

Climate Change as Systemic Risk

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ABSTRACT

Hindsight tells us that COVID-19, thought by former President Trump and others to have come out of nowhere, is more aptly labelled a “gray rhino” event, one that was highly probable and preventable. Indeed, despite considerable evidence of the impending threats of pandemics, for the most part, governments failed to prepare for the pandemic, resulting in wide-scale social and economic losses.

The lessons from COVID-19, however, should remind us of the perils of ignoring gray rhino risks. Nowhere is this more apparent than with climate change, a highly probable, high impact threat that has largely been ignored to date. Despite those who deny climate change, there remains ample evidence of the increasing temperature of the earth. Moreover, like COVID-19, climate change has the potential not only to create public health emergencies, but also to create wide-scale, enormous adverse impacts on the economy.

Indeed, the risks posed by climate change to the economy have the potential to be so far-reaching that climate change should—as this article argues—be termed a systemic risk. As such, the economic implications of climate change need to be mitigated in order to preserve economic stability. This is not only necessary for prudential and economic reasons, but also to protect citizens’ health and safety, and to ensure that business does not exceed the limits of the planet.

While there has been some attention to addressing the economic implications of climate change at the global level, progress in the U.S. has been minimal. This is surprising for two reasons. First, because climate change has already caused unprecedented damage in certain parts of the country. Second, because to some extent, existing legislation and models may offer the tools to address the systemic risks of climate change. Drawing inspiration from the Dodd-Frank Act, SEC rules, and the FDIC model, among others, this article proposes regulatory approaches for mitigating the systemic risks of climate change in hopes that COVID-19 does not foreshadow our fate for climate change.

Keywords: climate change, systemic risk, COVID-19, SEC, disclosure, corporate law, financial institutions, sustainable finance, stranded assets, green investments, greenhouse gases, fossil fuels

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INTRODUCTION

On New Year’s Eve 2019, the stock market closed with substantial gains. The S&P 500 posted gains of nearly 30% for the year; the Dow Jones, 22%; and the Nasdaq reflected gains of almost 35%.¹ The market had not seen such significant gains since 2013.²

On the same day that the markets closed at unprecedented highs, the Chinese government informed the World Health Organization (WHO) that they were treating cases of “pneumonia of unknown etiology” in Wuhan city.³ These cases

1. Sergei Klebnikov, *Here’s How 2019 Turned Out To Be A Historic Year For The Stock Market*, FORBES (Jan. 1, 2020), <https://www.forbes.com/sites/sergeiklebnikov/2020/01/01/heres-how-2019-turned-out-to-be-a-historic-year-for-the-stock-market/?sh=2e4744c78c47>; Al Lewis, *The Stock Market Boomed in 2019. Here’s How it Happened*, CNBC (Dec. 31, 2019).

2. Klebnikov, *supra* note 1; Lewis, *supra* note 1.

3. WORLD HEALTH ORG. [WHO], *Pneumonia of Unknown Cause – China* (Jan. 5, 2020).

later became known as COVID-19.⁴ Within three months of the Chinese report to the WHO, over 500,000 people around the world became infected with COVID-19, with over 68,000 confirmed cases in the U.S. alone.⁵ Seven months after the report, the number of U.S. COVID-19 cases surpassed 4 million.⁶

The effect of the pandemic on the economy was equally swift. Within two and a half months of the first confirmed case in the U.S., nearly 17 million Americans lost their jobs.⁷ On March 23, 2020, the S&P 500 fell by over 30% from the beginning of the year⁸ and by the end of March—only three months since the Chinese reported COVID-19 to the WHO—the S&P 500 and Dow Jones both posted their worst first quarters in history.⁹

The economic situation outside of the U.S. was similarly bleak. China's economic growth contracted by nearly seven percent in the first quarter,¹⁰ the UK's FTSE 100 posted its biggest quarterly fall since Black Monday,¹¹ and almost 80 countries sought aid from the International Monetary Fund (IMF).¹² At the market's lowest point in March, the global equity markets experienced a loss of 26 trillion dollars.¹³ The IMF director noted that the outlook for global growth was “negative—a recession at least as bad as during the global financial crisis or worse.”¹⁴

4. World Health Org. Dir.-Gen. Tedros Adhanom, Remarks at the Media Briefing on 2019-nCoV (Feb. 11, 2020) (transcript available online at <https://www.who.int/director-general/speeches/detail/who-director-general-s-remarks-at-the-media-briefing-on-2019-ncov-on-11-february-2020>).

5. World Health Org. [WHO], *Coronavirus Disease 2019 (COVID-19) Situation Report-67*, at 1 (Mar. 27, 2020), https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200327-sitrep-67-covid-19.pdf?sfvrsn=b65f68eb_4.

6. David J. Lynch et al., *U.S. Coronavirus Deaths Top 1,000 for Four Consecutive Days*, WASH. POST (July 26, 2020).

7. Sarah Chaney & David Harrison, *U.S. Jobless Claims Soar for Third Straight Week*, WALL ST. J. (Apr. 9, 2020), <https://www.wsj.com/articles/u-s-surge-in-unemployment-claims-expected-to-continue-11586424605>.

8. Julie Jason, *The Coronavirus Stock Market: A Market Gone Wild*, FORBES (Apr. 8, 2020), <https://www.forbes.com/sites/juliejason/2020/04/08/the-coronavirus-stock-market-a-market-gone-wild/?sh=369bf6fa31f2>.

9. Fred Imbert et al., *Stock Market Live Tuesday: Dow Drops 410 Points, Down 23% in 2020, Worst First Quarter Ever*, CNBC NEWS (Mar. 31, 2020), <https://www.cnbc.com/2020/03/31/stock-market-today-live.html>.

10. Laura He, *China's Economy Just Shrank for the First Time in Decades. It Could Still Eke Out Growth This Year*, CNN BUS. (Apr. 17, 2020), <https://www.cnnphilippines.com/business/2020/4/18/china-economy-shrank.html>.

11. Richard Partington, *FTSE 100 Posts Largest Quarterly Fall Since Black Monday Aftermath*, GUARDIAN (Mar. 31, 2020), <https://www.theguardian.com/business/2020/mar/31/ftse-100-posts-largest-quarterly-fall-since-black-monday-aftermath>.

12. Press Release, Int'l Monetary Fund [IMF] Managing Dir. Kristalina Georgieva, *The Great Lockdown: Worst Economic Downturn Since the Great Depression* (Mar. 23, 2020), (on file at <https://www.imf.org/en/News/Articles/2020/03/23/pr2098-imf-managing-director-statement-following-a-g20-ministerial-call-on-the-coronavirus-emergency>).

13. Adam Tooze, *How Coronavirus Almost Brought Down the Global Financial System*, GUARDIAN (Apr. 14, 2020), <https://www.theguardian.com/business/2020/apr/14/how-coronavirus-almost-brought-down-the-global-financial-system>.

14. IMF, *supra* note 12.

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The impacts of COVID-19 have caused some commentators to label it a “black swan” event,¹⁵ a rare event with an extreme impact that could not have been predicted.¹⁶ Trump described it as “an unforeseen problem” that “came out of nowhere.”¹⁷ Yet as early as 2005, the U.S. Department of Homeland Security was urging private sector businesses to take action in order to be able to prepare for, respond to, and recover from a pandemic.¹⁸ The WHO’s Global Preparedness Monitoring Board made similar pleas for states and businesses to prepare for a pandemic,¹⁹ as did the U.S. Intelligence Committee.²⁰ COVID-19, as it turns out, was completely foreseeable.

For that reason, it may be more apt to term COVID-19 a “gray rhino,” a “highly probable, high impact yet neglected threat.”²¹ Gray rhino events are not “complete” surprises, but rather are events one ought to see coming.²² Despite their size and the obviousness of the threat they pose, gray rhinos tend to be ignored even though they are crises that “we have the power to do something about.”²³

Ignoring threats such as COVID-19 demonstrates the perils of ignoring gray rhino risks. Nowhere is this more apparent than with climate change, a risk that likely perpetuated COVID-19,²⁴ and which is arguably a highly probable, high

15. *E.g.* 2020's *Black Swan: Coronavirus*, GOLDMAN SACHS (Mar. 3, 2020), <https://www.goldmansachs.com/insights/pages/coronavirus.html>; Sequoia, *Coronavirus: The Black Swan of 2020*, MEDIUM (March 5, 2020), <https://medium.com/sequoia-capital/coronavirus-the-black-swan-of-2020-7c72bdeb9753>; Robert Stapleman, *Coronavirus is a 'Black Swan' Event*, HERALD-TRIBUNE (Mar. 23, 2020), <https://www.heraldtribune.com/business/20200323/coronavirus-is-black-swan-event>.

16. *See* NASSIM NICHOLAS TALEB, *THE BLACK SWAN: THE IMPACT OF THE HIGHLY IMPROBABLE* xxii (2nd ed. 2010) (defining black swan event as “an outlier, as it lies outside the realm of regular expectations, because nothing in the past can convincingly point to its possibility,” that carries “an extreme impact,” and “in spite of its outlier status, human nature makes us concoct explanations for its occurrence after the fact, making it explainable and predictable”).

17. Donald J. Trump, President of the United States, Remarks by President Trump at Signing of the Coronavirus Preparedness and Response Supplemental Appropriations Act, 2020 (Mar. 6, 2020) (transcript available at <https://trumpwhitehouse.archives.gov/briefings-statements/remarks-president-trump-signing-coronavirus-preparedness-response-supplemental-appropriations-act-2020/>).

18. *See* U.S. DEP’T OF HOMELAND SEC., *PANDEMIC INFLUENZA: PREPAREDNESS, RESPONSE, AND RECOVERY—GUIDE FOR CRITICAL INFRASTRUCTURE AND KEY RESOURCES* ii (2006); HOMELAND SEC. COUNCIL, EXEC. OFF. OF THE PRESIDENT, *NATIONAL STRATEGY FOR PANDEMIC INFLUENZA* 11 (2005).

19. *See* GLOB. PREPAREDNESS MONITORING BD., *A WORLD AT RISK: ANNUAL REPORT ON GLOBAL PREPAREDNESS FOR HEALTH EMERGENCIES* 7, 24, 33 (2019), https://apps.who.int/gpmb/assets/annual_report/GPMB_annualreport_2019.pdf.

20. *See Worldwide Threat Assessment of the U.S. Intelligence Community Hearing Before the S. Select Comm. on Intelligence*, 116th Cong. 21 (2019) (statement of Daniel R. Coats, Director of National Intelligence).

21. MICHELE WUCKER, *THE GRAY RHINO - HOW TO RECOGNIZE AND ACT ON THE OBVIOUS DANGERS WE IGNORE* 235 (2016).

22. *Id.* at 7.

23. *Id.*

24. *See* Damian Carrington, *Coronavirus: 'Nature is Sending Us a Message', Says UN Environment Chief*, GUARDIAN (Mar. 25, 2020), <https://www.theguardian.com/world/2020/mar/25/coronavirus-nature-is-sending-us-a-message-says-un-environment-chief> (noting that climate change forces animals to move, which “creates an opportunity for pathogens to get into new hosts,” which is what caused COVID-19); Patrick Greenfield, *Ban Wildlife Markets to Avert Pandemics, Says UN Biodiversity Chief*, GUARDIAN (Apr. 6, 2020), <https://www.theguardian.com/world/2020/apr/06/ban-live-animal-markets-pandemics-un-biodiversity-chief-age-of-extinction>.

impact threat that has largely been ignored to date. Despite those who deny climate change, there remains ample evidence of the increasing temperature of the earth, from the tripling of heat waves in large cities,²⁵ to the largest wildfire in Los Angeles in its history,²⁶ to the costliest hurricanes all in one year (Irene, Harvey, and Maria) that caused a combined \$265 billion in damages.²⁷ Moreover, like COVID-19, climate change has the potential not only to create public health emergencies, but also to cause wide-scale, enormous adverse impacts on the economy. Indeed, the risks posed by climate change to the economy have the potential to be so far-reaching that climate change is, in effect, a systemic risk. As such, regulation aimed at curbing climate change must incorporate its systemic risk nature.

This article will argue for treating climate change as a systemic risk in three parts. Part I begins by examining climate change as a systemic risk. It defines systemic risk, presents a background on climate change, and then examines how these two seemingly disparate areas link together. Part II analyzes how climate change should be regulated as a systemic risk. It begins by examining whether regulation is needed in this area, and if needed, whether such regulation can be justified. It then explores existing regulatory approaches, focusing first on the Securities and Exchange Commission's (SEC) approach before looking at global approaches. Having found existing regulatory approaches lacking, Part III explores other approaches to regulating climate change as a systemic risk. Specifically, it focuses on regulatory approaches that not only address economic stability, but also work towards decoupling economic growth from greenhouse gas emissions.

I. CLIMATE CHANGE AS SYSTEMIC RISK?

To better understand why climate change should be viewed as a systemic risk, Section A will examine what precisely systemic risk is, and then Section B will explore what climate change entails. Section C will connect the previous two, discussing how climate change can be conceptualized as systemic risk.

25. Kendra Pierre-Louis, *Heat Waves in the Age of Climate Change: Longer, More Frequent and More Dangerous*, N.Y. TIMES (July 18, 2019), <https://www.nytimes.com/2019/07/18/climate/heatwave-climate-change.html>.

26. U.S. GLOB. CHANGE RSCH. PROGRAM, FOURTH NATIONAL CLIMATE ASSESSMENT: VOL. II – IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES 444 (2018).

27. Doyle Rice, *2017's Three Monster Hurricanes — Harvey, Irma and Maria — Among Five Costliest Ever*, USA TODAY (Feb. 1, 2018), <https://www.usatoday.com/story/weather/2018/01/30/2017-s-three-monster-hurricanes-harvey-irma-and-maria-among-five-costliest-ever/1078930001/>.

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A. Defining Systemic Risk

Systemic risk lacks a widely accepted definition.²⁸ Broadly speaking, it involves a shock that causes adverse economic effects that spread the consequences through a “domino effect,” leading to the material impairment of the market.²⁹

Systemic risk is often thought of in the context of failing financial institutions.³⁰ In this scenario, the emphasis is on the shock event leading to the failure of one or more financial institutions, which then causes adverse ripple effects throughout the financial system.³¹ The shock can be exogenous or endogenous; that is, from outside or inside the financial system.³² An example of systemic risk arising from an endogenous shock is the 2008-9 financial crisis. In that crisis, the interconnectedness of financial institutions led to wide-scale instability in the financial markets resulting from defaults of sub-prime mortgages.³³

Shocks can also have effects on more than just financial institutions and affect the economy generally.³⁴ Examples of such shocks can include sudden hyperinflation or “a liquidity shortage in an important market.”³⁵ These types of shocks can give rise to systemic risk since the risk is positively correlated with the market, and cannot be diversified away.³⁶ For this reason, the widespread failure of institutions, even if not financial institutions, can result in systemic risk if their failures are large enough to jeopardize the viability of capital markets.³⁷

By drawing these concepts together, a working definition for systemic risk emerges. Systemic risk thus involves a shock, either exogenous or endogenous, to the economic system that impairs the flow of capital and threatens the stability of the economy.³⁸

28. EUR. CENT. BANK, FINANCIAL STABILITY REVIEW: DECEMBER 2009, at 134 (2009); ARON GOTTESMAN & MICHAEL LEIBROCK, UNDERSTANDING SYSTEMIC RISK IN GLOBAL FINANCIAL MARKETS 2 (2017).

29. Oliver De Bandt & Philipp Hartmann, *What Is Systemic Risk Today?* 40-41 (Institute for Monetary and Econ. Studies, Bank of Japan, Working Paper, 1998), <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.195.400&rep=rep1&type=pdf>; Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L. J. 193, 198 (2008); EUR. CENT. BANK, *supra* note 28, at 134. Examples of shocks include failure of a financial institution due to fraud, a “sudden devaluation of a noninternationalised currency” due to a budgetary deficit, or a sudden increase in inflation. *See* De Bandt & Hartmann at 42.

30. Schwarcz, *supra* note 29, at 198.

31. De Bandt & Hartmann, *supra* note 29, at 40-41.

32. EUR. CENT. BANK, *supra* note 28, at 134; PAWEŁ SMAGA, THE CONCEPT OF SYSTEMIC RISK, SRC SPECIAL PAPER NO 5, at 5 (2014); Jean-Pierre Fouque & Joseph A. Langsam, *Introduction*, in HANDBOOK OF SYSTEMIC RISK xxi (Jean-Pierre Fouque & Joseph A. Langsam eds., 2013).

