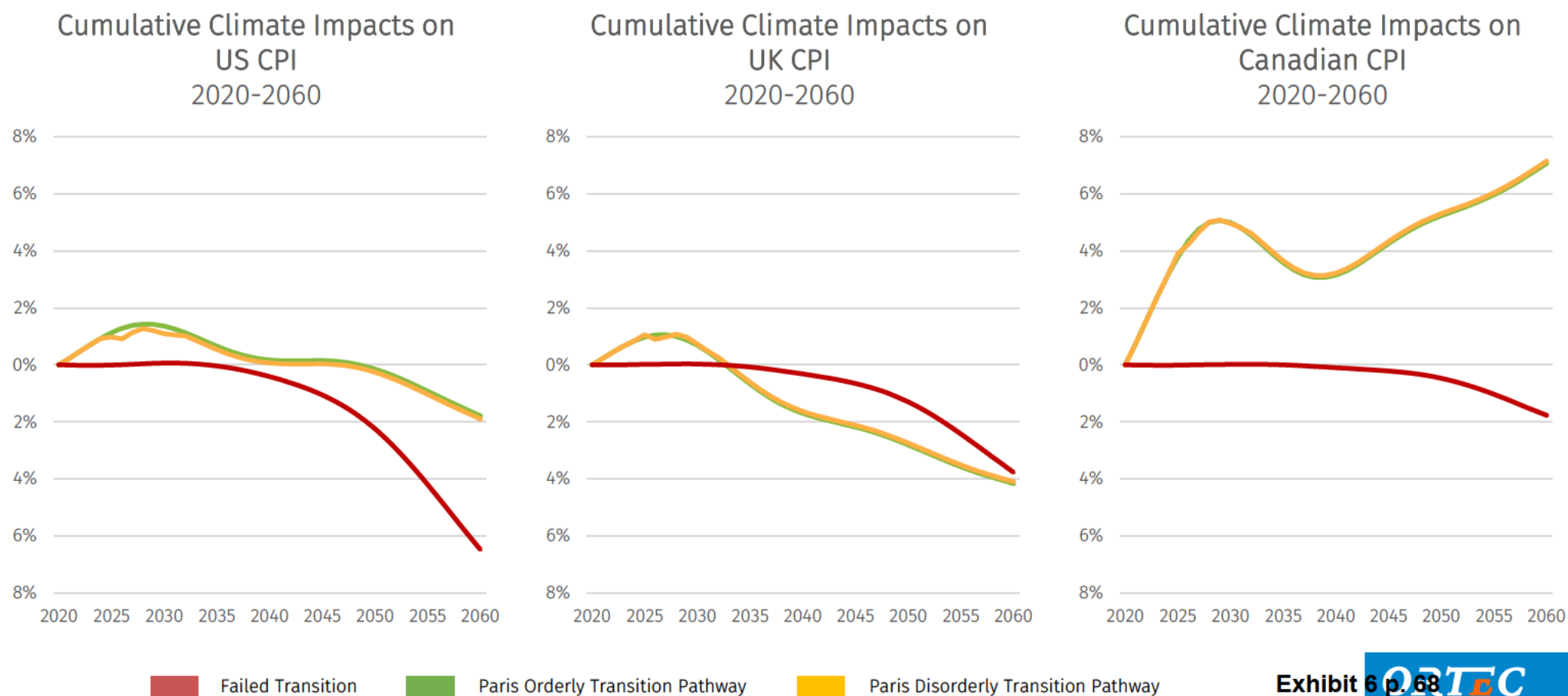
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In the Paris Orderly and Disorderly Transition Pathways, the transition puts upward pressure on inflation in the US.

The positive transition impact is larger than the (negative) impact of increasing physical risks up to 2030.

In the long run, increasing gradual physical risks lead to a reduction in inflation.

In the Failed Transition Pathway, increasing physical risks decrease inflation from the early 2030s.



Financial Results

Paris Orderly Transition

The following subsection focuses on the impacts induced by the Paris Orderly Transition pathway on your portfolio.

The key effects to keep in mind in this pathway are the initial transition shock occurring in the short-term as well as the locked-in physical risks that materialize later on. Annualized results are located in the annex.

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Risk/Return Analysis of portfolio constituents* (annualized absolute results)