33. Iman Anabtawi & Steven L. Schwarcz, *Regulating Systemic Risk: Towards an Analytical Framework*, 86 NOTRE DAME L. REV. 1349, 1410 (2011).

34. Schwarcz, *supra* note 29, at 200; De Bandt & Hartmann, *supra* note 29, at 43.

35. De Bandt & Hartmann, *supra* note 29, at 42.

36. Schwarcz, *supra* note 29, at 200; RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 446 (6th ed. 2003).

37. Schwarcz, *supra* note 29, at 202. *See also* De Bandt & Hartmann, *supra* note 29, at 43.

38. Fouque & Langsam, *supra* note 32, at xxi.

B. *Understanding Climate Change*

Climate change is one of, if not *the* defining challenge of the 21st century. It refers to the change in the earth's climate as a result of human activity and the adverse effects—driven by rising global temperatures—that arise from that change.³⁹ The rising temperature of the earth is caused by human activities that increase the “atmospheric concentrations of greenhouse gases,” which warm the earth's surface and “adversely affect natural ecosystems and humankind.”⁴⁰

Since the pre-industrial period, the earth's temperature has increased by approximately one degree Celsius.⁴¹ The Intergovernmental Panel Committee on Climate Change has warned that exceeding a 1.5 degrees Celsius increase in temperature poses large risks for natural and human systems, some of which may be irreversible.⁴² Indeed, the benefits of limiting global warming to 1.5 degrees Celsius are so crucial that they were codified in the *Paris Agreement under the United Nations Framework Convention on Climate Change*, although the Agreement allows for an upper limit of “well below” 2 degrees Celsius for global warming.⁴³

The impacts of climate change are already noticeable. Seventeen of the eighteen warmest years on record have all occurred during the 21st century,⁴⁴ cloud forests are dying,⁴⁵ and the 2017 hurricane season caused over \$250 billion in damages and over 250 deaths.⁴⁶ Australia has also recently suffered from “unprecedented bushfire activity,”⁴⁷ while forest fires have plagued the Arctic and Siberia, threatening the melting of the permafrost.⁴⁸

39. *Id.*; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, GLOBAL WARMING OF 1.5°C - AN IPCC SPECIAL REPORT ON THE IMPACTS OF GLOBAL WARMING OF 1.5°C ABOVE PRE-INDUSTRIAL LEVELS AND RELATED GLOBAL GREENHOUSE GAS EMISSION PATHWAYS, IN THE CONTEXT OF STRENGTHENING THE GLOBAL RESPONSE TO THE THREAT OF CLIMATE CHANGE, SUSTAINABLE DEVELOPMENT, AND EFFORTS TO ERADICATE POVERTY 51 (2019) [hereinafter IPCC REPORT].

40. The United Nations Framework Convention on Climate Change pmbl., May 9, 1992, 1771 U.N.T.S. 164.

41. IPCC REPORT, *supra* note 39, at 31 (2019).

42. *Id.* at 277.

43. Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 13, 2015, in Rep. of the Conference of the Parties on the Twenty-First Session, art. 2(1)(a), U.N. Doc. FCCC/CP/2015/10/Add.1, annex (2016).

44. WMO Confirms 2017 Among the Three Warmest Years on Record, WORLD METEOROLOGICAL ORG. [WMO] (Jan. 18, 2018), <https://public.wmo.int/en/media/press-release/wmo-confirms-2017-among-three-warmest-years-record>.

45. Cleiton B. Eller et al., *Cloud Forest Trees with Higher Foliar Water Uptake Capacity and Anisohydric Behavior are More Vulnerable to Drought and Climate change*, 211 NEW PHYTOLOGIST 489 (2016); Pru Foster, *The Potential Negative Impacts of Global Climate Change on Tropical Montane Cloud Forests*, 55 EARTH-SCIENCE REV. 73 (2001).

46. U.S. GLOBAL CHANGE RSCH. PROGRAM, *supra* note 26, at 66.

47. Geert Jan van Oldenborgh et al., *Attribution of the Australian Bushfire Risk to Anthropogenic Climate Change*, 21 NAT. HAZARDS EARTH SYS. SCI. 941, 941-42 (2020).

48. Jonathan Watts, *The Swedish Town on the Frontline of the Arctic Wildfires*, GUARDIAN (July 30, 2018), <https://www.theguardian.com/world/2018/jul/30/the-swedish-town-on-the-frontline-of-the-arctic-wildfires>; Jin-Soo Kim et al., *Extensive Fires in Southeastern Siberian Permafrost Linked to Preceding Arctic Oscillation*, SCI. ADVANCES, Jan 2020, at 1.

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Yet climate change experts predict that the impending impacts of climate change will be even more detrimental. For instance, coastal cities such as New York City, which have already experienced severe flooding, are expected to be partially under water in the near future due to rising sea levels.⁴⁹ Temperatures will continue to rise, making extreme heat waves more common. Precipitation and monsoons will be heavy in some regions, while droughts will occur in others. Both the risk of fires and the frequency of floods will increase.⁵⁰ Experts forecast that native species will be eliminated, the permafrost will continue thawing, ecosystems will be affected, and coral reefs will disappear almost completely.⁵¹ Rice, wheat, and other cereal crops yields will be reduced, livestock will be lost, and fisheries and aquaculture important to global food security will face increasingly greater risks.⁵² Humans will face increased rates of heat-related morbidity and mortality, higher incidences of malaria and dengue fever from warmer conditions, and other problems.⁵³

Despite finding that global warming will cross the 1.5 degrees Celsius threshold within ten to twenty years if the temperature continues to rise at the current rate, the Intergovernmental Panel on Climate Change remains cautiously optimistic.⁵⁴ The Panel concluded that scientifically it is possible to limit global warming to 1.5 degrees Celsius.⁵⁵ This would require rapid and far-reaching transitions in most sectors, deep emissions reductions in all sectors, numerous mitigation options, and a significant upscaling of investments in those options.⁵⁶ Global net human-caused emissions of carbon dioxide—one of the largest human created greenhouse gases—would also need to decrease by almost half by 2030 and reach net zero⁵⁷ by 2050 to effectively limit global warming to 1.5 degrees Celsius.⁵⁸

C. Climate Change as a Systemic Risk

It is initially difficult to view the links between climate change and systemic risk, given that they occupy such distinct arenas. To do so, it is useful to reason through analogy by revisiting the losses caused by the last systemic crisis, the 2008-9 financial crisis.

49. U.S. GLOBAL CHANGE RSCH. PROGRAM, *supra* note 26, at 335, 338. *See also* IPCC REPORT, *supra* note 39, at 207.

50. IPCC REPORT, *supra* note 39, at 187-88.

51. *Id.* at 221-29.

52. *Id.* at 236-38.

53. *Id.* at 240-41.

54. *Headline Statements – Understanding Global Warming of 1.5°C* (2019), INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, <https://www.ipcc.ch/sr15/resources/headline-statements/>.

55. IPCC REPORT, *supra* note 39, at 6.

56. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 54.

57. *See* Josh Burke, *What is Net Zero* (Apr. 30, 2019), (demonstrating net zero can be achieved by either balancing carbon emissions with carbon removal or by eliminating carbon emissions altogether).

58. IPCC REPORT, *supra* note 39, at 12.

The Government Accountability Office and others estimate that the 2008-9 financial crisis caused trillions of dollars of losses to the U.S. economy⁵⁹ and a 2.5 percent reduction in GDP.⁶⁰ Comparatively, experts predict that climate change will cause an even greater scale of losses than the last financial crisis.

Studies estimate that climate change will cause U.S. GDP to fall by at least 4 percent by 2050 and by over 10 percent by 2100 if global warming increases by more than 2 degrees Celsius.⁶¹ An IMF report predicts that the effect of climate change on the U.S. will outpace the loss in GDP experienced by comparable countries, which is expected to decrease by 2.5 percent by 2050 and 7.2 percent by 2100.⁶² There will also likely be productivity losses. Studies estimate the loss of \$160 billion in lost wages per year by 2090.⁶³

In short, the economic consequences of climate change are expected to be at least as dire, if not more pronounced, than the effects of the 2008-9 financial crisis. Indeed, the effects of climate change may be more akin to those arising from COVID-19, which caused the worst contraction in GDP since the second world war and the loss of 9.4 million jobs.⁶⁴

However, unlike the financial crisis, climate change risks that can result in a systemic crisis fall into two specific categories: physical risks and transition risks. The next two sections further elucidate the nature of these risks in an effort to better clarify the potential for climate change to cause a systemic crisis.

59. As the GAO notes, “[s]tudies generally find that the recent crisis was associated with large losses in economic output, but estimates of such losses vary and depend on several assumptions.” The GAO estimates output losses at over 10 trillion. See US GOVERNMENT ACCOUNTABILITY OFFICE (GAO), FINANCIAL REGULATORY REFORM – FINANCIAL CRISIS LOSSES AND POTENTIAL IMPACTS OF THE DODD FRANK ACT 12, 15 (2013). The Federal Reserve Bank of Dallas estimates lost household wealth at 16 trillion while the Treasury estimated the same losses at 19.2 trillion. See David Luttrell et al., *Assessing the Costs and Consequences of the 2007–09 Financial Crisis and Its Aftermath*, FED. RESERVE BANK DALL., Sept. 2013, at 1, <https://www.dallasfed.org/research/eclett/2013/el1307.cfm>; U.S. DEP’T TREASURY, THE FINANCIAL CRISIS RESPONSE IN CHARTS (Apr. 2012), https://www.treasury.gov/resource-center/data-chart-center/Documents/20120413_FinancialCrisisResponse.pdf.

60. Kimberly Amadeo, *2009 GDP Statistics, Growth, and Updates by Quarter*, BALANCE (Feb 15, 2020), <https://www.thebalance.com/2009-gdp-statistics-3306037>.

61. Matthew E. Kahn et al., *Long-Term Macroeconomic Effects of Climate Change: A Cross-Country Analysis* 35 (IMF Working Paper 2019); Tom Kompas et al., *The Effects of Climate Change by GDP on Country and the Global Economic Gains from Complying With the Paris Climate Accord*, 6 EARTH’S FUTURE 1153, 1161 (2018) (predicting over six percent loss of GDP by 2047). See also U.S. GLOBAL CHANGE RRCH. PROGRAM, *supra* note 26, at 26 (“annual losses in some sectors are expected to reach billions of dollars by the end of the century”).

62. Kahn et al., *supra* note 61, at 35.

63. JEREMY MARTINICH & ALLISON CRIMMINS, MULTI-MODEL FRAMEWORK FOR QUANTITATIVE SECTORAL IMPACTS ANALYSIS: A TECHNICAL REPORT FOR THE FOURTH NATIONAL CLIMATE ASSESSMENT 55 (2017).

64. John-Paul Ford Rojas, *COVID-19: US Economy Posts Worst Annual Decline Since 1946*, SKY NEWS (Jan. 28, 2021), <https://news.sky.com/story/covid-19-us-economy-posts-worst-annual-decline-since-1946-12201710>; Lucia Mutikani, *U.S. Economy Loses Jobs as COVID-19 Hammers Restaurants, Bars*, REUTERS (Jan. 8, 2021), <https://www.reuters.com/article/usa-economy-idCNL1N2J13BK>.

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1. Physical Risks

The physical risks of climate change arise from frequent and/or “severe weather events,” as well as long-term changes to the environment.⁶⁵ More specifically, physical risks arise “from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability of exposure of human and natural systems, including their ability to adapt.”⁶⁶ Physical risks from climate change include more frequent and severe floods, droughts, fires, and/or hurricanes, as well as declining arability of farmland, rising sea levels, ecosystem collapse, and worsening levels of water availability and quality.⁶⁷ These risks may be acute—involving event-driven risks such as a hurricane—or chronic, such as a sea level rise which is caused by “longer-term shifts in climate patterns.”⁶⁸

The G20-appointed Task Force on Climate-Related Financial Disclosures identified some of the financial impacts of the physical risks of climate change. These include reduced revenue arising from decreased production capacity, such as transport difficulties or interruptions to supply chains; impacts on the workforce such as health problems for workers; and lower sales or output.⁶⁹ Physical risks will also increase costs due to problems with the workforce arising from health, safety, or absenteeism, as well as higher operating costs and increased capital costs from damage to facilities.⁷⁰ Damage to property and assets from climate change may also result in write-offs to assets and increased insurance premiums. Insurers may even make it more difficult to insure assets that are located in areas prone to climate change risks.⁷¹

It is easy to imagine scenarios where one or more of these types of physical risks of climate change arise as a systemic risk. The fall of either a systemically important financial institution (SIFI)⁷² or correlated stress from a number of

65. Gregg Gelzins & Graham Steele, *Climate Change Threatens the Stability of the Financial System*, Center for American Progress, CTR. FOR AM. PROGRESS (Nov 21, 2019), <https://www.americanprogress.org/issues/economy/reports/2019/11/21/477190/climate-change-threatens-stability-financial-system/>; FINANCIAL STABILITY BOARD, RECOMMENDATIONS OF THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES – FINAL REPORT 6 (2017) [hereinafter TASK FORCE REPORT]; Yannis Dafermos et al., *Climate Change, Financial Stability and Monetary Policy*, 152 ECOLOGICAL ECON. 219 (2018); Brett Christophers, *Climate Change and Financial Instability: Risk Disclosure and the Problematics of Neoliberal Governance*, 107 ANNALS AM. ASS’N GEOGRAPHERS 1108, 1111 (2017); Michel Aglietta & Étienne Espagne, *Climate and Finance Systemic Risks, More than an Analogy?: The Climate Fragility Hypothesis* 14-15 (Working Paper No. 2016-10, 2016).

66. Sandra Batten et al., *Let’s Talk About the Weather: The Impact of Climate Change on Central Banks* 5 (Bank of England Staff Working Paper No. 603, 2016).

67. Gelzins & Steele, *supra* note 65; Christophers, *supra* note 65, at 1111.

68. TASK FORCE REPORT, *supra* note 65, at 6.

69. *Id.* at 10.

70. *Id.*

71. *Id.*

72. Systemically important financial institutions include global systemically important banks, as designated by the Financial Stability Board, financial institutions (bank and non-bank entities) with consolidated assets of more than \$50 million, and those institutions designated as such by the Financial

smaller firms exposed to the same physical risk could cause a systemic crisis.⁷³ In 1992, at least 16 insurance companies in Florida became insolvent after Hurricane Andrew caused \$26.5 billion in damages.⁷⁴ One can only imagine that when the next major hurricane hits—with damages predicted to exceed \$50 billion⁷⁵—and systemically important insurers are involved,⁷⁶ the effects on the economy could be devastating. Indeed, as insurance companies themselves have realized, climate change may bring about a world that is not insurable anymore.⁷⁷ Without the ability to insure, one commentator has argued that “the global credit system. . . would simply cease to function.”⁷⁸

2. Transition Risks

Contrary to the focus of physical risks of climate change events, transition risks highlight the risks associated with society’s response to climate change. They typically involve policy, regulatory, technological, and market risks.⁷⁹ Policy or regulatory risks include those risks that result from either constraining actions that contribute to climate change, or promoting actions that help businesses adapt to climate change.⁸⁰ These risks will inevitably lead to increased operating costs for businesses due to greater compliance costs and higher insurance premiums.⁸¹ Such risks may also lead to asset losses.⁸² For example, bans or limitations on the use of fossil fuels—one of the dominant causes of global warming⁸³—will pose significant risks for several industries including oil, energy,

Stability Oversight Council. *See* Financial Stability Board, *2019 List of Global Systemically Important Banks (G-SIBs)* (Nov. 22, 2019), <https://www.fsb.org/wp-content/uploads/P221119-1.pdf>.

73. Gelzinis & Steele, *supra* note 65.

74. *Id.*; SWISS RE, HURRICANE ANDREW: THE 20 MILES THAT SAVED MIAMI 1 (2017), https://media.swissre.com/documents/Hurricane_Andrew_25_Years.pdf; Amy O’Connor, *25 Years Later...What If an Andrew-Type Storm Hit Florida Today?*, INSURANCE J. (Aug. 28, 2017), <https://www.insurancejournal.com/news/southeast/2017/08/28/462518.htm>.

75. SWISS RE, *supra* note 74, at 1.

76. The Financial Account Stability Board previously identified systemically important insurers. *See* Financial Stability Board, *Review of the List of Global Systemically Important Insurers (G-SIIs)* (2017). It has now taken an activity rather than an entity-based approach to identifying systemic importance although insurers’ collective work continues to be identified as systemically important. *See* Ben Dyson, *IAIS to Suspend Annual Identification of ‘Systemically Important’ Insurers*, S&P GLOB. MKT. INTEL. (Nov. 15, 2018), <https://www.spglobal.com/marketintelligence/en/news-insights/trending/t564hucsvgbedqlian5h9a2>.

77. Arthur Nelsen, *Climate Change Could Make Insurance Too Expensive for Most People – Report*, GUARDIAN, Mar. 21, 2019. *See also* Mark Carney, Governor of the Bank of England and Chairman of the Financial Stability Board at Lloyd’s of London, *Breaking the Tragedy of the Horizon – Climate Change and Financial Stability* 5 (Sept. 29, 2015) (transcript available at <https://www.bis.org/review/r151009a.pdf>).

78. Adam Tooze, *Why Central Banks Need To Step Up On Global Warming*, FOREIGN POL’Y, July 20, 2019.

79. TASK FORCE REPORT, *supra* note 65, at 5; Christophers, *supra* note 65, at 1111; Gelzinis & Steele, *supra* note 65; Aglietta & Espagne, *supra* note 65, at 15.

80. TASK FORCE REPORT, *supra* note 65, at 5.

81. *Id.* at 10.

82. *Id.*

83. IPCC REPORT, *supra* note 39, at 5.

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and utilities. These risks may lead to early retirement of their assets or total write-offs, a concept known as stranded assets.⁸⁴

Improvement or innovations in technology can also pose risks for businesses.⁸⁵ As the Task Force on Climate Change-Related Disclosure notes, emerging technologies such as renewable energy, battery storage, energy efficiency, and carbon capture and storage will affect the competitiveness of certain organizations, their production and distribution costs, and ultimately the demand for their products and services from end users.⁸⁶

Technology risks can also lead to loss of assets through write-offs and early retirement, as well as reduced demand for businesses' existing products and services.⁸⁷

Finally, businesses face market risks in relation to climate change. This is the risk of "shifts in supply and demand" as consumer preferences change, and the market landscape evolves in response to climate change.⁸⁸ In this regard, one of the most alarming market risks will be not only those faced by certain industries, but also assets and securities tied to such industries.⁸⁹ For instance, by reducing carbon emissions activities in the economy, not only could carbon emission-emitting industries become less valuable, but the value of securities issued by such firms and "assets exposed to the price of carbon" would also decrease.⁹⁰ Commentators estimate that one-third of equity and fixed income assets are in carbon-intensive industries.⁹¹ Moving to a carbon neutral goal would "strand those assets" and result in trillion dollar losses.⁹²

Market risks from climate change could further materialize by way of what the former Bank of England's governor calls a "Minsky moment," or the "sudden collapse in asset prices."⁹³ This could occur, for instance, if there was a sudden shift away from carbon intensive industries. The revaluation of carbon-intense assets could result in related assets being offloaded at fire-sale prices, defaults on loans from stressed firms, debt repricing, and credit losses, all of which would

84. See Fergus Green, *The Logic of Fossil Fuel Bans*, 8 NATURE CLIMATE CHANGE 449 (2018) (discussing recent state initiatives to ban or limit fossil fuels); The write off or losses of assets from climate change are termed stranded assets. See Carney, *supra* note 77, at 10.

85. Batten et al., *supra* note 66, at 4.

86. TASK FORCE REPORT, *supra* note 65, at 6.

87. *Id.* at 10.

88. *Id.* at 6; Christophers, *supra* note 65, at 1112.

89. Christophers, *supra* note 65, at 1112; Gelzinis & Steele, *supra* note 65; Carney, *supra* note 77, at 10; Robinson Meyer, *How Climate Change Could Trigger the Next Global Financial Crisis*, ATLANTIC, Aug 1, 2019.

90. EUR. SYSTEMIC RISK BD., TOO LATE, TOO SUDDEN: TRANSITION TO A LOW-CARBON ECONOMY AND SYSTEMIC RISK 11 (2016); Christophers, *supra* note 65, at 1112; Gelzinis & Steele, *supra* note 65.

91. Carney, *supra* note 77, at 10.

92. Tooze, *supra* note 78.

93. Carney, *supra* note 77, at 9; Carney et al., Letter from Mark Carney, Open Letter on Climate-related Financial Risks, BANK OF ENGLAND (Apr. 17, 2019), <https://www.bankofengland.co.uk/news/2019/april/open-letter-on-climate-related-financial-risks>.

cause financial instability.⁹⁴ Recently, major oil producer British Petroleum (BP) announced that it will reduce the value of its oil and gas assets by \$17.5 billion in anticipation of a lowered demand from oil as more governments and businesses move to pursue the 2 degree Celsius threshold set out in the Paris Agreement.⁹⁵

3. Conclusion

Climate change thus aligns with the notion of systemic risk.⁹⁶ Beyond the numerous economic risks it poses generally, climate change will inevitably cause a shock to the economic system. The shock might arise from a physical risk or a transition risk, most likely in the form of policy changes to carbon usage once global warming crosses a certain threshold. The shock will likely then impair the flow of capital, for instance, by causing SIFIs to fail or by stranding carbon-intensive assets. Eventually, this will lead to widespread financial instability, not only in nation states, but quite possibly on an international scale.

While climate change has traditionally not been viewed by governments or commentators as a systemic risk, there are now a number of organizations that recognize the systemic risks posed by climate change. These include the Commodity Futures Trading Commission, the Senate Democrats' Special Committee on the Climate Crisis, and the Federal Reserve.⁹⁷

II. REGULATING CLIMATE CHANGE AS SYSTEMIC RISK

Despite the numerous risks posed by climate change, climate change regulation has typically faced an uphill battle. Government administrations have often made efforts to counter the risks of climate change, only to have these efforts reversed by subsequent administrations. For instance, the Clinton administration initially signed the Kyoto Protocol, which set out targets for developed countries to reduce their greenhouse gas emissions.⁹⁸ However, it failed to ratify the treaty, and the Bush administration eventually withdrew its

94. EUR. SYSTEMIC RISK BD., *supra* note 90, at 12; Meyer, *supra* note 89; Gelzinis & Steele, *supra* note 65.

95. Anjali Raval, *BP to Take Up to \$17.5bn Hit on Assets After Cutting Energy Price Outlook*, FIN. TIMES, June 15, 2020.

96. For an excellent discussion on this issue, see generally Graham S. Steele, *Confronting the 'Climate Lehman Moment': The Case For Macroprudential Climate Regulation*, 30 CORNELL J.L. & PUB. POL'Y 109 (2020).

97. COMMODITY FUTURE TRADING COMMISSION, *MANAGING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM, REPORT OF THE CLIMATE-RELATED MARKET RISK SUBCOMMITTEE, MARKET RISK ADVISORY COMMITTEE OF THE U.S. COMMODITY FUTURES TRADING COMMISSION* (2020); SENATE DEMOCRATS' SPECIAL COMMITTEE ON THE CLIMATE CRISIS, *THE CASE FOR CLIMATE ACTION* (2020); BD. GOVERNORS FED. RESERVE, *FINANCIAL STABILITY REPORT* (Nov. 2020).

98. Riley Beggin, *The Last Time a US President Dumped a Global Climate Deal*, ABC NEWS (June 1, 2017), <https://abcnews.go.com/Politics/time-us-president-dumped-global-climate-deal/story?id=47771005>.

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signature.⁹⁹ Similarly, the Obama administration entered into the Paris Agreement, which sets out aims for limits to global warming, only for Trump to signal his intention to withdraw the U.S. from the treaty.¹⁰⁰ Although the Biden administration recently rejoined the Paris Agreement, for some time, the U.S. was the only country not to embrace the agreement.¹⁰¹

Domestic efforts to regulate climate change have not fared much better. The Obama administration introduced binding standards for reduced automobile carbon emissions,¹⁰² limits on greenhouse gas emissions from power plants,¹⁰³ and restricted carbon dioxide pollution from future power plants,¹⁰⁴ among other initiatives. The Trump administration later rolled back all of these initiatives.¹⁰⁵

Climate change regulations may face a challenging path, in part, because of their potential effects on the economy. The Bush administration, for instance, proclaimed that the Kyoto Protocol would have limited America's growth and shifted jobs elsewhere.¹⁰⁶ The Trump administration was even more effusive in withdrawing from the Paris Agreement, lamenting that the "draconian financial and economic burdens" the agreement imposed on the United States¹⁰⁷ would force American workers to absorb "lost jobs, lower wages, shuttered factories, and vastly diminished economic production."¹⁰⁸

Economic-oriented climate change regulation has not fared much better. The SEC has specifically noted that it is reluctant to introduce climate change-relating rules. As an SEC Commissioner stated, "We ought not to step outside our lane

99. *Id.*

100. Press Release, The White House, Statement by President Trump on the Paris Climate Accord (June 1, 2017) [hereinafter Trump Statement].

101. Benjamin Hart, *Syria Leaves U.S. As Complete Outlier on Paris Climate Deal*, N.Y. MAG. (Nov. 7, 2017), <https://nymag.com/intelligencer/2017/11/syria-leaves-u-s-as-complete-outlier-on-paris-climate-deal.html>; Alexander C. Kaufman, *Syria Vows To Sign Paris Agreement, Leaving U.S. Alone In Climate Denial*, HUFFINGTON POST (Nov. 7, 2017), https://www.huffpost.com/entry/syria-paris-agreement_n_5a01b87fe4b0368a4e86ed4d. See Alex Leary, *Biden Signs Executive Orders on Face-Mask Mandate, Keystone Pipeline, Paris Accord*, WALL ST. J. (Jan. 20, 2021), <https://www.wsj.com/articles/bidens-first-day-orders-will-include-mask-mandate-blocking-keystone-pipeline-11611136804> (stating the US rejoined the Paris Agreement in January 2021).

102. EPA, FINAL DETERMINATION ON THE APPROPRIATENESS OF THE MODEL YEAR 2022-2025 LIGHT-DUTY VEHICLE GREENHOUSE GAS EMISSIONS STANDARDS UNDER THE MIDTERM EVALUATION, EPA-420-R17-001 (Jan. 2017), <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100QQ91.pdf>.

103. 40 C.F.R. § 60 (2015).

104. 40 C.F.R. §§ 60, 70, 71, 98 (2015).

105. See Juliet Eilperin & Brady Dennis, *EPA to Roll Back Car Emissions Standards, Handing Automakers a Big Win*, WASH. POST (Apr. 2, 2018), [washingtonpost.com/national/health-science/epa-to-roll-back-car-emissions-standards/2018/04/02/b720f0b6-36a6-11e8-acd5-35eac230e514_story.html](https://www.washingtonpost.com/national/health-science/epa-to-roll-back-car-emissions-standards/2018/04/02/b720f0b6-36a6-11e8-acd5-35eac230e514_story.html);

Jennifer A. Dlouhy, *Trump to Swap Obama's 'Clean Power Plan' for Modest Upgrades*, BLOOMBERG, (June 18, 2019); Umair Irfan, *The EPA is Lifting Greenhouse Gas Limits on Coal Power Plants*, VOX (Dec. 7, 2018), [vox.com/energy-and-environment/2018/12/6/18127399/trump-coal-epa-carbon-capture](https://www.vox.com/energy-and-environment/2018/12/6/18127399/trump-coal-epa-carbon-capture).

106. Press Release, The White House, President Bush Discusses Climate Change (Apr. 16, 2008), [whitehouse.archives.gov/news/releases/2008/04/20080416-6.html](https://www.whitehouse.gov/news/releases/2008/04/20080416-6.html).

107. See Trump Statement, *supra* note 100.

108. *Id.*

and take on the role of environmental regulator or social engineer.”¹⁰⁹ Similarly, the Department of Labor recently proposed prohibiting pension plans from being able to incorporate environmental considerations into investment decisions if doing so would subordinate the financial interests of plan participants or beneficiaries.¹¹⁰

Given the U.S. government’s reluctance to introduce climate change regulation, Section A examines the arguments and justifications for introducing economic-oriented climate change regulations. Section B then examines existing approaches to economic-oriented climate change regulations, beginning with the SEC’s approach before looking globally. Section C then evaluates the most common existing regulatory approach, disclosure, to determine whether it sufficiently addresses the economic risks of climate change. In this regard, it is important to add a caveat here: the regulatory approaches explored in this Section are limited to corporate law-related regulations. It therefore does not discuss environmental or (carbon) tax measures that are integral to addressing climate change but are beyond the scope of this article.

A. Is Economic-Oriented Climate Change Regulation Needed?

The lack of economic-oriented climate change regulation raises the question of whether such regulation is needed. This Section argues not only that such regulation is warranted, but that it is also justified.

I. Arguments for Regulation

There are three main reasons why the economic aspects of climate change need regulation: (a) market failures necessitate intervention to ensure the efficiency and stability of the economy; (b) the number of companies and industries that continue to deny climate change; and (c) even if companies believe in climate change, they underestimate its risks, leaving them woefully under-prepared.

a. Regulation and market failures

Regulation, particularly in the context of economic risk, is considered necessary when there are market failures.¹¹¹ This need may arise due to

109. Public Statement from Hester M. Peirce, Comm’r, SEC, Statement on Proposed Amendments to Modernize and Enhance Financial Disclosures (Jan. 30, 2020), <https://www.sec.gov/news/public-statement/peirce-mds-2020-01-30>.

110. Press Release, U.S. Department of Labor, U.S. Department of Labor Proposes New Investment Duties Rule (June 23, 2020), <https://www.dol.gov/newsroom/releases/ebsa/ebsa20200623>.

111. Cary Coglianesi, *The Law and Economics of Risk Regulation*, F.A.C. SCHOLARSHIP PA. L., Feb. 2020, at 1, 4.

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information asymmetries;¹¹² principal-agent problems;¹¹³ imperfect competition;¹¹⁴ public goods;¹¹⁵ and in instances of negative externalities, where an individual or firm's action imposes costs on third parties.¹¹⁶ Many of these market failures may justify the need for regulation of climate change's economic risk, although the most cogent justification is likely climate change's ability to impose negative externalities onto others. For instance, a firm's failure to address climate change in its operational practices can lead to costs being imposed on others. Thus, an insurance company's failure to model extreme climate change scenarios into its pricing and underwriting decisions may leave it unable to satisfy insurance claims from individuals or businesses in the event of a serious climate change event. Regulation for the economic risks of climate change is therefore justified from an efficiency standpoint, because regulation prevents or internalizes individual firms' climate change-related externalities.¹¹⁷

By recognizing the systemic risks posed by climate change, regulation can also prevent one or more firms' related economic risks from cascading throughout the economy. As commentators have observed, even if market participants understand "the risks of their investments, their motivation is to protect themselves but not the system as a whole."¹¹⁸ From an efficiency standpoint, regulation is therefore necessary to ensure that climate change economic risks prevent damage to the system as a whole.

As the COVID-19 crisis demonstrates, systemic crises also generate social costs. Schwarcz argues that systemic crises can engender "widespread poverty and unemployment, which in turn can destroy lives and foster crime" and contends that the protection of health and safety should be a goal in regulating systemic risk.¹¹⁹ He subsumes these social costs under the umbrella of stability and concludes that the stability of the financial system, just like efficiency, should be a goal of regulating systemic risk.¹²⁰

112. Joseph E. Stiglitz, *Markets, Market Failures, and Development*, 79 AM. ECON. REV. 197, 197-202 (1989); Robert A. Brown, *Financial Reform and The Subsidization of Sophisticated Investors' Ignorance in Securitization Markets*, 7 N.Y.U. J.L. & BUS. 105, 146 (2010).

113. Steven L. Schwarcz, *Regulating Shadows: Financial Regulations and Responsibility Failure*, 70 WASH. & LEE L. REV. 1781, 1785-86 (2013).

114. Joseph E. Stiglitz, *Government Failure vs. Market Failure: Principles of Regulation*, in GOVERNMENT AND MARKETS TOWARD A NEW THEORY OF REGULATION, 18-19 (Edward J. Balleisen & David A. Moss eds., 2010).