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Scenario 1: Paris orderly transition pathway	2021-2025			2026-2030			2031-2040			2041-2050			2051-2060			2021-2060		
	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR
Fund	0 5%	7 2%	8 1%	0 1%	7 9%	8 0%	0 3%	5 0%	5 2%	0 5%	5 2%	5 5%	0 5%	5 2%	5 5%	0 4%	2 7%	2 9%
Fixed income	0 0%	2 5%	2 9%	0 1%	3 3%	3 6%	0 1%	2 9%	2 9%	0 3%	3 4%	4 9%	0 3%	3 4%	4 9%	0 1%	1 4%	1 8%
US Investment Grade																		
US Government Bonds																		
US Index Linked																		
US High Yield																		
EM Debt																		
Equity	0 5%	11 5%	12 1%	0 1%	12 2%	11 7%	0 3%	8 6%	8 7%	0 5%	8 8%	9 1%	0 5%	8 8%	9 1%	0 4%	4 6%	4 6%
MSCI World AC																		
Small Cap																		
Minimum Volatility																		
Private Equity	0 7%	14 4%	17 2%	0 1%	14 7%	16 6%	0 3%	8 8%	9 3%	0 5%	9 4%	9 7%	0 5%	9 4%	9 7%	0 4%	4 6%	4 7%
Venture Capital/Growth																		
Buyout																		
Emerging Market																		
Distressed Debt																		
Real Estate	0 6%	6 7%	7 0%	0 1%	6 7%	6 7%	0 3%	4 6%	4 8%	0 6%	4 7%	5 0%	0 6%	4 7%	5 0%	0 4%	2 5%	2 8%
Direct Real Estate																		
REITs																		
Real Assets	2 0%	10 3%	10 5%	1 0%	11 0%	12 0%	1 1%	6 0%	5 8%	1 0%	6 3%	6 5%	1 0%	6 3%	6 5%	1 2%	3 1%	3 4%
Real Asset Portfolio																		
Opportunity Portfolio																		
Diversifying Strategies	0 1%	5 1%	5 3%	0 0%	4 9%	5 5%	0 1%	3 9%	3 8%	0 1%	3 8%	4 1%	0 1%	3 8%	4 1%	0 1%	2 0%	1 8%
HF Fund of Funds																		
Risk Parity	0 2%	10 1%	10 7%	0 0%	10 7%	10 7%	0 2%	6 3%	7 0%	0 2%	6 7%	8 0%	0 2%	6 7%	8 0%	0 0%	3 4%	3 8%
Global Sovereign Rates																		
Inflation Linked Bonds																		
Corporate Credits																		
Listed Equities																		
Commodities																		

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*Additional granularity can be provided upon request

Sectorial Impacts under the Paris Orderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 5 years

	5Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-1.8%	-11.7%	-8.5%	10.0%	-54.4%	-1.7%	-1.7%	-1.2%	-3.0%	-0.6%	-2.0%	-1.6%	-1.8%	-1.3%	-1.0%	-1.4%	-1.5%
	DM	-2.9%	-19.3%	-9.2%	29.0%	-47.9%	-2.5%	-2.9%	-2.7%	-5.2%	-2.0%	-2.9%	-1.0%	-2.8%	-2.5%	-2.2%	-2.7%	-2.9%
	Europe	-1.5%	-16.6%	-12.3%	5.7%	-44.8%	-0.1%	-0.5%	-0.9%	-1.2%	-0.4%	-1.5%	0.2%	-0.8%	-0.8%	-0.1%	-0.1%	-0.8%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-1.4%	-17.4%	-6.4%	10.8%	-54.2%	-0.9%	-0.9%	-0.4%	-1.0%	-0.2%	-2.1%	-1.0%	-0.9%	0.5%	-0.5%	0.0%	-0.9%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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only redacting the quantified results for sub-asset classes and sectors depicted in tables in the report

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Cumulative return (difference to baseline) heat map Public equities 10 years

	10Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-0.5%	-21.2%	-14.5%	55.3%	-72.8%	-0.2%	-0.9%	1.1%	-3.5%	2.4%	-1.9%	-1.1%	-1.4%	-0.4%	1.7%	-0.2%	-0.4%
	DM	-2.4%	-30.1%	-14.6%	105.5%	-72.4%	-2.0%	-2.6%	-1.8%	-7.0%	-0.4%	-2.7%	-0.6%	-3.2%	-2.5%	-0.8%	-2.4%	-3.0%
	Europe	-0.7%	-33.2%	-21.2%	22.3%	-72.7%	3.0%	0.3%	1.5%	-1.2%	2.6%	-0.8%	1.1%	-0.8%	-0.1%	3.6%	1.9%	0.2%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
EM		0.0%	-26.9%	-10.4%	58.2%	-69.1%	0.2%	0.5%	3.0%	0.1%	3.2%	-2.6%	0.0%	-0.1%	2.8%	1.8%	2.3%	0.7%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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* Note that some region/sector combinations were originally very small which cause the growth rate to appear particularly large

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Sectorial Impacts under the Paris Orderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 20 years

	20Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-2.2%	-33.6%	-24.2%	81.2%	-94.5%	-1.2%	-2.6%	-1.0%	-6.4%	0.7%	-3.8%	-2.0%	-2.7%	-1.4%	-0.5%	-1.3%	-1.7%
	DM	-4.5%	-45.0%	-24.6%	179.0%	-86.6%	-3.9%	-4.6%	-4.9%	-11.4%	-3.2%	-4.9%	-0.2%	-5.2%	-4.0%	-3.5%	-4.6%	-5.4%
	Europe	-1.5%	-50.2%	-34.5%	25.3%	-88.6%	5.3%	0.1%	0.0%	-1.4%	1.5%	-1.8%	3.4%	-0.4%	-0.4%	1.6%	2.9%	-0.1%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-1.1%	-39.9%	-15.6%	181.7%	-79.9%	-0.1%	-0.3%	1.8%	-0.7%	1.9%	-4.1%	-0.6%	-0.8%	5.1%	0.4%	3.1%	-0.7%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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* Note that some region/sector combinations were originally very small which cause the growth rate to appear particularly large

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Sectorial Impacts under the Paris Orderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 40 years

	40Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Orderly	World	-11.3%	-48.0%	-36.3%	83.3%	-100.0%	-12.3%	-11.4%	-10.2%	-17.2%	-7.8%	-12.3%	-10.8%	-12.0%	-9.9%	-9.8%	-10.7%	-10.8%
	DM	-12.8%	-62.1%	-35.1%	206.7%	-95.3%	-12.6%	-13.8%	-14.0%	-22.2%	-11.9%	-13.3%	-5.9%	-13.2%	-11.4%	-12.1%	-13.6%	-14.6%
	Europe	-7.5%	-56.6%	-42.3%	7.5%	-99.0%	-4.8%	-3.6%	-7.0%	-6.6%	-5.4%	-7.4%	-0.8%	-5.2%	-4.7%	-5.5%	-3.9%	-5.6%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
EMERGING MARKETS	Finland																	
	Denmark																	
	Norway																	
	EM	-6.3%	-54.9%	-27.6%	588.6%	-97.9%	-6.9%	-5.8%	-4.5%	-7.3%	-4.1%	-11.1%	-7.0%	-6.4%	-1.0%	-4.8%	-5.1%	-6.9%
	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
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Public equities:

- The asset class is impacted by pricing-in shocks spread over 2021-2026.

Summary of climate impacts on equities:

- Equities suffer from transition risks in the first years. After 2026, physical risks gradually increase over time. The cumulative relative performance of the equity arm of the portfolio compares to baseline over 40 years is -11% under the Paris Orderly transition pathway.
- Emerging markets tend to be less sensitive to both climate-related risks.
- Canada & the US suffers the most due to their dependency on fossil fuel exports, lack of energy efficiency and carbon pricing progress and high sensitivity to market sentiment.
- Overall, Japan and Singapore are the winners among the developed markets.
- Low carbon electricity
 - Winners: emerging markets, Australia and Singapore
 - Losers: Europe, the UK
- Other utilities and energy are the most negatively impacted sectors where all regions suffer important losses.

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Fixed Income:

- Interest rates in Canada, and most other countries, are not materially impacted in the short-run due to limited climate-related impacts on growth in this pathway.
- In the medium-run most countries experience some negative impacts from the transition, and in the longer term, they suffer more from physical risks.
- The gradual (but generally modest) decline in yields leads to a slight upward pressure on fixed income returns.
- Canadian corporate credits are more significantly impacted with cumulative return of -7% over the next 40 years compared to baseline. Still, these impacts remain much lower than those on equities.

Property:

- Listed and unlisted real estate behave similarly as listed equities. However, differences arise from divergence in regional exposure. It also has some differences in volatility between listed and unlisted benchmarks within a country.

Infrastructure:

- Listed infrastructure assets are expected to perform in a similar fashion as broad equities, albeit with a slightly more negative cumulative performance. OPERF's specific infrastructure exposure is slightly more at risk than our broad benchmark, but remain in line with what's expected on the asset class.

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Paris Disorderly Transition

The following subsection focuses on the impacts induced by the Paris Disorderly Transition pathway your portfolio.

The key effects to keep in mind in this pathway are the delayed transition shock that strikes in 2024 as well as the sentiment shock and increased volatility in the following few years. After this initial chaotic transition, this pathway behaves the same way as its orderly counterpart. Annualized results are located in the annex.

Risk/Return Analysis of portfolio constituents* (annualized absolute results)

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Scenario 2: Paris disorderly transition pathway	2021-2025			2026-2030			2031-2040			2041-2050			2051-2060			2021-2060		
	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR
Fund	2 6%	7 4%	8 4%	0 6%	8 0%	8 0%	0 3%	5 0%	5 2%	0 5%	5 1%	5 5%	0 5%	5 1%	5 5%	0 5%	2 7%	2 9%
Fixed income	0 5%	2 7%	2 9%	0 8%	3 5%	3 8%	0 1%	2 9%	2 9%	0 3%	3 4%	4 9%	0 3%	3 4%	4 9%	0 1%	1 4%	1 8%
US Investment Grade																		
US Government Bonds																		
US Index Linked																		
US High Yield																		
EM Debt																		
Equity	3 3%	12 2%	13 1%	0 4%	12 4%	12 2%	0 3%	8 6%	8 7%	0 5%	8 8%	9 1%	0 5%	8 8%	9 1%	0 7%	4 6%	4 7%
MSCI World AC																		
Small Cap																		
Minimum Volatility																		
Private Equity	3 5%	14 4%	17 1%	1 0%	14 8%	16 6%	0 3%	8 8%	9 3%	0 5%	9 4%	9 7%	0 5%	9 4%	9 7%	0 6%	4 6%	4 7%
Venture Capital/Growth																		
Buyout																		
Emerging Market																		
Distressed Debt																		
Real Estate	2 0%	6 7%	7 1%	0 3%	6 8%	6 7%	0 3%	4 6%	4 8%	0 6%	4 7%	5 0%	0 6%	4 7%	5 0%	0 6%	2 5%	2 8%
Direct Real Estate																		
REITs																		
Real Assets	4 9%	10 3%	10 5%	0 1%	11 0%	12 0%	1 1%	6 0%	5 8%	1 0%	6 3%	6 5%	1 0%	6 3%	6 5%	1 5%	3 1%	3 4%
Real Asset Portfolio																		
Opportunity Portfolio																		
Diversifying Strategies	1 3%	5 1%	5 5%	0 7%	5 0%	5 5%	0 1%	3 9%	3 9%	0 1%	3 8%	4 1%	0 1%	3 8%	4 1%	0 2%	1 9%	1 9%
HF Fund of Funds																		
Risk Parity	2 3%	10 6%	11 3%	1 0%	10 8%	10 9%	0 1%	6 3%	7 1%	0 2%	6 8%	8 0%	0 2%	6 8%	8 0%	0 1%	3 4%	3 8%
Global Sovereign Rates																		
Inflation Linked Bonds																		
Corporate Credits																		
Listed Equities																		
Commodities																		