115. Gabriel Rauterberg, *The Corporation's Place in Society*, 114 MICH. L. REV. 913, 918 (2016); HARVEY S. ROSEN, PUBLIC FINANCE 47-48 (7th ed. 2005).

116. Stiglitz, *supra* note 114, at 18-19.

117. See RICHARD J. HERRING & ROBERT E. LITAN, FINANCIAL REGULATION IN THE GLOBAL ECONOMY 79 (1995); Schwarcz, *supra* note 29, at 205-06.

118. PRESIDENT'S WORKING GROUP ON FIN. MKTS., HEDGE FUNDS, LEVERAGE, AND THE LESSONS OF LONG TERM CAPITAL MANAGEMENT 31 (1999). See also BANK FOR INTERNATIONAL SETTLEMENTS - COMMITTEE ON THE GLOBAL FINANCIAL SYSTEM, STRESS TESTING AT MAJOR FINANCIAL INSTITUTIONS: SURVEY RESULTS AND PRACTICE 3-5 (2005); David Greenlaw et al., *Stressed Out: Macprudential Principles for Stress Testing* 3 (Chicago Booth Working Paper No. 12-08, 2012).

119. Schwarcz, *supra* note 29, at 207.

120. *Id.* at 207-208.

A climate change-related systemic crisis would generate many of the same social costs to which Schwarcz refers, and some of these costs could similarly be subsumed under the general aim of seeking economic stability. However, the potential social costs of a climate change-induced systemic crisis could easily surpass economic stability costs because the effects of these costs may be irreversible.¹²¹ Climate change events could, for instance, eliminate the land masses on which businesses or homes are located, or harm workers that contribute to the economy. Thus, regulation of climate change economic risks is also necessary because without it, companies could exceed the limits of the planet and be physically unable to run their businesses.¹²²

b. Denial of climate change

A second reason why regulation is necessary to mitigate the economic risk of climate change is because of the tendency, by some businesses, to deny climate change altogether. Specifically, the fossil fuel industry has had a long history of denying climate change.¹²³ For instance, in 1997, ExxonMobil published an advertorial in the *New York Times* stating “the science of climate change is too uncertain to mandate a plan of action.”¹²⁴ This public proclamation stood in sharp contrast to its own internal research, dating back to 1979, confirming that carbon dioxide emissions were caused by fossil fuel combustion, which in turn led to global warming.¹²⁵ Moreover, the research found that the current practice of fossil fuel combustion would cause “dramatic environmental effects before the year 2050.”¹²⁶

Despite this and other internal research confirming the existence of climate change,¹²⁷ ExxonMobil went on to become one of the most important funders of

121. See NETWORK FOR GREENING THE FIN. SYS., A CALL FOR ACTION CLIMATE CHANGE AS A SOURCE OF FINANCIAL RISK 4 (2019); see also Susan Solomon et al., *Irreversible Climate Change Due To Carbon Dioxide Emissions*, 106 PNAS 1704 (2009) (describing the irreversible nature of climate change).

122. See Brad Plumer, *Humans Are Speeding Extinction and Altering the Natural World at an ‘Unprecedented’ Pace*, N.Y. TIMES (May 6, 2019), <https://www.nytimes.com/2019/05/06/climate/biodiversity-extinction-united-nations.html>; David Wallace-Wells, *The Uninhabitable Earth*, N.Y. MAG. (July 2017), <https://nymag.com/intelligencer/2017/07/climate-change-earth-too-hot-for-humans.html>.

123. Benjamin Franta, *Early Oil Industry Knowledge of CO2 and Global Warming*, 8 NATURE CLIMATE CHANGE 1024 (2018); JOHN COOK ET AL., AMERICA MISLED – HOW THE FOSSIL FUEL INDUSTRY DELIBERATELY MISLED AMERICANS ABOUT CLIMATE CHANGE 6 (2019). See Riley E. Dunlap & Aaron M. McCright, *Climate Change Denial: Sources, Actors & Strategies*, in ROUTLEDGE HANDBOOK OF CLIMATE CHANGE AND SOCIETY 240 (Constance Lever-Tracy ed., 2010) (describing the history of climate change denial and the actors involved).

124. Geoffrey Supran & Naomi Oreskes, *Assessing ExxonMobil’s Climate Change Communications (1977–2014)*, ENV’T RSCH. LETTERS, Aug. 2017, at 1, 8.

125. STEVE KNISELY, CO2 AND FUEL USE PROJECTIONS (1979), <https://mk0insideclimats3pe4.kinstacdn.com/wp-content/uploads/2015/09/CO2-and-Fuel-Use-Projections.pdf>.

126. *Id.*

127. Supran & Oreskes, *supra* note 124, at 8.

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the climate change denial movement.¹²⁸ Yet it did not act alone. Other notable players include companies such as Koch Industries and Peabody Coal, and industry associations such as American Petroleum Institute and Western Fuels Association.¹²⁹ Several corporations promoted their connections with so-called climate change “associations,” which in name shielded individual corporations from public scrutiny while actually putting forth an agenda of climate denial.¹³⁰ Oil, coal, and auto companies were part of the Global Climate Coalition, which employed an aggressive lobbying and public relations campaign denying climate change, and the Heartland Institute, a front for several fossil fuel companies, employed tactics such as using mass murderers in advertisements to promote the futility of climate change.¹³¹

More recently, given public recognition of the perils of climate change, businesses may be obfuscating their denial of climate change. ExxonMobil, for example, publicly claims that it is committed to “advancing effective solutions to address climate change.”¹³² Its CEOs, past and present, also publicly acknowledge climate change as a serious problem.¹³³ However, its corporate strategy has been to increase new investments in oil projects and make only minimal investments in green technologies.¹³⁴ While ExxonMobil funds a lobbying group advocating carbon taxes, it spends almost ten times as much funding lobbying groups that challenge environmental regulation.¹³⁵ Furthermore, it has conveyed to shareholders that there is “no scientific basis” for limiting global warming to 2 degrees Celsius.¹³⁶ Despite public acknowledgements to the contrary, its corporate actions suggest that ExxonMobil is continuing to deny climate change, or at least, not take it seriously as a risk.

128. Robert J. Brulle, *Institutionalizing Delay: Foundation Funding and the Creation of U.S. Climate Change Counter-movement Organizations*, 122 *CLIMATIC CHANGE* 681 (2014); Dunlap & McCright, *supra* note 123, at 245.

129. Dunlap & McCright, *supra* note 123, at 245-46; CHRISTOPHER WRIGHT & DANIEL NYBERG, *CLIMATE CHANGE, CAPITALISM, AND CORPORATIONS* 77 (2015); CHRISTOPHER LEONARD, *KOCHLAND: THE SECRET HISTORY OF KOCH INDUSTRIES AND CORPORATE POWER IN AMERICA* (2019).

130. Dunlap & McCright, *supra* note 123, at 246.

131. WRIGHT & NYBERG, *supra* note 129, at 78; Andrew C. Revkin, *Industry Ignored Its Scientists on Climate*, N.Y. TIMES (Apr. 23, 2009), <https://www.nytimes.com/2009/04/24/science/earth/24deny.html>.

132. *Energy and Environment*, EXXONMOBIL, <https://corporate.exxonmobil.com/Energy-and-environment/Environmental-protection/Climate-change> (last visited May 7, 2021).

133. Steven Mufson, *Climate Resolutions Fall Short at ExxonMobil's Annual Meeting*, WASH. POST (May 25, 2016), https://www.washingtonpost.com/business/economy/climate-resolutions-fall-short-at-exxon-mobils-annual-meeting/2016/05/25/7108d45c-2287-11e6-9e7f-57890b612299_story.html; The Economist Briefing, *ExxonMobil Gambles on Growth*, ECONOMIST, (Feb. 9, 2019), <https://www.economist.com/briefing/2019/02/09/exxonmobil-gambles-on-growth>.

134. The Economist Briefing, *supra* note 133.

135. *Id.*

136. Mufson, *supra* note 133.

Regulation is therefore needed to compel climate change deniers into mitigating climate change. Without regulation, these businesses would simply not engage in mitigation, even if they publicly declare otherwise.

c. Tendency to underestimate risk

Even for those companies not denying climate change, regulation for climate change financial risk may be necessary because of firms' tendency to underestimate risk. That is, even if firms believe in the risks of climate change, they may not adequately prepare for that risk.

The COVID-19 crisis has already demonstrated that despite numerous international bodies, institutions, and individuals warning of the high risks and costs of a global pandemic, the world was unprepared for COVID-19.¹³⁷ The Trump administration even cancelled an early-warning program for pandemics three months before COVID-19 appeared in China,¹³⁸ while UK prime minister Boris Johnson continued to shake hands with everyone, despite being cautioned otherwise, before eventually contacting COVID-19.¹³⁹ Moreover, with companies needing a \$454 billion rescue package, it is likely that businesses were similarly ill-prepared for COVID-19.¹⁴⁰

Psychologists and behavioral economists have argued that the tendency of businesses and individuals to underestimate risks is due to a number of systematic biases that impair decision-making.¹⁴¹ Such biases include optimism bias: the tendency to “view the world as more benign than it really is, our own attributes as more favorable than they really are, and the goals we adopt as more achievable than they are likely to be.”¹⁴² Optimism bias can lead to the underestimation of the likelihood of future losses because of the belief that the believer is at less risk than others of experiencing a negative event.¹⁴³ Businesses prone to optimism bias will therefore discount the risk of a serious climate

137. See GLOB. PREPAREDNESS MONITORING BD., *supra* note 19; FED. EMERGENCY MGMT. AGENCY [FEMA], 2019 NATIONAL THREAT AND HAZARD IDENTIFICATION AND RISK ASSESSMENT (THIRA) – OVERVIEW AND METHODOLOGY (2019); Bill Gates, *The Next Outbreak? We're Not Ready*, TED (Mar. 2015), https://www.ted.com/talks/bill_gates_the_next_outbreak_we_re_not_ready?.

138. Emily Baumgaertner & James Rainey, *Trump Administration Ended Pandemic Early-warning Program to Detect Coronaviruses*, L.A. TIMES, Apr. 2, 2020; Zachary Cohen, *Trump Administration Shuttered Pandemic Monitoring Program, Then Scrambled to Extend It*, CNN, Apr. 10, 2020.

139. Conrad Duncan, *Coronavirus: How Boris Johnson Ignored Health Advice at His Peril Before Covid-19 Diagnosis*, INDEPENDENT, Mar. 27, 2020; The Guardian Staff, *I Shook Hands With Everybody, Says Boris Johnson Weeks Before Coronavirus Diagnosis*, GUARDIAN, Mar. 27, 2020.

140. See Jonathan O'Connell, *Congress to Bail Out Firms That Avoided Taxes, Safety Regulations and Spent Billions Boosting Their Stock*, WASH. POST, Mar. 25, 2020; David Shepardson & Ben Klayman, *U.S. Set to Grant Automakers a Lifeline—But No Bailout*, REUTERS (Mar. 25, 2020), <https://www.reuters.com/article/health-coronavirus-autos-funding/u-s-set-to-grant-automakers-a-lifeline-but-no-bailout-idUSL1N2B11J9>.

141. See, e.g., DANIEL KAHNEMAN, THINKING FAST AND SLOW (2011); RICHARD THALER & CASS SUNSTEIN, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH AND HAPPINESS (2009); ROBERT MEYER & HOWARD KUNREUTHER, THE OSTRICH PARADOX: WHY WE UNDERPREPARE FOR DISASTERS (2017).

142. KAHNEMAN, *supra* note 141, at 255.

143. MEYER & KUNREUTHER, *supra* note 141, at 37.

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change event, believing that losses that occur from climate change will happen to others, if at all. In fact, a recent survey of over 1,200 CFOs found that more than half of surveyed companies have not adopted any carbon emission targets and that measures taken to mitigate climate change arise only after pressure from stakeholders.¹⁴⁴ Businesses, it seems, are not being proactive in mitigating climate change.¹⁴⁵

A second bias that impairs proper evaluation of risks is availability bias: the evaluation of a specific course of action based on the readiness of examples that come to the decision-maker's mind.¹⁴⁶ Availability bias can distort risk evaluation based on how many relevant, recent, or familiar examples of a particular risk are available to the decision-maker.¹⁴⁷ Thus, the risk of a pandemic will now be viewed as more serious after COVID-19, given its recency, than other forms of risk. Indeed, given the need to react to the disastrous effects of COVID-19, mitigating pandemic risks may be a factor that further decreases companies' attention to climate change risks.

Finally, companies may be underestimating risk because of normalcy bias: the tendency to expect things to carry on, as they have in the past, as normal.¹⁴⁸ Normalcy bias can result in people proceeding as normal, even when given a disaster warning, because of disbelief that a negative event will occur.¹⁴⁹ It can also occur because of the preference to stay with the status quo rather than chart a new course of action.¹⁵⁰ Normalcy bias therefore prevents a proper estimation of risks, as it can cause individuals to be slow to react to dangers and fail to prepare for such dangers until it is too late. This seems to encapsulate the situation for many companies that are not preparing for climate change and that continue to let the status quo dictate their operations.¹⁵¹

Normalcy bias may also result because of herd behavior or the tendency to mimic the actions of others.¹⁵² This can result in excessive risk taking or risk

144. DELOITTE, EUROPEAN CFO SURVEY – INTO THE WOODS 23 (2019), <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/finance/european-cfo-survey-q3-2019.pdf>.

145. *See id.* at 24.

146. THALER & SUNSTEIN, *supra* note 141, at 25; MEYER & KUNREUTHER, *supra* note 141, at 35. *See also* Avos Tversky & Daniel Kahneman, *Availability: A Heuristic for Judging Frequency and Probability*, 5 COGNITIVE PSYCH. 207 (1973).

147. THALER & SUNSTEIN, *supra* note 141, at 25. *See also* MEYER & KUNREUTHER, *supra* note 141, at 34-35.

148. MEYER & KUNREUTHER, *supra* note 141, at 43-50; THOMAS E DRABEK, HUMAN SYSTEM RESPONSES TO DISASTER: AN INVENTORY OF SOCIOLOGICAL FINDINGS 72-73 (1986).

149. DRABEK, *supra* note 148, at 73.

150. MEYER & KUNREUTHER, *supra* note 141, at 50.

151. Allie Goldstein et al., *The Private Sector's Climate Change Risk And Adaptation Blind Spots*, 9 NATURE CLIMATE CHANGE 18, 23 (2019) (noting, “[C]ompanies report the costs of both physical climate change impacts and the strategies required to manage them sporadically and inconsistently, while the strategies themselves overall reflect a narrow view of risk that underestimates supply chain and broader societal impacts.”); David Kiron et al., *How Serious Is Climate Change to Business?*, MIT SLOAN MGMT. REV., Sept. 17, 2013.

152. THALER & SUNSTEIN, *supra* note 141, at 53-71; MEYER & KUNREUTHER, *supra* note 141, at 61-65.

aversion, depending on the preferences of the “herd.”¹⁵³ Given that the corporate response to climate change risks continues to be muted,¹⁵⁴ herd behavior may further explain why companies continue to underestimate climate change risk.

2. *Justifying Regulation*

While regulation is necessary because of market failures, climate change denials, and the corporate tendency to underestimate risk, government intervention in the form of regulation still needs to be justified.¹⁵⁵ One common method for justifying regulation is by reference to enhanced efficiency.¹⁵⁶ Thus, most regulators now engage in a cost-benefit analysis to assess proposed regulation.¹⁵⁷ The purpose of cost-benefit analyses is to improve policy goals without imposing unacceptable or unreasonable costs on society, and to ensure that proposed governmental interventions are proportionate to the harm that the intervention is intended to address.¹⁵⁸

Two recent studies have concluded that the mitigation costs for limiting global warming to 2 degrees Celsius or below are less than the anticipated economic damages.¹⁵⁹ These join previous studies finding that a cost-benefit analysis of climate change mitigation measures supports the introduction of these types of measures.¹⁶⁰ There are, however, some studies that conclude that the costs of climate change mitigation outweigh the benefits.¹⁶¹

153. MEYER & KUNREUTHER, *supra* note 141, at 65.

154. Goldstein et al., *supra* note 151, at 23; Kiron et al., *supra* note 151. *See also How Will Companies Respond to the Risk of Climate Change?*, MIT SLOAN MGMT. REV. (Jan. 29, 2020) (in which many of the experts note that even if companies are planning for climate change, they are not doing enough), <https://sloanreview.mit.edu/strategy-forum/how-will-companies-respond-to-the-risk-of-climate-change/>.