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*Additional granularity can be provided upon request

Sectorial Impacts under the Paris Disorderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 5 years

	5Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-15.9%	-26.8%	-23.3%	-2.7%	-67.8%	-15.8%	-15.8%	-15.4%	-17.2%	-14.7%	-16.1%	-15.6%	-15.9%	-15.4%	-15.2%	-15.5%	-15.6%
	DM	-16.6%	-34.3%	-23.5%	23.4%	-59.1%	-16.0%	-16.3%	-16.2%	-19.0%	-15.6%	-16.3%	-14.1%	-16.2%	-15.8%	-15.7%	-16.2%	-16.4%
	Europe	-16.7%	-33.1%	-28.6%	-9.5%	-57.1%	-15.2%	-15.5%	-16.2%	-16.3%	-15.7%	-16.7%	-14.6%	-15.9%	-15.8%	-15.5%	-15.2%	-15.9%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-18.0%	-34.4%	-23.1%	-2.7%	-82.9%	-17.0%	-17.0%	-16.8%	-16.3%	-15.6%	-17.7%	-17.3%	-16.1%	-16.3%	-13.8%	-16.9%	-14.8%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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* Note that some region/sector combinations were originally very small which cause the growth rate to appear particularly large

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Sectorial Impacts under the Paris Disorderly Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 10 years

	10Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-12.2%	-32.6%	-26.2%	41.1%	-80.2%	-12.0%	-12.6%	-10.9%	-15.2%	-9.6%	-13.5%	-12.7%	-13.0%	-12.0%	-10.3%	-11.9%	-12.1%
	DM	-13.7%	-41.4%	-25.9%	102.6%	-77.4%	-13.2%	-13.8%	-13.1%	-18.3%	-11.8%	-13.9%	-11.4%	-14.2%	-13.5%	-12.2%	-13.6%	-14.1%
	Europe	-13.2%	-44.6%	-33.7%	8.0%	-78.0%	-9.8%	-12.1%	-11.4%	-13.6%	-10.4%	-13.4%	-11.0%	-13.1%	-12.5%	-9.5%	-10.7%	-12.3%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-13.5%	-39.8%	-23.6%	54.7%	-89.2%	-12.3%	-12.2%	-10.5%	-12.2%	-9.5%	-14.9%	-13.0%	-12.2%	-11.4%	-9.2%	-11.7%	-10.7%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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Cumulative return (difference to baseline) heat map Public equities 20 years

	20Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-14.0%	-43.4%	-34.8%	64.2%	-96.0%	-13.1%	-14.3%	-12.9%	-18.0%	-11.3%	-15.5%	-13.8%	-14.5%	-13.2%	-12.5%	-13.1%	-13.5%
	DM	-15.7%	-53.9%	-34.7%	175.3%	-88.8%	-15.1%	-15.7%	-16.1%	-22.3%	-14.5%	-16.0%	-11.2%	-16.2%	-15.1%	-14.7%	-15.7%	-16.5%
	Europe	-14.1%	-58.8%	-45.1%	10.2%	-90.8%	-8.0%	-12.5%	-13.0%	-14.0%	-11.5%	-14.5%	-9.3%	-13.0%	-13.0%	-11.5%	-10.0%	-12.8%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-14.6%	-50.3%	-29.5%	215.5%	-95.4%	-12.6%	-13.2%	-11.7%	-13.1%	-10.8%	-16.4%	-13.6%	-13.1%	-11.7%	-10.6%	-12.2%	-12.2%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
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Cumulative return (difference to baseline) heat map Public equities 40 years

	40Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.*	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Paris Disorderly	World	-22.1%	-55.7%	-45.3%	65.9%	-100.0%	-23.0%	-22.2%	-21.1%	-27.5%	-18.9%	-23.0%	-21.6%	-22.7%	-20.7%	-20.8%	-21.5%	-21.6%
	DM	-23.0%	-68.0%	-43.8%	204.1%	-95.8%	-22.8%	-23.8%	-24.0%	-31.8%	-22.2%	-23.4%	-16.3%	-23.2%	-21.6%	-22.3%	-23.7%	-24.6%
	Europe	-19.3%	-64.1%	-51.6%	-5.4%	-99.2%	-16.8%	-15.7%	-19.0%	-18.5%	-17.6%	-19.4%	-13.0%	-17.2%	-16.8%	-17.7%	-16.0%	-17.6%
DEVELOPED MARKETS	US																	
	Japan																	
	UK																	
	France																	
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	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-18.6%	-60.7%	-37.6%	545.3%	-97.9%	-19.0%	-18.1%	-17.1%	-18.7%	-16.1%	-22.4%	-19.2%	-17.8%	-13.7%	-14.9%	-17.7%	-17.3%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
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Public equity:

- The asset class is impacted by the pricing-in shock in 2025H2 – 2026H1. This shock is deployed rapidly due to the delay in the implementation of required policies under the Paris transition.
- Both the pricing-in shock and the sentiment shock have a large impact across all regions from 2025H2 – 2026H1 onwards as delayed market pricing-in strikes.
- Under the Paris Disorderly pathway, there is a loss of about 17% on your equity portfolio in the first 5 years compared to the baseline. In 2025H2 – 2026H1, the abrupt sentiment shock also takes place and adds on top of the pricing-in shock.
- After the recovery, equity returns move roughly to baseline levels in both Paris pathways, while towards the end of the time horizon, equity returns are lowered by physical risks.