155. For a good critique and reply to why government intervention in the form of regulation needs to be justified, *see* Andrei Shleifer, *Understanding Regulation*, 11 EUR. FIN. MGMT. 439 (2005).

156. Coglianesse, *supra* note 111, at 6.

157. *See, e.g.*, Exec. Order No. 12866, 58 Fed. Reg. 190 (Oct. 4, 1993), <https://www.archives.gov/files/federal-register/executive-orders/pdf/12866.pdf>; Financial Conduct Authority, *How We Analyse The Costs And Benefits Of Our Policies* (July 2018).

158. Exec. Order No. 12866, *supra* note 157, at 1; Financial Conduct Authority, *supra* note 157, at 4.

159. *See, e.g.*, Nicole Glanemann et al., *Paris Climate Agreement Passes the Cost-Benefit Test*, 11 NATURE COMMUNICATIONS, no. 110, 2020, at 1; Marshall Burke et al., *Large Potential Reduction in Economic Damages Under UN Mitigation Targets*, 557 NATURE 549 (2018).

160. *See, e.g.*, NICHOLAS STERN, *THE ECONOMICS OF CLIMATE CHANGE – THE STERN REVIEW* (2007); NETHERLANDS ENVIRONMENTAL ASSESSMENT AGENCY, *COSTS AND BENEFITS OF CLIMATE CHANGE ADAPTATION AND MITIGATION: AN ASSESSMENT ON DIFFERENT REGIONAL SCALES* (2014); David Maddison, *A Cost-Benefit Analysis of Slowing Climate Change*, 23 ENERGY POLICY 337 (1995). *See also* Martin L. Weitzman, *Fat-Tailed Uncertainty in the Economics of Catastrophic Climate Change*, 5 REV. ENVIRONMENTAL ECONOMICS & POL’Y 275 (2011) (arguing in favor of climate change mitigation for catastrophic events).

161. *See, e.g.*, Richard S. J. Tol, *Economic Impacts of Climate Change* (Working Paper No. 75-2015, 2015) (arguing that climate change will only have “a limited impact on the economy and human welfare”); Roger Bezdek et al., *Cost Benefit Analysis in CLIMATE CHANGE RECONSIDERED II: FOSSIL FUELS*, NONGOVERNMENTAL INTERNATIONAL PANEL ON CLIMATE CHANGE 671 (C.D. Idso et al. eds., 2019) (arguing “the benefits of fossil fuels far outweigh their costs”).

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Possible reasons for the disparities in these findings are because, as Nobel Laureate William Nordhaus notes, “there is substantial uncertainty about the path of climate change and its impacts,” and it is unknown precisely “how damaging climate change will be.”¹⁶² The presence of these uncertainties is the reason that some commentators find that the efficacy of cost-benefit analysis as a policy tool for climate change is limited.¹⁶³

Because of the limits of cost-benefit analysis for justifying climate change-related costs, governments may need to rely on other means of justification. This could be achieved, for example, by the precautionary principle, a common justification for regulations in the environmental context. The precautionary principle enables governmental intervention “where there are threats of serious or irreversible damage,” even if there is a lack of full scientific certainty.¹⁶⁴ Governments can rely on the precautionary principle when the probability of risks from a concern is unknown, but the concern is scientifically plausible, and the harm from the concern is serious and irreversible.¹⁶⁵ It allows governmental intervention either before the harm occurs or before certainty about the harm is achieved.¹⁶⁶ These interventions must be “proportional to the chosen level of protection and the magnitude of possible harm” and consider the implications of both action and inaction. Certainly, regulation for the systemic risks caused by climate change would fall under the broad heading of the precautionary principle, given the seriousness of damage to the economy and society that global warming poses, so long as the regulations are proportional to the magnitude of the potential harm.

Commentators have further advocated for a third means of justification for regulation. As Sunstein argues, irreversible and catastrophic events warrant regulation.¹⁶⁷ In part, such regulation is needed in order to preserve “option value,” the paying of a certain amount now for flexibility in the future.¹⁶⁸ Posner explains the utility of the concept of option value in the global warming context. As he notes, making shallower cuts to greenhouse gas emissions “now can be

162. William D. Nordhaus, *Projections and Uncertainties About Climate Change in an Era of Minimal Climate Policies* 4 (Nat'l Bureau of Econ. Rsch. Working Paper No. 22933, 2017).

163. Eric A. Posner & Jonathan Masur, *Climate Regulation and the Limits of Cost-Benefit Analysis* 5-6 (U. Chi. Pub. Law. Working Paper No. 315, 2010); Frank Ackerman & Elizabeth A. Stanton, *Climate Risks and Carbon Prices: Revising the Social Cost of Carbon*, 6 *ECON.: OPEN-ACCESS, OPEN-ASSESSMENT E-J.*, no. 10, 2012, at 1, 20.

164. Report of the U.N. Conference on Environment and Development, United Nations Conference on Environment and Development, Rio Declaration, U.N. Doc. A/Conf. 151/5/Rev.1 (1992), reprinted in 31 *I.L.M.* 876, Principle 15 (1992).

165. WORLD COMM'N ON THE ETHICS OF SCI. KNOWLEDGE & TECH. (COMEST), THE PRECAUTIONARY PRINCIPLE 13 (2005); Timothy O'Riordan & James Cameron, *The History and Contemporary Significance of the Precautionary Principle*, in *INTERPRETING THE PRECAUTIONARY PRINCIPLE* 17-18 (Timothy O'Riordan & James Cameron eds., 1994).

166. WORLD COMM'N ON THE ETHICS OF SCI. KNOWLEDGE & TECH., *supra* note 165, at 13-14. See also O'Riordan & Cameron, *supra* note 165, at 17-18.

167. See generally Cass R. Sunstein, *Irreversible and Catastrophic*, 91 *CORNELL L. REV.* 841, 848 (2006).

168. *Id.* at 858.

thought of as purchasing an option to enable global warming to be stopped or slowed at some future time at a lower cost.”¹⁶⁹ Moreover, as Sunstein adds, because the irreversible losses from investments in reducing greenhouse gas emissions are less than the anticipated irreversible losses from global warming, this favors investments in reducing greenhouse gases.¹⁷⁰ In other words, by passing regulations today, regulators will have flexibility in the future to counter the potentially irreversible losses from climate change.

Accordingly, economic-oriented climate change regulation can be justified, potentially through a cost benefit analysis, but also from a precautionary perspective, if regulations are proportional to expected harm. Such regulation may further be justified for its “option value” in enabling regulators to control climate change, as needed, in the future.

B. Current Regulatory Approaches

As we have seen, regulation of the financial aspects of climate change is needed and such regulation is justified as an option of preserving our future ability to regulate in this area. Yet in the U.S., there is currently no specific legislation regulating the economic aspects of climate change. Rather, the SEC relies on existing rules to encourage companies to report on climate change issues. Conversely, at the global level, there are a number of initiatives that offer tailored approaches for regulating the economic risks emanating from climate change.

1. The SEC’s Approach

In 2010, the SEC began offering guidance for companies on using existing SEC rules to disclose climate change issues.¹⁷¹ The rules were not targeted to climate change. Rather, the SEC advocated their use on climate change matters because of its conclusion that climate change has an impact on companies’ operating and financial decisions and poses risks to business.¹⁷²

The SEC advises companies to disclose climate change issues within four parameters: a description of their business, any ongoing or prospective legal proceedings, risk factors of the business, and the management’s discussion and analysis.¹⁷³ As the SEC has noted, such disclosure can include issues such as climate change compliance costs, climate change litigation, climate change risk factors, the effects of climate change regulations on companies’ financial

169. Richard A. Posner, *Public Policy Towards Catastrophe in GLOBAL CATASTROPHIC RISKS* 196 (Nick Bostrom & Milan M. Cirkovic eds., 2011).

170. Sunstein, *supra* note 167, at 863-64.

171. Sec. & Exch. Comm’n [SEC], Commission Guidance Regarding Disclosure Related to Climate Change, Release No. 33-9106 (Feb. 8, 2010) [hereinafter SEC Climate Change Guidance].

172. *Id.* at 5-7.

173. See 17 C.F.R. §§ 229.101, .103, .105, .303 (2021).

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condition or results of operations, the effects of climate change developments on demand and competition, and the physical impacts of climate change.¹⁷⁴

In addition to offering only light touch regulation for the economic risks of climate change, the SEC has further taken a lackadaisical approach to enforcement of climate change disclosure. After it issued the 2010 guidance, companies were initially more motivated to disclose climate change issues, and the SEC was more likely to enforce such disclosure.¹⁷⁵ However, the SEC has taken a step back in recent years, issuing less than a handful of climate change disclosure enforcement letters since January 2017.¹⁷⁶ Not surprisingly, climate change disclosure from companies has often been weak.¹⁷⁷

Recently, the SEC updated some of its rules, parts of which might better capture climate change issues.¹⁷⁸ While one SEC commissioner observed that these changes were insufficient to combat climate change,¹⁷⁹ another noted that the SEC should not be taking on a greater role in combatting climate change through disclosure rules.¹⁸⁰ This sentiment may change, as the House Financial Services Committee recently approved a bill to introduce the Climate Risk Disclosure Act of 2019, which would mandate the SEC to introduce specific climate change disclosure rules.¹⁸¹

2. Global Approaches

While the SEC has been reluctant to introduce disclosure rules specifically for climate change, economic-oriented climate change initiatives have been progressing at the international level. For instance, the CDP (Carbon Disclosure Project), which has been operating as an international non-profit organization since 2000 in most G20 nations, collects climate change information from

174. SEC Climate Change Guidance, *supra* note 171, at 22-27.

175. Mindy S. Lubber, Chief Executive Officer and President, Ceres, Written Testimony Prepared for the U.S. House of Representatives, Committee on Financial Services, Subcommittee on Investor Protection, Entrepreneurship and Capital Markets, Building a Sustainable and Competitive Economy: An Examination of Proposals to Improve Environmental, Social and Governance Disclosures 11 (July 10, 2019) (available at <https://www.congress.gov/116/meeting/house/109770/witnesses/HHRG-116-BA16-Wstate-LubberM-20190710.pdf>).

176. *Id.*

177. See, e.g., the studies cited in Rick E. Hansen, *Climate Change Disclosure by SEC Registrants: Revisiting the SEC's 2010 Interpretive Release*, 6 BROOK. J. CORP. FIN. & COM. L. 487, 522-26 (2012); Alan R. Palmiter, *Climate Change Disclosure: A Failed SEC Mandate* (Aug. 5, 2015), (unpublished manuscript) (on file at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2639181).

178. SEC, Proposed Rule on Modernization of Regulation S-K Items 101, 103, and 105, Rel. No. 33-10668, n.11 (Aug. 8, 2019); SEC, Proposed Rule on Management's Discussion and Analysis, Selected Financial Data, and Supplementary Financial Information, Rel. No. 33-10750, n.95 (Jan. 30, 2020).

179. Public Statement from Allison Herren Lee, Comm'r, SEC, "Modernizing" Regulation S-K: Ignoring the Elephant in the Room (Jan 30, 2020), https://www.sec.gov/news/public-statement/lee-md-a-2020-01-30#_ftn1.

180. Peirce, *supra* note 109.

181. Ben Maiden, *House Panel Passes Climate Risk Disclosure Bill*, IR MAGAZINE, July 22, 2019.

companies backed by investor requests.¹⁸² It then makes the collected information publicly available, acting as a year-on-year source for investors on climate change risks, strategies, and performance, as well as greenhouse gas emissions.¹⁸³ Similarly, the Climate Disclosure Standards Board (CDSB), an international consortium formed in 2007, has been providing a global “corporate reporting model to equate climate change and natural capital information with information about financial capita.”¹⁸⁴ A reporting framework is also the hallmark of the Sustainability Accounting Standards Board, which provides standards for industry-specific sustainability disclosures, including on climate change.¹⁸⁵

However, today the most important global initiative for climate change disclosure is likely the Recommendations of the Task Force on Climate-Related Financial Disclosures. In 2015, the G20 Finance Ministers and Central Bank Governors asked the Financial Stability Board, which is tasked with monitoring the global financial system, to explore how the financial sector could better consider climate change issues.¹⁸⁶ The Financial Stability Board—which includes the SEC, the Federal Reserve, and the U.S. Department of the Treasury, among others as members¹⁸⁷—appointed an industry-level task force, known as the Task Force on Climate-related Financial Disclosures (“the Task Force”).¹⁸⁸ The Task Force was mandated to develop voluntary climate change financial disclosures.

In its 2017 report, the Task Force made several different recommendations for disclosing climate change. It structured its recommendations around four core organizational elements: governance, strategy, risk management, and metrics and targets.¹⁸⁹

The first element, governance, involves disclosure of the firm’s governance around climate related risks and opportunities.¹⁹⁰ This includes disclosure of both the board’s oversight of as well as management’s role in assessing and managing climate-related risks and opportunities.¹⁹¹

The second element, strategy, involves disclosure of the “actual and potential impacts of climate-related risks and opportunities on the organization’s

182. ORGANISATION FOR ECON. CO-OPERATION & DEV. [OECD], CLIMATE CHANGE DISCLOSURE IN G20 COUNTRIES: STOCKTAKING OF CORPORATE REPORTING SCHEMES 37 (2015).

183. *Id.* at 38.

184. SUSTAINABILITY ACCT. STANDARDS BD., CONVERGING ON CLIMATE RISK: CDSB, THE SASB, AND THE TCFD – THE EMERGING ALIGNMENT OF MARKET-BASED APPROACHES TO CLIMATE-RELATED FINANCIAL DISCLOSURE 5 (2017).

185. *See generally* SUSTAINABILITY ACCT. STANDARDS BD., CLIMATE RISK TECHNICAL BULLETIN #: TB001-10182016 (2016).

186. TASK FORCE REPORT, *supra* note 65, at iii.

187. Public Statement of Chairman Jay Clayton, Chairman of the SEC, Proposed Amendments to Modernize and Enhance Financial Disclosures; Other Ongoing Disclosure Modernization Initiatives; Impact of the Coronavirus; Environmental and Climate-Related Disclosure (Jan 30, 2020).

188. TASK FORCE REPORT, *supra* note 65, at iii.

189. *Id.* at 13.

190. *Id.* at 14.

191. *Id.*

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businesses, strategy, and financial planning where such information is material.”¹⁹² The Task Force recommended that companies include the following specific disclosures: identification of the climate-related risks and opportunities over the short, medium, and long term; the impact of the identified risks and opportunities on the firm’s businesses, strategy, and financial planning; and the resilience of the strategy, “taking into consideration different climate-related scenarios, including a 2°C or lower scenario.”¹⁹³

For the third element, risk management, the Task Force explained that this relates to how the firm “identifies, assesses, and manages climate-related risks.”¹⁹⁴ This involves providing disclosure on the processes by which a firm ascertains, evaluates, and manages climate-related risks, as well as on how these processes are integrated into the firm’s overall risk management.¹⁹⁵

For the final element, metrics and targets, the Task Force advises firms to “disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.”¹⁹⁶ This involves disclosing how the firm measures and manages its climate-related risks and opportunities; its greenhouse gas (GHG) emissions and related risks; and its key climate-related targets, and its performance against such targets.¹⁹⁷

The Task Force further identified supplemental guidance for the financial sector as well as for industries that account for the largest proportion of GHG emissions, energy usage, and water usage.¹⁹⁸ While its focus on the second group is self-evident, the Task Force noted that its guidance for the financial sector was in recognition of the fact that “disclosures by the financial sector could foster an early assessment of climate-related risks and opportunities, improve pricing of climate-related risks, and lead to more informed capital allocation decisions.”¹⁹⁹ The Task Force thus recommended that the financial sector and key industries at risk for climate change also make the recommended disclosures relating to strategy, risk management, and metrics and targets.²⁰⁰

The Task Force’s recommendations have been taken up by “1,027 organizations, representing a market capitalization of over \$12 trillion,” including Ford, Dow Chemical, the Bank of America, Bloomberg, and Deloitte.²⁰¹ They have also been incorporated by existing disclosure initiatives such as the Climate Change Disclosure Board and the Sustainability Accounting

192. *Id.*

193. *Id.*

194. *Id.*

195. *Id.*

196. *Id.* at 22.

197. *Id.* at 22-23.

198. *Id.* at 15.

199. *Id.*

200. *Id.*

201. TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES, <https://www.fsb-tcfd.org/tcfd-supporters/> (last visited May 6, 2021).

Standards Board,²⁰² and used as the basis for mandatory disclosure in the United Kingdom.²⁰³

Apart from disclosure, however, there are other efforts attempting to regulate the financial aspects of climate change. In 2017, eight central banks established the Network for Greening the Financial System (NGFS).²⁰⁴ Since then, the NGFS has grown to 34 members and 5 observers, although the Federal Reserve is not one of the participants.²⁰⁵ Recently, however, it has made a request to join the NGFS.²⁰⁶

The mandate of the NGFS is to ensure the success of the Paris Agreement, which involves understanding how climate change, as a structural change, affects the financial system and economy.²⁰⁷ To that end, the NGFS recognizes climate change as a structural change affecting the financial system, with potential impacts that are “larger. . . [and] more widespread and diverse than those of other structural changes.”²⁰⁸ It views climate change as being foreseeable in nature, bearing irreversible consequences, and causing impacts that are largely dependent on the actions taken today by central banks, governments, firms, and financial participants.²⁰⁹ It also concludes that climate-related financial risks are not fully reflected in asset valuations and makes a series of recommendations designed to address that problem.²¹⁰

For instance, the NGFS recommends that central banks, supervisors, and some financial institutions “assess[] climate-related financial risks in the financial system,” and, “integrat[e] climate-related risks into prudential supervision.”²¹¹ It also recommends that these institutions integrate sustainability factors into their own portfolio management, by way of their own funds or pension funds.²¹² The NGFS further supports the Task Force’s work by recommending climate change disclosure as well as the development of a taxonomy of economic activities for climate change risks as a way of mobilizing capital for green investments.²¹³ The work of the NGFS is ongoing, although its

202. SUSTAINABILITY ACCT. STANDARDS BD., *supra* note 184.

203. *UK Expects All Listed Companies and Large Asset Owners to Disclose in Line With TCFD by 2022, Commits to Work With International Partners to Catalyse Market-led Action on Nature-related Financial Disclosures*, CLIMATE DISCLOSURE STANDARDS BD. (July, 2 2019), <https://www.cdsb.net/mandatory-reporting/937/uk-expects-all-listed-companies-and-large-asset-owners-disclose-line-tcfd>.

204. NETWORK FOR GREENING THE FINANCIAL SYSTEM, *supra* note 121, at 7.

205. *Id.* at 7-8.

206. Alister Bull, *Fed Set to Join NGFS, the Climate-Change Club for Central Banks*, BLOOMBERG (Nov. 11, 2020), <https://www.bloomberg.com/news/articles/2020-11-11/fed-set-to-join-ngfs-the-climate-change-club-for-central-banks>.

207. NETWORK FOR GREENING THE FINANCIAL SYSTEM, *supra* note 121, at 4.

208. *Id.*

209. *Id.*

210. *Id.*

211. *Id.* at 4-5.

212. *Id.* at 5.

213. *Id.* at 6.

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driving force continues to be its recognition that “climate change presents significant financial risks that are best mitigated through an early and orderly transition.”²¹⁴

C. Evaluating Disclosure

Whether it is the SEC’s light touch approach, or the Task Force and NGFS’s more prescriptive approach, disclosure appears to be the favored regulatory approach for companies to manage climate change financial risks. Disclosure certainly has many benefits. It enables companies to make early assessments of climate change financial risks, plan how to mitigate such risks, and consider these types of risks in their business routines.²¹⁵ Disclosure also enables financial institutions and investors to better price climate-related risks, allowing for a more efficient allocation of capital.²¹⁶ The CEO of BlackRock, Larry Fink, even views climate change disclosure as being integral to a firm’s ability to attract capital.²¹⁷

Nevertheless, reliance on disclosure alone remains problematic for several reasons. First, compliance with disclosure provisions relating to climate change has traditionally been low. The Task Force recently reviewed the disclosures of 1,126 companies from 142 countries in eight industries over three years.²¹⁸ On the basis of the reviewed information, it concluded that, although the percentage of companies disclosing climate-related information has increased, overall corporate disclosure on climate change-related information is still low.²¹⁹ Moreover, it found that even for companies that were disclosing climate change-related information, the disclosure was insufficient and that more and further disclosure was needed.²²⁰ For instance, companies were prone to disclosing climate risks and opportunities or climate-related metrics, but less likely to report on the resilience of their strategies.²²¹

A worldwide report by KPMG found similar results.²²² After reviewing the annual financial reports of over 4,900 companies worldwide, it found that only 28 percent of these companies disclose climate change-related financial risk in

214. *Id.* at 8.

215. TASK FORCE REPORT, *supra* note 65, at i, 15.

216. *Id.*

217. Letter from Larry Fink, Founder, Chairman and CEO of BlackRock, Inc. to CEOs - A Fundamental Reshaping of Finance (2020).

218. FINANCIAL STABILITY BD., TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES: STATUS REPORT 120 (2019) [hereinafter TASK FORCE STATUS REPORT].

219. *Id.* at 7.

220. *Id.*; *See also* Goldstein et al., *supra* note 151, at 18 (noting there are “significant blind spots in companies’ assessments of climate change impacts and in their development of strategies for managing them”).

221. *See* TASK FORCE STATUS REPORT, *supra* note 218, at 8.

222. *See generally* KPMG, THE ROAD AHEAD - THE KPMG SURVEY OF CORPORATE RESPONSIBILITY REPORTING 2017 (2017).

their annual reports.²²³ Moreover, for those companies disclosing climate change risks, very few of them quantify these risks or model their financial impacts.²²⁴

Incompleteness of climate change disclosure can also characterize SEC required reporting. As one study noted, most climate change disclosures to the SEC “are very brief, provide little discussion of material issues, and do not quantify impacts or risks.”²²⁵ Climate change disclosure to the SEC has further been described as vague, nebulous, and boilerplate.²²⁶ One notable reason explaining the poor disclosure on climate change issues to the SEC is because of the SEC’s failure to enforce climate change disclosure, as the SEC has tended to take a light-handed approach to climate change disclosure enforcement.²²⁷ This may be because, as an SEC commissioner has noted, it views climate change disclosure as beyond its mandate.²²⁸

In addition to poor compliance rates, climate change disclosure poses other problems. For instance, companies often use disclosure in a selective manner to disclose or emphasize information that only shows the corporation in a favorable light.²²⁹ Even where negative information is disclosed, the disclosed information may be marginalized or abstracted in such a way that the disclosure is used as a tool for greenwashing or for public relations.²³⁰ A recent study found that where firms were not required to provide full disclosure in connection with their greenhouse gas emissions, they used “soft stories” to influence judgment of their actions in an attempt to obscure their emissions rate rather than inform stakeholders.²³¹

There is also competing evidence as to whether disclosure induces companies to change their behavior. One of the purported aims of disclosure requirements in relation to climate change is that by disclosing climate change-related issues, companies will recognize the risks of climate change and this will “stimulate

223. *See id.* at 30.

224. *See id.* at 31.

225. JIM COBURN & JACKIE COOKE, COOL RESPONSE: THE SEC & CORPORATE CLIMATE CHANGE REPORTING: SEC CLIMATE GUIDANCE & S&P 500 REPORTING – 2010 TO 2013, CERES REPORT 5 (2014).

226. *See* Benjamin Hulac, *Inside the Mirage of Good Climate Info at the SEC*, E&E NEWS (Aug. 11, 2016), <https://www.eenews.net/stories/1060041464>; *see also* Roshan Wasim, Note, *Corporate (Non)Disclosure of Climate Change Information*, 119 COLUM. L. REV. 1311, 1334 (2019); Palmiter, *supra* note 177, at 4.

227. From 2016 to 2020, the SEC only made a handful of requests for further information on climate change. *See* Lubber, *supra* note 175, at 11.

228. Peirce, *supra* note 109. *See also* Clayton, *supra* note 187.

229. *See* Reggy Hooghiemstra, *Corporate Communication and Impression Management –New Perspectives Why Companies Engage in Corporate Social Reporting*, 27 J. BUS. ETHICS 55 (2000); *see also* Rudiger Hahn & Regina Lulfs, *Legitimizing Negative Aspects in GRI-Oriented Sustainability Reporting: A Qualitative Analysis of Corporate Disclosure Strategies*, 123 J. BUS. ETHICS 401 (2013); Yu Cong et al., *Mandated Greenhouse Gas Emissions and Required SEC Climate Change Disclosures* 247 J. OF CLEANER PRODUCTION, no. 119111, Feb. 2020, at 1.

230. Cong et al., *supra* note 229, at 8; Hahn & Lulfs, *supra* note 229; *see* Hooghiemstra, *supra* note 229, at 60-66; Olajo Aiyegbayo & Charlotte Villiers, *The Enhanced Business Review: Has It Made Corporate Governance More Effective*, 2011 J. BUS. L. 699, 703 (2011).

231. Cong et al., *supra* note 229, at 8.

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ingenuity and strategic thinking. . . [to] improve sustainability performance.”²³² Certainly, some studies demonstrate that disclosure requirements can prompt corporations to make more commitments to reducing greenhouse gas emissions, be more ethical, and improve environmental performance.²³³ However, other studies have found that disclosure did not alter corporate environmental behavior.²³⁴

Finally, a disclosure regime focuses on market discipline, meaning that its aim is to provide accurate information in order for investors to be able to correctly price securities.²³⁵ Climate change information, however, is highly uncertain, and these uncertainties can impede the market’s ability to discipline actors.²³⁶ Market discipline via disclosure also only works when investors are incentivized to use that information, and there is evidence that investors are ignoring climate change risks.²³⁷ Climate change disclosure as a means of market discipline therefore may be inherently flawed.²³⁸

Thus, on the one hand, disclosure may facilitate early corporate recognition of climate change issues and prompt corporate changes in behavior. On the other hand, compliance with climate change disclosure is weak, some companies are using it to obscure poor climate change performance, and it may not be providing

232. Lubber, *supra* note 175, at 6.

233. See Ceres, TURNING POINT - CORPORATE PROGRESS ON THE CERES ROADMAP FOR SUSTAINABILITY 50 (2018); Ioannis Ioannou & George Serafeim, *The Consequences of Mandatory Corporate Sustainability Reporting: Evidence From Four Countries* 4 (Harvard Business School Working Paper No. 11–100, 2011); Dara O’Rourke & Eungkyoon Lee, *Mandatory Planning for Environmental Innovation: Evaluating Regulatory Mechanisms for Toxics Use Reduction* (2004) 47 J. ENV’T PLANNING & MGMT. 181; Bradley C. Karkkainen, *Information as Environmental Regulation: Tri and Performance Benchmarking, Precursor to a New Paradigm?*, 89 GEO. L.J. 257 (2001).

234. See, e.g., Martin Freedman & Bikki Jaggi, *Global Warming and Corporate Disclosures: A Comparative Analysis of Companies From the European Union, Japan and Canada*, in SUSTAINABILITY, ENVIRONMENTAL PERFORMANCE AND DISCLOSURES 129, 132 (Martin Freedman & Bikki Jaggi eds., 2009); Carlos Larrinaga-Gonzalez et al., *The Role of Environmental Accounting in Organizational Change: An Exploration of Spanish Companies*, 14 ACCOUNTING, AUDITING & ACCOUNTABILITY J. 213 (2013); Jędrzej G. Frynas, *Corporate Social Responsibility or Government Regulation? Evidence on Oil Spill Prevention*, 17 ECOLOGY & SOC’Y 4 (2012).

235. Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 737-40 (2006); Christophers, *supra* note 65, at 1116-17.

236. Dimitri Zenghelis & Nicholas Stern, *The Importance of Looking Forward to Manage Risks: Submission to the Task Force on Climate-Related Financial Disclosures, Policy Paper 4* (June 2016), <http://eprints.lse.ac.uk/67133/1/Zenghelis-and-Stern-policy-paper-June-2016.pdf> (noting climate change risks are “Knightian’ or deep uncertainty or ‘unknown unknowns’”); TASK FORCE REPORT, *supra* note 65, at 25 (noting the “timing and magnitude [of climate change is] uncertain. This uncertainty presents challenges for individual organizations in understanding the potential effects of climate change on their businesses”); Goldstein, *supra* note 151, at 23 (noting that there is no “guidance on reporting long-term, uncertain risks” of climate change).

237. Jamie Caruana, General Manager, Bank for Int’l Settlements, Keynote Speech to the FSB Roundtable: Financial Stability and Risk Disclosure 1 (Dec. 9, 2011) (transcript available at <https://www.bis.org/speeches/sp111222.pdf>); BLACKROCK, *THE PRICE OF CLIMATE CHANGE: GLOBAL WARMING’S IMPACT ON PORTFOLIOS* 6 (2015) (noting “many equity investors ignore climate risk and credit investors and ratings agencies do not routinely assess it); Alan Hsu, *Brewing Storm: Are Investors Discounting Climate Risks and Opportunities?*, WELLINGTON MGMT., Dec 2017 (noting “one powerful, non-mean-reverting trend that we think many investors are ignoring is climate change”).

238. Christophers, *supra* note 65, at 1124.

adequate market discipline. The equivocal effects of climate change disclosure suggest that while disclosure may be useful as a tool to combat climate change, it should not be relied on *exclusively* to regulate the systemic issues arising out of climate change. Rather, disclosure seems to work best as a complementary regulatory tool.²³⁹

Still, given governmental preference for light-touch regulation, climate change disclosure remains a good first step in combatting climate change as a systemic risk. The SEC's failure to adopt climate change disclosure rules is thus a noteworthy misstep.

III. DESIGNING REGULATION FOR CLIMATE CHANGE AS SYSTEMIC RISK

As disclosure alone is insufficient as a solitary regulatory tool, this Part considers other regulatory approaches that could work alongside disclosure in combatting the economic risks of climate change.²⁴⁰ These include reducing financial institutions' investments in fossil fuels, introducing climate change stress tests for financial institutions and insurance companies, introducing a climate change fund, and reorienting investment towards "green" investments. While varying in approach, the common denominator among each of these proposals is that they fulfill the twin aims of helping to ensure the economy's economic stability and working towards decoupling economic growth from greenhouse gas emissions.²⁴¹

A. Reducing Fossil Fuel Investments

Without a doubt, the most important regulatory tool for mitigating climate change risks, systemic or otherwise, is to reduce the principal cause of carbon emissions, fossil fuels. There has already been some movement in this area. The G7 nations agreed to phase out fossil fuels by 2100,²⁴² and several countries and territories, including possibly California,²⁴³ are moving towards banning fossil

239. BARNALI CHOUDHURY & MARTIN PETRIN, CORPORATE DUTIES TO THE PUBLIC (2019), 88; MICHAEL E. KRAFT ET AL., COMING CLEAN: INFORMATION DISCLOSURE AND ENVIRONMENTAL PERFORMANCE (2011).

240. For other regulatory ideas, see also Steele, *supra* note 96, at 145 et seq.

241. See OECD, Indicators to Measure Decoupling of Environmental Pressure From Economic Growth, SG/SD(2002)1/FINAL, 4 (May 16, 2002) (stating that decoupling "occurs when the growth rate of an environmental pressure [such as carbon emissions] is less than that of its economic driving force").

242. Kate Conolly, *G7 Leaders Agree to Phase out Fossil Fuel Use by End of Century*, GUARDIAN (June 8, 2015), <https://www.theguardian.com/world/2015/jun/08/g7-leaders-agree-phase-out-fossil-fuel-use-end-of-century>.

243. Chris Woodyard, *Is California Ready to Ban Gas-powered Cars? Not Yet. But They're Thinking About it, USA TODAY* (Dec. 16, 2019), <https://www.usatoday.com/story/news/nation/2019/05/16/california-gas-powered-car-sales-ban/3699738002/>.