Summary of climate impacts on equities:

- Because of the delayed pricing-in shock, all the impacts are more significant in this pathway than under the Paris Orderly transition. Furthermore, the sentiment shock materially affects cumulative climate impacts by 2026.
- Emerging markets benefit from the transition to low-carbon technologies but are also more sensitive to negative impacts on high carbon technologies.
- Japan and Singapore are the “winners” among developed markets.
- Low carbon electricity – all regions benefit, however relatively we see the following:
 - Winners are Australia, emerging markets, Japan, the US
 - Losers: Europe and the UK
- Other utilities and Energy are the most negatively impacted sectors where all regions suffer important losses.

Paris Disorderly Transition Pathway

Climate impacts summary – Others

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Fixed Income:

- Apart from the sentiment shock as well as different size and timing of the pricing-in shock, the yields are impacted in the same way as under the Paris Orderly Transition pathway. Therefore, in the medium term, interest rates generally go down slightly, with a somewhat larger impact for Canada than the UK for instance.
- This gradual (but generally modest) decline in yields leads to slight upward pressure on fixed income returns.
- The sentiment shock causes some upward short-term movements of sovereign yields, especially for the Canada, which in turn improves fixed income returns.
- For corporate credits, spread tightening movements benefit the portfolio after climate shocks.

Property:

- Similar impacts as under the Paris Orderly Transition pathway.

Infrastructure:

- Similar impacts as under the Paris Orderly Transition pathway.

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Failed Transition

The following subsection focuses on the impacts induced by the Failed Transition pathway on your portfolio. The key effects to keep in mind in this pathway are the important physical risks that build up as time goes on. The expected losses associated with the physical risks compound with time and lead to important losses. As noted earlier, by 2038, the Failed Transition pathway is already expected to be the worst pathway of the three. From our experience, your portfolio is moderately impacted due to its exposure to relatively exposed assets classes such as public equities, real estate and infrastructure. The strong emphasis on Canadian assets reduces the exposure of the portfolio due to the smaller physical risks, compared to other, less resilient countries such as the US. All alternative asset mixes increase this exposure due to the reduction in Canadian exposure. Annualized results are located in the annex.

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Risk/Return Analysis of portfolio constituents* (annualized absolute results)

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Scenario 3: Failed transition pathway	2021-2025			2026-2030			2031-2040			2041-2050			2051-2060			2021-2060		
	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR	Median	Bottom 5% VaR	Top 5% VaR
Fund	0 0%	7 2%	8 1%	0 7%	7 9%	8 0%	2 8%	4 9%	5 1%	0 9%	5 1%	5 5%	0 9%	5 1%	5 5%	1 1%	2 7%	2 9%
Fixed income	0 0%	2 5%	2 9%	0 0%	3 4%	3 7%	0 0%	2 9%	3 0%	0 3%	3 4%	4 9%	0 3%	3 4%	4 9%	0 0%	1 4%	1 7%
US Investment Grade																		
US Government Bonds																		
US Index Linked																		
US High Yield																		
EM Debt																		
Equity	0 0%	11 5%	12 1%	0 9%	12 2%	11 7%	3 5%	8 6%	8 7%	1 2%	8 8%	9 1%	1 2%	8 8%	9 1%	1 5%	4 6%	4 6%
MSCI World AC																		
Small Cap																		
Minimum Volatility																		
Private Equity	0 0%	14 4%	17 2%	1 3%	14 7%	16 6%	5 0%	8 8%	9 3%	1 1%	9 4%	9 7%	1 1%	9 4%	9 7%	1 9%	4 6%	4 7%
Venture Capital/Growth																		
Buyout																		
Emerging Market																		
Distressed Debt																		
Real Estate	0 1%	6 7%	7 0%	0 8%	6 8%	6 8%	3 2%	4 7%	4 9%	1 1%	4 7%	4 9%	1 1%	4 7%	4 9%	1 4%	2 5%	2 8%
Direct Real Estate																		
REITs																		
Real Assets	0 0%	10 3%	10 5%	0 8%	11 1%	12 1%	3 4%	6 0%	5 9%	1 2%	6 3%	6 5%	1 2%	6 3%	6 5%	1 4%	3 1%	3 4%
Real Asset Portfolio																		
Opportunity Portfolio																		
Diversifying Strategies	0 0%	5 1%	5 3%	0 3%	4 9%	5 5%	1 1%	3 9%	3 8%	0 3%	3 8%	4 1%	0 3%	3 8%	4 1%	0 4%	2 0%	1 8%
HF Fund of Funds																		
Risk Parity	0 0%	10 1%	10 6%	0 4%	10 7%	10 7%	1 4%	6 4%	7 1%	0 3%	6 7%	8 0%	0 3%	6 7%	8 0%	0 5%	3 3%	3 8%
Global Sovereign Rates																		
Inflation Linked Bonds																		
Corporate Credits																		
Listed Equities																		
Commodities																		

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*Additional granularity can be provided upon request

Sectorial Impacts under the Failed Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 5 years

Cumulative climate impact - Failed Transition	5Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
	World	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%
	DM	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
	Europe	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
	DEVELOPED MARKETS																	
	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
	EMERGING MARKETS																	
	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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only redacting the quantified results for sub-asset classes and sectors depicted in tables in the report

Full slide re-inserted

Sectorial Impacts under the Failed Transition Pathway

Cumulative return (difference to baseline) heat map Public equities 10 years

	10Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
Cumulative climate impact - Failed Transition	World	-5.2%	-5.0%	-5.1%	-5.2%	-4.9%	-5.2%	-5.2%	-5.2%	-5.1%	-5.2%	-5.2%	-5.2%	-5.1%	-5.1%	-5.2%	-5.2%	-5.1%
	DM	-5.3%	-4.7%	-4.9%	-4.7%	-4.4%	-5.2%	-5.2%	-5.3%	-4.6%	-5.4%	-5.5%	-5.1%	-4.8%	-5.1%	-5.3%	-4.9%	-4.7%
	Europe	-4.3%	-3.9%	-4.0%	-3.7%	-2.7%	-3.6%	-4.1%	-4.7%	-3.5%	-5.2%	-5.1%	-4.1%	-3.4%	-4.2%	-4.5%	-4.2%	-3.9%
	US																	
DEVELOPED MARKETS	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-4.0%	-3.8%	-4.0%	-3.8%	-3.7%	-3.7%	-3.8%	-4.0%	-3.8%	-4.4%	-4.4%	-3.9%	-3.8%	-3.9%	-3.2%	-3.8%	-3.6%
EMERGING MARKETS	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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Cumulative return (difference to baseline) heat map Public equities 20 years

Cumulative climate impact - Failed Transition	20Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
	World	-36.3%	-36.2%	-36.3%	-36.3%	-36.1%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%	-36.3%
	DM	-34.9%	-34.0%	-34.1%	-32.1%	-31.9%	-32.4%	-34.5%	-35.2%	-31.9%	-36.4%	-36.3%	-34.2%	-31.9%	-33.7%	-34.0%	-33.1%	-32.7%
	Europe	-24.1%	-23.8%	-23.9%	-18.5%	-17.7%	-18.5%	-23.5%	-27.4%	-17.6%	-31.4%	-30.6%	-23.0%	-17.6%	-23.1%	-24.5%	-21.9%	-20.1%
	DEVELOPED MARKETS																	
	US																	
	Japan																	
	UK																	
	France																	
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	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-40.6%	-42.4%	-42.5%	-41.0%	-41.0%	-41.0%	-41.6%	-41.4%	-40.9%	-36.8%	-37.4%	-41.7%	-40.3%	-41.8%	-33.3%	-41.3%	-34.3%
	EMERGING MARKETS																	
	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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Cumulative return (difference to baseline) heat map Public equities 40 years

Cumulative climate impact - Failed Transition	40Y	Total	Oil & Gas	Other Energy	Low Carbon Electric.	Other Utilities	Water Supply	Forestry	Materials	Public Admin.	Industrials	Consumer Disc.	Consumer Staples	Health	Financials	IT	Telecom	Real Estate
	World	-49.7%	-49.6%	-49.7%	-49.8%	-49.6%	-49.7%	-49.8%	-49.7%	-49.7%	-49.7%	-49.7%	-49.8%	-49.7%	-49.7%	-49.8%	-49.7%	-49.7%
	DM	-45.7%	-44.7%	-44.8%	-42.5%	-42.3%	-42.8%	-45.1%	-45.7%	-42.4%	-47.2%	-47.0%	-44.9%	-42.3%	-44.2%	-44.6%	-43.7%	-43.3%
	Europe	-34.2%	-33.9%	-34.0%	-28.2%	-27.5%	-28.2%	-33.5%	-37.6%	-27.3%	-41.7%	-40.9%	-33.0%	-27.2%	-33.1%	-34.6%	-31.8%	-29.9%
	DEVELOPED MARKETS																	
	US																	
	Japan																	
	UK																	
	France																	
	Germany																	
	Canada																	
	Sweden																	
	Switzerland																	
	Australia																	
	Netherlands																	
	Spain																	
	Italy																	
	Singapore																	
	Finland																	
	Denmark																	
	Norway																	
	EM	-51.4%	-52.9%	-52.9%	-51.0%	-51.0%	-51.0%	-51.6%	-51.7%	-50.7%	-48.3%	-49.0%	-52.0%	-50.1%	-52.0%	-40.9%	-51.5%	-43.3%
	EMERGING MARKETS																	
	China																	
	India																	
	South Korea																	
	Brazil																	
	Russia																	
	Malaysia																	
	Thailand																	
	Indonesia																	
	Philippines																	
	Taiwan																	

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Failed Transition Pathway

Climate impacts summary – Public equities

Public equities:

- The entire asset class is affected by the delayed pricing in shocks from 2026-2031 and 2036-2041.

Summary of climate impacts on equities:

- In the first 5 year time bucket, impacts on equities are muted when compared to those of the Paris transition pathways. This is because under the Failed transition pathway, pricing-in shocks only start in 2026 and no transition shock occurs. A second pricing shock strikes in 2036-2041, intensifying the impact of physical risks on the asset class.
- Unlike under the Paris transition pathways, the low-carbon electricity sector does not grow under the Failed transition pathway. Since no additional efforts are made to transition towards renewable energy and no additional “green” technologies are developed, sectors only suffer from physical and extreme weather impacts, without experiencing any transition opportunities.
- There are no winners. The least impacted countries are Switzerland and Canada – due to their geographic location.