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fuel-powered vehicles in approximately 15 to 20 years.²⁴⁴ Governments have not expressed an interest in making more impending reductions in fossil fuel usage because to do so would result in spiraling increases in fuel and energy prices, especially given the increasing demand for energy.²⁴⁵ Nevertheless, since fossil fuels are a finite resource, reducing reliance on them is inevitable.²⁴⁶

In the context of reducing climate change-related systemic risks, phasing out fossil fuels could come in the form of reducing financial institutions' investments in fossil fuels. While fossil fuel companies must reduce their investments into untapped sources of fossil fuels,²⁴⁷ this proposal focuses on reducing financial institutions' investments in this area because they are the primary provider of finance to the fossil fuel industry.²⁴⁸ One study estimates that the four largest American banks financed fossil fuels for over \$583 billion over the last three years alone.²⁴⁹ Indeed, the large role played by financial institutions in supplying financing to the fossil fuel industry has caused commentators to label them as the "de facto enabler of global warming."²⁵⁰

One approach to reducing investment in fossil fuels would be to draw from measures introduced after last financial crisis. As part of its efforts in addressing the repercussions of the 2008-9 financial crisis, Congress introduced the Volcker Rule.²⁵¹ The aim of the Rule was to counter the excessive risk taken by SIFIs, which was one of the causes of the financial crisis.²⁵² The Volcker Rule, introduced as part of the reforms in the Dodd-Frank Act, thus prohibited financial institutions from engaging in proprietary trading, subject to some exceptions, as

244. See ISABELLA BURCH & JOCK GILCHRIST, SURVEY OF GLOBAL ACTIVITY TO PHASE OUT INTERNAL COMBUSTION ENGINE VEHICLES 6-9 (2020), <https://theclimatecenter.org/wp-content/uploads/2020/03/Survey-on-Global-Activities-to-Phase-Out-ICE-Vehicles-update-3.18.20-1.pdf>.

245. See generally MIKE BERNERS-LEE & DUNCAN CLARK, THE BURNING QUESTION (2013); see also Duncan Clark, *Why Can't We Quit Fossil Fuels?*, GUARDIAN (Apr. 17, 2013), <https://www.theguardian.com/environment/2013/apr/17/why-cant-we-give-up-fossil-fuels>.

246. See Megan Douglah, *Oil States Energy Services v. Greene's Energy Group: The Future of Inter Partes Review and Its Impact on the Energy Sector*, 3 OIL & GAS, NAT. RES. & ENERGY J. 1343, 1346 (2018); Jared Wiesner, *A Grassroots Vehicle For Sustainable Energy: The Conservation Reserve Program & Renewable Energy*, 31 WM. & MARY ENV'T. L. & POL'Y REV. 571, 575 (2007).

247. This would be achieved through environmental or tax regulations (by reducing demand for fossil fuel), but these issues are beyond the scope of this article which focuses on supply side regulations.

248. FINANCE WATCH, BREAKING THE CLIMATE-FINANCE DOOM LOOP – HOW BANKING PRUDENTIAL REGULATION CAN TACKLE THE LINK BETWEEN CLIMATE CHANGE AND FINANCIAL INSTABILITY, 14-15 (2020).

249. See RAINFOREST ACTION NETWORK ET AL., BANKING ON CLIMATE CHANGE 8 (2020), http://priceofoil.org/content/uploads/2020/03/Banking_on_Climate_Change_2020.pdf.

250. FINANCE WATCH, *supra* note 248, at 6.

251. See Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. No. 111-203, 124 Stat. 1376, § 619 (July 21, 2010).

252. Paul Volcker, *How to Reform Our Financial System*, N.Y. TIMES (Jan. 30, 2010) <https://www.nytimes.com/2010/01/31/opinion/31volcker.html>; GROUP OF THIRTY, FINANCIAL REFORM: A FRAMEWORK FOR FINANCIAL STABILITY 27 (2009), http://www.group30.org/images/PDF/Financial_Reform-A_Framework_for_Financial_Stability.pdf.

a means of preventing them from taking on excessive risk.²⁵³ The Volcker Rule reminds us that the Federal Reserve has the authority to limit financial institutions from taking on excessive risk under the Dodd-Frank Act. On this understanding, if climate change gives rise to excessive risk, then the Dodd-Frank Act must also enable the Federal Reserve to limit financial institutions' activities in relation to climate change risks.

As mentioned above, regardless of whether it is the transition risks or physical risks of climate change that ultimately prompt the retraction from fossil fuel investments, doing so could lead to drastic financial losses. For example, experts predict the losses from having to write off stranded assets will demolish approximately one-half of the value of fossil fuel reserves and possibly even obliterate the fossil fuel industry entirely.²⁵⁴ While the precise amount of financial losses from fossil fuels is difficult to predict, commentators expect it will be well beyond the losses caused by the last financial crisis.²⁵⁵

Accordingly, given the excessive systemic risks posed by financial institutions' investments in fossil fuels, the Federal Reserve could, using the Volcker rule as precedent, prohibit them from investing in this area.²⁵⁶ However, given the existing significant investment in this area, a sudden shift away from investments in this area could cause a transition risk-induced systemic crisis. A more prudent approach would be to have the Federal Reserve limit the amount of fossil fuel investments financial institutions can hold, with the aim of gradually decreasing that limit over time until the investments were in line with the Paris Agreement goals. A more cautious approach would be to limit only new investments in fossil fuels, as this would not impair current energy usage (or pose large transition risks), but would limit future global warming. Alternatively, a third (and even more cautious) approach would be to introduce a framework for reducing financial institutions' fossil fuel investments over a period of time. However, rather than making compliance with the framework mandatory, financial institutions would report on their progress with the framework as part of their management discussion and analysis reporting obligations²⁵⁷ or in other sustainability reporting.

253. See the latest exceptions to the Rule at Prohibitions and Restrictions on Proprietary Trading and Certain Interests in, and Relationships With, Hedge Funds and Private Equity Funds, 84 Fed. Reg. 61,974 (Nov. 14, 2019), <https://www.fdic.gov/news/board/2019/2019-08-20-notice-dis-a-fr.pdf>.

254. Alan Livsey, *Lex in Depth: The \$900bn Cost of 'Stranded Energy Assets'*, FIN. TIMES, Feb 4, 2020; see CARBON TRACKER INITIATIVE, THE \$2 TRILLION STRANDED ASSETS DANGER ZONE: HOW FOSSIL FUEL FIRMS RISK DESTROYING INVESTOR RETURNS (2015); Jean-Francois Mercure et al., *Macroeconomic Impact of Stranded Fossil Fuel Assets*, 8 NATURE CLIMATE CHANGE 588, 591(2018) (noting that lower demand for fossil fuels may lead to the loss of the entire oil and gas industry in the United States).

255. Mercure et al., *supra* note 254; Kompas, *supra* note 61.

256. For non-bank financial institutions, this could be initiated under the Dodd Frank Act, which permits the Federal Reserve to establish additional prudential standards as it deems appropriate. See Dodd-Frank Act, *supra* note 251, § 165.

257. See 17 C.F.R. § 229.303.

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While mandatory limits on the amount of fossil fuel investments a financial institution can hold would certainly be the most efficient method for addressing climate change problems, a non-mandatory approach would engender greater business support. As a result, a non-mandatory approach could inspire greater political will for the government to act in this area.

In any case, the recent practices of a number of financial institutions confirm that reducing fossil fuel investments is feasible. Barclays, for instance, has pledged “to be net-zero by 2050” and has committed to align its “financing portfolio to the goals of the Paris agreement.”²⁵⁸ The European Investment Bank, the world’s largest multilateral financial institution, has similarly announced that it will end financing for all fossil fuel energy projects from the end of 2021 and align future financial projects with the goals of the Paris Agreement.²⁵⁹ Businesses therefore seem to be slowly moving in this direction, suggesting that regulation could help prompt laggards.

B. Stress Tests

A second regulatory tool for addressing the systemic risks of climate change would be to use climate change-oriented stress tests, particularly for SIFIs. Stress tests are analytic “what if” exercises that gauge how an institution will be affected by a change in variables, the so called “stress.”²⁶⁰ Stress tests identify whether a firm is sufficiently capitalized to withstand the stress and how vulnerable specific aspects of its business are to the stress.²⁶¹ They can also assess system-wide capital adequacy, identifying firms that are sufficiently capitalized in isolation but which may not be adequately capitalized in instances where there is a threat to financial stability.²⁶² By identifying vulnerabilities, stress tests can guide the strategic directions of both firms and regulators in mitigating the stress.²⁶³

In a climate change stress test, a firm simulates the effects of a climate change event on its business to determine its resilience to the expected losses from the event. Several institutions including the IMF, the European Systemic Risk Board, the Dutch National Bank, the Bank of England, the Bank of France, and

258. Barclays PLC, AGM Statements - Chairman’s 2020 AGM Statement (May 7, 2020), <https://home.barclays/content/dam/home-barclays/documents/investor-relations/reports-and-events/AGM2019/RNS%20-%20Barclays%202020%20AGM%20statements.pdf>.

259. Press Release, European Investment Bank, EU Bank Launches Ambitious New Climate Strategy and Energy Lending Policy (Nov. 14, 2019).

260. Robert Weber, *A Theory for Deliberation-Oriented Stress Testing Regulation*, 98 MINN. L. REV. 2236, 2238 (2014); Robert T. Miller, *Oversight Liability for Risk-Management Failures at Financial Firms*, 84 S. CAL. L. REV. 47, 69-70 (2010).

261. BANK FOR INTERNATIONAL SETTLEMENTS - COMMITTEE ON THE GLOBAL FINANCIAL SYSTEM, *supra* note 118, at 3-5; Greenlaw et al., *supra* note 118, at 3.

262. Greenlaw et al., *supra* note 118, at 3.

263. BANK FOR INTERNATIONAL SETTLEMENTS - COMMITTEE ON THE GLOBAL FINANCIAL SYSTEM, *supra* note 118, at 4-5; DELOITTE, THE PREDICTIVE POWER OF STRESS TESTS TO TACKLE CLIMATE CHANGE 13-14 (2020), https://www2.deloitte.com/content/dam/Deloitte/fr/Documents/sustainability-services/deloitte_climate-risk-assessment.pdf.

the NGFS, among others, are considering or have already implemented climate change stress tests.²⁶⁴

The Bank of England recently set out its proposed model for climate change stress tests, which it intends to apply to the banking and insurance sectors. Firms apply the stress test to three scenarios using a 30-year modeling horizon. In the first scenario, the Paris Agreement global warming goals are met with early action; in the second, the Paris Agreement global warming goals are met but with a delayed transition requiring a more severe transition to make up for the late start; and in the third, no policy action is taken.²⁶⁵ Based on these three scenarios, the Bank intends to test the resilience of firms' current business models to climate change, by having the firms "quantify the change in the value of their assets and (for insurers) liabilities at different points in each scenario."²⁶⁶ The Bank will also assess how firms would "change their business models in response to the risks in each scenario."²⁶⁷ Based on this information, the Bank will then identify system-wide impacts of firms' "exposure to climate change, including the main sources of loss by sector and geography."²⁶⁸

The Dutch government has taken a different approach with their climate change stress test. Rather than soliciting information from firms, the Dutch devised four extreme but plausible scenarios; applied them to over \$2 trillion in assets held by domestic banks, insurers, and pension funds; and modeled the risks over a five-year time period.²⁶⁹ The scenarios used are as follows: (1) policies designed to reduce carbon dioxide emissions are implemented abruptly, leading to a large increase in the price of carbon; (2) technological breakthroughs lead to decreases in the cost of renewable energy, enabling the share of renewable energy to double in five years; (3) both of the first two scenarios occur simultaneously; and (4) uncertainty surrounding governmental climate change policies causes consumer, producer, and investor confidence in them to drop suddenly.²⁷⁰ The stress test concluded that the losses for financial institutions would be large but manageable.²⁷¹ The study recommended that individual

264. Adrian Tobias et al., *Stress Testing at the IMF*, IMF Departmental Paper No. 20/04, at 45 (Feb. 5, 2020); EUR. SYSTEMIC RISK BD., *supra* note 90; BANK OF ENGLAND, *THE 2021 BIENNIAL EXPLORATORY SCENARIO ON THE FINANCIAL RISKS FROM CLIMATE CHANGE*, DISCUSSION PAPER (2019); ROBERT VERMEULEN ET AL., *AN ENERGY TRANSITION RISK STRESS TEST FOR THE FINANCIAL SYSTEM OF THE NETHERLANDS* (2018); François Villeroy de Galhau, Governor of the Banque de France, *Speech: New Year Wishes* (Jan. 14, 2020) (transcript available at <https://www.banque-france.fr/en/intervention/new-year-wishes-paris-financial-centre-0>); NETWORK FOR GREENING THE FINANCIAL SYSTEM, *GUIDE TO CLIMATE SCENARIO ANALYSIS FOR CENTRAL BANKS AND SUPERVISORS* 18 (2020).

265. BANK OF ENGLAND, *THE 2021 BIENNIAL EXPLORATORY SCENARIO ON THE FINANCIAL RISKS FROM CLIMATE CHANGE* 8 (2019).

266. *Id.* at 9

267. *Id.*

268. *Id.* at 20.

269. VERMEULEN ET AL., *supra* note 264, at 47.

270. *Id.* at 19, 24, 29, 32.

271. *Id.* at 56.

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institutions mitigate energy transition risks by incorporating them into their overall risk management programs.²⁷²

The approaches of the Bank of England and Dutch government offer two options for devising climate change stress tests. Of course, the overall utility of climate change stress tests will depend on assumptions made in the modeling, as well as on the choice of methodology.²⁷³ Climate change information is also not similar to the information that is typically used in stress tests as it is forward-looking, characterized by deep uncertainty and dependent on political decisions.²⁷⁴ This distinguishes climate change stress tests from regular stress tests, as they must “consider multiple scenarios and equilibria with unknown probabilities.”²⁷⁵ Nevertheless, despite these limitations, a stress test of a SIFI’s resilience to climate change could help identify systemic tensions and shortcomings which may prevent more severe problems in the future. In particular, the Bank of England’s model is especially noteworthy as it envisions the changes that firms would need to undertake to adapt to climate change successfully. This type of stress test would provide a strategy to guide firms in changing their behavior in response to climate change.

The Federal Reserve already has the authority to create climate change stress tests under the Dodd Frank Act.²⁷⁶ The Act enables the Federal Reserve to introduce such tests and to develop at least three scenarios against which they would be conducted.²⁷⁷ This would enable the Federal Reserve to devise scenarios for adverse climate change events against which bank and non-bank financial institutions could conduct stress tests to determine if they would be able to absorb losses from these events. The Dodd Frank Act further enables the Federal Reserve to require companies to conduct their own annual or even semi-annual stress tests.²⁷⁸

The idea of stress tests has recently found support through a bill introduced in the Senate in late 2019, which would require the Federal Reserve to introduce climate change stress tests.²⁷⁹ Known as the Climate Change Financial Risk Act of 2019, the proposed legislation would mandate that the Federal Reserve introduce three scenarios for stress testing: global warming to 1.5 degrees Celsius; global warming to 2 degrees Celsius; and “business as usual,” or global

272. *Id.* at 56.

273. *Id.* at 57.

274. Irene Monasterolo, *Assessing Climate Risks in Investors’ Portfolios: A Journey Through Climate Stress-testing*, UN PRINCIPLES RESPONSIBLE INV. BLOG (Mar. 2, 2020), <https://www.unpri.org/pri-blog/assessing-climate-risks-in-investors-portfolios-a-journey-through-climate-stress-testing/5526.article>; VERMUELEN ET AL., *supra* note 264, at 57.

275. Monasterolo, *supra* note 274. Due to these uncertainties, Monasterolo and her colleagues have developed their own climate change stress test. See Stefano Battiston et al., *A Climate Stress-test of the Financial System*, 7 NATURE CLIMATE CHANGE 283 (2017).

276. Dodd-Frank Act, *supra* note 251, § 165(i).

277. *Id.* § 165(i)(1).

278. *Id.* § 165(i)(2).

279. See S. 2903, 116th Cong. (2019).

warming based on current predictions.²⁸⁰ The proposed Act also provides for a newly established subcommittee of the Financial Stability Oversight Council that would be tasked with identifying and responding to climate change risks and threats to the stability of the financial system.²⁸¹ While the bill is widely supported by Democrats,²⁸² the Republican response has been muted, and it is unclear as to whether the bill will pass.²⁸³

C. Climate Change Fund

A third idea is to create a climate change-related systemic crisis fund. As we have seen from COVID-19, the pandemic's decimation of the economy has required Congress to step in and provide aid. This has included around \$750 billion to the fossil fuel industry and \$50 billion in loans and payroll support to the airline industry as part of a \$2 trillion stimulus package.²⁸⁴ The last financial crisis necessitated similar governmental intervention with government bailouts to ailing financial institutions ranging from \$700 billion to \$1 trillion.²⁸⁵ If climate change events create a systemic crisis on par with COVID-19 or the 2008 financial crisis, government intervention will certainly be necessary once again.