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Climate impacts summary – Others

Fixed income:

- Pricing in physical shocks in 2026-2031 and 2036-2041 hit the asset class during these periods. However, the credit spreads tightening in the subsequent years after both shocks benefit the asset class. From 2040, we see a rebound in credit returns.
- The asset class is not strongly affected by slow onset physical risks over the short and medium term. The influence on interest rates becomes significant in the long term (roughly from 2040 onwards). Significant lower economic growth in the long term drives nominal yields down.
- In the short to medium term, fixed income returns are not significantly impacted. In the long term, expected returns are lower due to the structurally low yields.
- Credits have a positive climate shock over the whole horizon. In comparison to equities, this is partially explained by the shorter term horizon compared to equities while climate impacts, especially under the Failed Transition, are more long-term oriented.

Property:

- Real estate is significantly affected by the pricing in shocks as the asset class is sensitive to physical damages and requires a strong correction in its valuation.
- The asset class is further impacted more significantly towards the end of the period when physical damages start to affect real estate prices.

Infrastructure:

- Infrastructure assets are expected to be affected more than other asset classes, particularly so in the US. The asset class suffers more or less like listed equities.

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Tobias Read
Oregon State Treasurer

Michael Kaplan
Deputy State Treasurer

January 18, 2023

Members of the Oregon Legislature:

I've been asked in recent days about my position on HB 2601 and other investment-related legislation. I'll be direct: Statutorily limiting the investment opportunities of the Oregon Public Employee Retirement Fund (OPERF)—no matter how well-intentioned—will lead to lower returns, higher employer rates, and a less robust retirement for thousands of Oregonians.

Nearly 400,000 current and former public employees receive or will receive retirement benefits via OPERF. The average annual benefit is \$33,550. Money in OPERF, currently valued at more than \$91 billion, belongs to these individuals and no one else. This money comes from two sources. The first is contributions from employers and approximately 181,000 public employees, who currently pay into the fund and rightly expect that someday it will make their retirement possible. The second is earnings from the investment of these contributions, managed at Treasury under my leadership and the oversight of the Oregon Investment Council.

Just under 75 percent of all benefits paid out to retirees are made possible by Treasury-managed investment earnings. In 2022, OPERF returns outperformed policy benchmarks by nearly 7 percent and the standard market portfolio by over 15 percent, proving that our investment strategies are beating expectations and resilient in all market conditions. Under Treasury's management, OPERF investment strategies have returned billions of dollars in net revenues to beneficiaries.

Legislation that imposes blanket or even targeted restrictions on how or where Treasury can invest will affect these numbers and would mean that funding retirement incomes is no longer the sole purpose of OPERF. Claims that limiting Oregon's investment choices through statute will automatically or easily be revenue-neutral or yield higher returns are pure fiction.

Instead, these restrictions will almost certainly lead to a reduction in investment returns and the benefits OPERF payments afford communities across our state. Lower returns would mean an increase in OPERF's unfunded liability. This could potentially erase the progress in funding status we've achieved from 75.4 percent when I was elected Treasurer in 2016, to 86 percent in 2021. A larger unfunded liability will require larger contributions from employers and their employees. When public entities must direct more money to cover their retirement system obligations, they have less money for the classroom, the firehouse, child welfare offices, and other state and local government services. Further, disregarding existing state law about investing for the sole benefit of OPERF beneficiaries will invite lawsuits and threaten our tax-Members of the Oregon Legislature exempt status while breaking beneficiaries' trust in our stewardship of their personal retirement dollars.



Treasurer's Office - Capitol
900 Court Street NE, Room 159
Salem, OR 97301-3896
503.378.4329

Main Office
867 Hawthorne Ave SE
Salem, OR 97301
503.378.4000

oregon.gov/treasury
oregon.treasurer@state.or.us

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Members of the Oregon Legislature
January 18, 2023
Page Two

It's one thing to offer commentary and criticism of how this money is invested or which companies to pick; it's quite another to have a fiduciary and statutory responsibility to make participants' money as productive as possible, and to earn a rate of return each and every year, in good markets and bad, to ensure Oregon meets its promises to public servants. Our team of investment professionals has proven to be more than capable of meeting our fiduciary responsibilities while navigating changing market conditions and macro industry shifts, and I am confident in our ability to anticipate and respond to future market conditions.

Our obligation extends far into the future, and so does our planning. As legislation is introduced and debated this session, I urge you to reach out to me and my team, which includes 69 investment professionals who have taken great care to construct and manage diversified portfolios that deliver for Oregonians. I would be happy to provide details about work underway at Treasury to develop a responsible pathway to a net-zero portfolio that still allows us to respond to dynamic market conditions as the energy transition continues.

Sincerely,



Tobias Read

CC:

Governor Tina Kotek
Bob Livingston, Legislative Director and Labor Liaison, Office of the Governor
Kevin Olineck, Director, Oregon Public Employees Retirement System
Cara Samples, Chair, Oregon Investment Council
John Russell, Vice-Chair, Oregon Investment Council
Lorraine Arvin, Member, Oregon Investment Council
Pia Wilson-Body, Member, Oregon Investment Council
George Naughton, Chief Financial Officer, Department of Administrative Services
Amanda Beitel, Legislative Fiscal Officer, Oregon State Legislature
Chris Allanach, Legislative Revenue Officer, Oregon State Legislature
Misty Mason Freeman, Legislative Policy and Research Director, Oregon State Legislature

Returns for periods ending DEC-2021

Oregon Public Employees Retirement

Regular Account

OPERF

Policy¹Target¹\$ Thousands²

Actual

Public Equity

25.0-35.0%

30.0%

\$ 25,734,656

26.7%

Thank you, Chair Samples, and members of the Oregon Investment Council.

In his recent letter to the legislature about HB 2601, the Treasury Investment and Climate Protection Act, Treasurer Read said: “**I’ll be direct:** Statutorily limiting the investment opportunities of OPERF... will lead to lower returns, higher employer rates, and a less robust retirement for thousands of Oregonians.”

But is this true? Treasurer Read provided no data to support his statement, no analysis of OPERF’s fossil fuel performance to counter analysis presented at the public hearings for the bill that fossil fuels have in fact already been costing beneficiaries over the past decade, and, astonishingly, no data to counter the Ortec reports’ conclusions that divesting fossil fuels would be a significant money maker for OPERF.

A recent study showing that supports divestment comes from the Colorado Public Employees’ Retirement Association, which covers 650,000 of their public employees. Boulder County commissioned a study to find out what would have happened if their pension fund had divested from thermal coal, oil and gas stocks.

I’ll be direct: The report found what we have found in Oregon - the Colorado pension fund could have earned an additional 21.8% from 2012 to 2022 if it had divested all its fossil fuel stocks in favor of the rest of the [portfolio](#).

The leading researcher stated: <QUOTE> “While it’s true that oil and gas stocks had a banner year over the past 12 months thanks to the Russia–Ukraine conflict, even taking this highwater mark for their stocks into account, over the past 10 years oil and gas was the worst-performing sector from a total returns perspective.” <UNQUOTE>

As Rick mentioned, OST’s own commissioned climate risk assessment came to the same conclusion. The Colorado study is just the latest set of data demonstrating that it is fossil fuel **investment** – not **divestment** – that risks pension funds returns.

Another example? The New York State Common Retirement Fund that has been divesting from fossil fuels for the last 3 years and had **higher returns** in 2022 than did the Oregon Treasury (9.5% to Oregon’s 6.3%). This followed results

from a similar study in 2016 that they had lost at least \$5.3 billion from investments in coal, oil, and gas.

Continuing to shovel large, illiquid investments into fossil fuel private investment funds, as was reported at the January OIC meeting, when others are exiting the sector, will cause more risk to OPERF, not less.

As the co-lead of Divest Oregon, I ask that this fear mongering is stopped and that you respond to the over 66,000 PERS members that our coalition represents when they ask for no new fossil fuel investments and a timely phased divestment plan.

Thank you.

Susan Palmiter

Divest Oregon Co-Lead

From: [annie](#)
To: [OIC Public Comments](#)
Subject: stop investing in fossil fuels
Date: Tuesday, April 11, 2023 8:24:51 PM

This email is from a party external to Treasury. Use care with links and attachments.

As a taxpayer, I don't want my money invested in a dying industry. I want the state to make smart investments and get good returns.

As a person who breathes and drinks water, I am horrified that the state is making illogical investments in companies that are already hurting our environment and our health, like Zenith Energy here in Portland.

I don't want to be hurt twice by these imprudent investments. Get out of fossil fuels NOW and make us financially healthy and environmentally healthy.

annie capestany

97202

From: [Patricia Kramer](#)
To: [OIC Public Comments](#)
Subject: support for HB 2601
Date: Wednesday, March 1, 2023 4:53:48 PM

This email is from a party external to Treasury. Use care with links and attachments.

Dear members of the OIC,

I am an enthusiastic proponent of HB 2601 (Treasury Investment and Climate Protection Act) and I welcome the opportunity to comment on this important bill. I have been a PERS member since 1988, when I joined the faculty at Oregon Health Sciences University. I also serve on the Climate, Energy and Environment Team of the Consolidated Oregon Indivisible Network, which strongly supports this legislation.

Until last year, I rested assured that the Oregon State Treasury was making informed, responsible investments for Oregon, particularly regarding PERS pension funds. As a PERS member and beneficiary, I am aghast to find out that approximately 60% of the \$90 billion of Oregon Treasury funds invested in PERS are in Private Equity funds -- a primary source of funds for the fossil fuel industry. This, despite the fact that fossil fuels are driving the climate crisis and are a risky mid- and long-term investment. Thus, **financial urgency and risk of the climate crisis on PERS funds requires no new fossil fuel investments and a phased exit from existing holdings**

As a private citizen, I am actively involved in stewarding our natural resources in the context of impacts of climate change on our economy and landscape. I am deeply disturbed by Oregon Treasury investments in the fossil fuel industry in both PERS and non-PERS portfolios, and the risk that these investments create for the sustainability of the Treasury for all Oregonians. Furthermore, **I am alarmed at the lack of accountability demonstrated by Treasury leadership and by the lack of transparency in providing clear information to Oregonians on where and how their money is invested.**

To be fair, Treasurer Read published a report in February 2022, Climate Risk Scenario Modelling Report, which agrees that PERS public equity fossil fuel investments are a financial risk to the Treasury, and that the portfolio needs to be “decarbonized”. Less than a year later, the Treasury made a half-billion dollars’ worth of NEW investments in fossil fuels in January 2023. **Clearly, there is a lack of oversight of the Oregon Treasury.** It is clearly time for a legislative statute to provide certainty and structure for a permanent, enforceable solution to this serious problem.

I want to feel confident again that the Oregon Treasury is protecting the investments not only for PERS beneficiaries but for all the good people of Oregon, as we grapple with the reality of climate change and practice responsible stewardship of our natural and financial resources. I believe this bill is a clear and expedient way to accomplish that.

Sincerely,
Patricia L. Kramer, Ph.D.
Portland
Emeritus Professor of Neurology, OHSU
Member, the Consolidated Oregon Indivisible Network (COIN)