At the same time, even though government assistance in times of a systemic crisis can be necessary, there is a fear that bailouts can lead to firms' moral hazard behavior.²⁸⁶ Indeed, in times of profitability, businesses seem to be more interested in stock buy backs²⁸⁷ than preparing for any gray rhino risks,

280. *Id.* §§ 4, 5.

281. *Id.* § 7.

282. The bill is co-sponsored by Elizabeth Warren (D-Mass.), Chris Van Hollen (D-Md.), Sheldon Whitehouse (D-R.I.), Michael Bennet (D-Colo.), Jeff Merkley (D-Or.), Cory Booker (D-N.J.), Amy Klobuchar (D-Minn.), Kamala Harris (D-Cal.), and Patty Murray (D-Wash.). *See* S. 2903, 116th Cong. (2019).

283. Dean Scott, *Senate Bill Would Extend Bank Stress Tests to Climate Risk*, BLOOMBERG L., Nov. 8, 2019.

284. Fiona Harvey, *US Fossil Fuel Giants Set For a Coronavirus Bailout Bonanza*, GUARDIAN, May 12, 2020; Alan Rappeport & Niraj Chokshi, *Crippled Airline Industry to Get \$25 Billion Bailout, Part of It as Loans*, N.Y. TIMES, Apr. 29, 2020; Timothy Massad, *Airlines Got the Sweetest Coronavirus Bailout Around*, BLOOMBERG, May 4 2020; Tim Wu & Yaryna Serkez, *These Companies Enriched Themselves. Now They're Getting a Bailout*, N.Y. TIMES, Mar. 27, 2020.

285. U.S. GOVERNMENT ACCOUNTABILITY OFFICE, FEDERAL RESERVE SYSTEM – OPPORTUNITIES EXIST TO STRENGTHEN POLICIES AND PROCESSES FOR MANAGING EMERGENCY ASSISTANCE (2011) (noting “[f]rom late 2007 through mid-2010, Reserve Banks provided more than a trillion dollars in emergency loans to the financial sector to address strains in credit markets and to avert failures of individual institutions believed to be a threat to the stability of the financial system”). *Id.* at 1.

286. Moral hazard behavior involves a firm increasing its exposure to risk because it knows it is protected against bearing the full costs of that risk. *See* Antonio E. Bernardo et al., *Designing Corporate Bailouts*, 59 J.L. & ECON. 75, 76 (2016); Marilyn Friedman, *To Bail Out or Not to Bail Out: Moral Hazard and Other Ethical Considerations*, 11 GEO. J. L. & PUB. POL'Y 411, 413-14 (2013); Neel Kashkari, President and CEO, Fed. Reserve Bank of Minneapolis, *Lessons from the Crisis: Ending Too Big to Fail*, Remarks at the Brookings Institution, Washington, D.C. (Feb. 16, 2016); Kathryn Judge, *The Truth About The COVID-19 Bailouts*, FORBES, Apr 15, 2020.

287. *See e.g.*, Wu & Serkez, *supra* note 284; Ruben Munsterman, *After \$16 Billion of Stock Buybacks, a Tech Company Seeks Government Aid*, BLOOMBERG, Apr. 24, 2020.

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suggesting that moral hazard behavior is driving firms' failure to adequately mitigate risks, including climate change risks.²⁸⁸

One possibility for countering this behavior is to have firms pay into a fund, which would be used to mitigate the costs of addressing the systemic crisis a climate change event could cause. Commentators have previously advocated for the creation of a systemic crisis fund or safety net as a means of addressing the risks and costs of a systemic crisis.²⁸⁹ As Gordon and Muller note, the fund model can mutualize risk by aligning incentives, encouraging firms "to press regulators to rein in firms and practices that pose systemic risks."²⁹⁰ The aim of having this model in place is to act as a monitoring device, prompting firms to monitor one another and control risky behavior as a means of not having to increase their contributions to the fund or safety net.²⁹¹ The fund model could also transfer at least some of the losses stemming from the systemic crisis from being paid for by tax payers to firms themselves.²⁹²

In many ways, the fund model is analogous to the Federal Deposit Insurance Corporation (FDIC) model, which uses premiums paid by financial institutions to guarantee deposits as part of a larger goal of maintaining financial system stability.²⁹³ Thus, following the FDIC model approach, firms would pay into a climate change fund, which would be managed by a government agency. The amount of payment by individual firms into the fund could be determined, for instance, by the amount of the firm's investment in fossil fuels or other leading causes of climate change,²⁹⁴ or by other criteria.²⁹⁵ The goal would be to have

288. Editorial, *How to Think About Moral Hazard During a Pandemic*, ECONOMIST, Apr. 25, 2020 (arguing that "[b]ut the threat posed by climate change means that such extraordinary natural calamities might not be so infrequent. It might thus become harder for governments to credibly declare that aid provided during such disasters is a one-off, as is needed to discourage reckless behavior and to stop dangerous risks from accumulating"); See also Judge, *supra* note 286 (arguing that "[t]he decision by so many large corporations to take on so much debt in recent years did not cause COVID-19, but it did reduce the capacity of the corporate sector to weather this storm").

289. See e.g., Jeffrey N. Gordon & Christopher Muller, *Confronting Financial Crisis: Dodd-Frank's Dangers and the Case for a Systemic Emergency Insurance Fund*, 28 YALE J. ON REG. 151 (2011); Iman Anabtawi & Steven L. Schwarcz, *Regulating Ex Post: How Law Can Address the Inevitability of Financial Failure*, 92 TEX. L. REV. 75 (2013). See also Restoring American Financial Stability Act of 2010, S. 3217, 111th Cong. § 210(n) (2009) (proposing a bailout fund for systemically important financial institutions, that was later abandoned due to political opposition).

290. Gordon & Muller, *supra* note 289, at 208.

291. Steven L. Schwarcz, *Misalignment: Corporate Risk-Taking and Public Duty*, 92 NOTRE DAME L. REV. 1, 19 (2016).

292. Gordon & Muller, *supra* note 289, at 205.

293. *Id.*; Steven A. Ramirez, *The Law and Macroeconomics of the New Deal at 70*, 62 MD. L. REV. 515, 543-44 (2003).

294. The EPA lists the leading causes of greenhouse gas emissions. See *Sources of Greenhouse Gas Emissions*, EPA, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions> (last visited May 6, 2021).

295. For example, Gordon & Muller suggest that the fund should be scaled to the size of the current US economy. Gordon & Muller, *supra* note 289, at 204. Alternatively, a proposal for a fund attached to the Dodd-Frank Act, which was later abandoned suggests that the fund be capitalized based on several risk-based assessments which the proposal outlines. See Restoring American Financial Stability Act of 2010, *supra* note 289, § 210(o).

the fund capitalized to a target amount within a specified period of time.²⁹⁶ Payments into the fund, however, could be varied to accord with an individual firm's risk propensity for specified climate change events, with payments lowered for firms working to mitigate specified climate change risks. Once the fund is capitalized and a climate change event occurs that triggers a systemic crisis, the fund would then be used to support firms according to a set of pre-determined criteria.²⁹⁷ In addition, use of fund amounts to support firms could be conditioned on having to achieve prescribed climate change targets, such as reducing emissions or investments in fossil fuels, within allocated time periods.²⁹⁸

The biggest objection to the use of such a fund would likely be the fear that the existence of the fund would institutionalize the moral hazard problem. Certainly, this was the objection to the 50 billion liquidation fund, proposed under the Dodd-Frank Act, to bail out failing banks.²⁹⁹ Critics noted that the fund "amounted to a permanent bailout fund that would weaken market discipline."³⁰⁰

The climate change fund, however, need not perpetuate moral hazard behavior. First, since the size of payments made by individual firms would be dependent on their climate change risk propensity, firms should be incentivized to minimize, not exacerbate, their individual risks. Second, the climate change target conditionalities added to any amounts used by firms from the fund should also reduce moral hazard behavior. Third, since the aim by firms will be to keep overall payments into the fund low, they may monitor one another to ensure that risky behavior, such as new fossil fuel investments, is discouraged. In addition, even if moral hazard is not contained, the fund, at least, represents a fairer solution to the public than the status quo since it lessens the burdens on individual citizens—who would otherwise pay the costs of systemic stability with taxpayer dollars—since the firm capitalized fund would be used to support businesses.

It is also unlikely that a fund, in and of itself, would cause moral hazard behavior. As commentators have noted, a fund is simply "a prudential measure against possibilities we may not project, notwithstanding efforts to avoid them, and it is no more causative of failure than a safety net under a tightrope walker."³⁰¹ In addition, since the last financial crisis, firms have continued to

296. For example, Gordon & Muller suggest capitalization of \$1 trillion over 20 years while the Restoring American Financial Stability Act proposed a \$50 billion target achieved within a 5 to 10 year period. See Gordon & Muller, *supra* note 289, at 204-206; Restoring American Financial Stability Act of 2010, *supra* note 289, § 210(n)(5).

297. Anabtawi & Schwarcz, *supra* note 289, at 106. Whether a climate change induced systemic crisis has occurred should be determined by a panel of pre-selected scientists and economists, while disbursements from the fund should be overseen by the Federal Reserve and Treasury acting in concert.

298. Cameron Hepburn et al., *Will COVID-19 Fiscal Recovery Packages Accelerate or Retard Progress on Climate Change?*, 26 OXFORD REV. ECON. POL'Y S359 (2020).

299. Restoring American Financial Stability Act of 2010, *supra* note 289, § 210(n).

300. Greg Hitt & Damian Paletta, *Senate Ends Financial-Bill Standoff*, WALL ST. J., Apr. 29, 2010, at A2.

301. Gordon & Muller, *supra* note 289, at 210.

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engage in moral hazard behavior, even without a fund in place, and some of these firms are the ones asking for bailouts due to COVID-19.³⁰² Moral hazard behavior thus seems to be par for the course for some firms, not necessarily behavior exacerbated by the presence of a safety net.

D. Moving Towards Green Investments

A final idea would be to incentivize reallocating capital from investments that contribute to climate change to those that mitigate climate change. Governments could encourage such behavior by increasing or decreasing the cost of capital depending on whether an investment furthers or mitigates climate change. That is, banks could be penalized or forced to engage in additional capital requirements for engaging in “brown” (climate change problem-causing) investments or have capital charges lowered for “green” (climate change-mitigating) investments.³⁰³ Alternatively, investments can be reallocated towards green projects by using green bonds.³⁰⁴ Green bonds raise financing for projects that deliver environmental benefits, including climate change mitigation, and can be issued by financial institutions, governments, and companies.³⁰⁵ Both of these approaches lower the systemic risk of climate change by encouraging green investments and reducing brown investments.

However, at present both approaches are plagued by taxonomy issues, as the definition as to what precisely constitutes a green or brown investment has not yet been determined. This results in a complicating classification of investments. Efforts are underway to develop a climate change financial-oriented taxonomy, although data on the relative riskiness of green versus brown projects remains limited and continues to complicate investment classification.³⁰⁶

A second problem is that the greenness of green bonds cannot be independently verified. Until recently, for instance, China was issuing green bond financing for coal projects, despite coal being a contributor to climate change problems.³⁰⁷ There are a number of different organizations such as the Climate Bonds Initiative, Moody’s, and the International Capital Market

302. Judge, *supra* note 286; Wu & Serkez, *supra* note 284.

303. See, e.g., Margherita Giuzio et al., *Climate Change and Financial Stability*, EUR. CENTRAL BANK (2019), https://www.ecb.europa.eu/pub/financial-stability/fsr/special/html/ecb.fsrart201905_1~47cf778cc1.en.html#toc1; Silla Brush & Alastair Marsh, *BOE Considers Raising Capital Costs for Pollution in Green Push*, BLOOMBERG LAW, Mar. 10, 2020; EU HIGH LEVEL EXPERT GROUP ON SUSTAINABLE FINANCE, FINANCING A SUSTAINABLE EUROPEAN ECONOMY - FINAL REPORT 68 (2018).

304. Caroline Flammer, *Green Bonds: Effectiveness and Implications for Public Policy*, 1 ENV’T & ENERGY POL’Y & ECON. 95 (2020); Tooze, *supra* note 78.

305. Flammer, *supra* note 304, at 95; Lyubov Pronina, *What Are Green Bonds and How ‘Green’ Is Green?*, BLOOMBERG, Mar. 24, 2019.

306. See *Action Plan: Financing Sustainable Growth*, COM (2018) 97 final (Mar. 8, 2018); Brush & Marsh, *supra* note 303.

307. Christian Shepherd & Don Weinland, *China to Stop Green Bond Financing For ‘Clean Coal’ Projects*, FIN. TIMES, May 29, 2020; David Stanway et al., *China Excludes Clean Coal Projects From List Eligible For Green Bonds*, REUTERS, May 29, 2020.

Association's Green Bond Principles that can certify the veracity of a green bond. However, the criteria for certification varies across organizations.³⁰⁸

Yet with over \$185 billion in green bond financing raised last year alone, and green investments exceeding \$31 trillion, green investing seems to be an increasingly desired strategy by investors.³⁰⁹ Moreover, recent studies have found that green investments are outperforming standard investments while green bonds that are independently certified improve both firm performance as well as a firm's environmental performance.³¹⁰ There is concern, however, that green investments are not being oriented towards changing the actions of greenhouse gas emitters or being channeled into renewable energy companies.³¹¹ Thus, while the greening of investments may be redirecting finance towards less risky assets, it is unclear as to whether the greening of investments is sufficient to prompt corporations to implement practices that better mitigate climate change.

CONCLUSION

COVID-19 reminds us that gray rhino risks that are ignored are done so at peril. It also provides a glimpse of the devastation on the economy that failing to prepare for climate change could impose. At the same time, COVID-19 has also afforded us an opportunity by pausing the economy. While there is no doubt that the economic engine must be restarted, this halt to the economy allows us to take one of two paths to recovery. The first is one where we return to life pre-pandemic, where the status quo prevails, and where, despite the urgency of addressing climate change risks, we return to business as normal. The second path looks very different. It is premised on a green recovery in which climate change is better incorporated into economic measures. It would also mean an economy premised on decoupling economic growth from greenhouse gas emissions, which would involve using one or more of the regulatory options explored above alongside enhanced climate change disclosure.

Still, it may be that governments choose to focus only on one crisis at a time. Government attention today seems to center only on economic recovery in the face of containing COVID-19. This could mean that governments overlook or ignore climate change action, even in relation to economic recovery. Yet failure to attend to issues of climate change now may make it impossible to do so later.

308. Flammer, *supra* note 304, at 96.

309. Elliot Smith, *The Numbers Suggest the Green Investing 'Mega Trend' Is Here to Stay*, CNBC, Feb. 14, 2020; Reed Lamberg et al., *Green Finance Is Now \$31 Trillion and Growing*, BLOOMBERG, June 7, 2019.

310. Siobhan Riding, *Majority of ESG Funds Outperform Wider Market Over 10 Years*, FIN. TIMES, June 30, 2020 (citing a report by Morningstar); Mark Haefele, *Sustainable Investing Can Propel Long-term Returns*, FIN. TIMES, Sept. 25, 2018; Flammer, *supra* note 304, at 97-98.

311. The Economist Staff, *How Much Can Financiers Do About Climate Change?*, ECONOMIST, June 20, 2020.

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This is ardently apparent in relation to the economic aspects of climate change. A failure to mitigate climate change will lead to substantial losses with rippling effects throughout the entire global economy. Moreover, the damage will not be limited to the economy, as the wide-scale economic effects will likely also cause knock-on effects on society. Even worse, once we have reached this stage, it will be difficult or impossible to course correct.

In short, an economy post-COVID-19 cannot ignore the impact of climate change. COVID-19 has already revealed the parts of the economy that are most susceptible to climate change. Moving forward, governments must prioritize an environmentally resilient economic model. Regulating to ensure that the systemic risks climate change poses are mitigated is just one step, but an important one, in this direction.