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Assessing the Fossil Fuel Divestment Movement

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April 2018

WORKINGPAPER SERIES

Number 462

**POLITICAL ECONOMY
RESEARCH INSTITUTE**

ECONOMICS AND CLIMATE JUSTICE ACTIVISM: ASSESSING THE FOSSIL FUEL DIVESTMENT MOVEMENT

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April 2018 Draft

ABSTRACT:

We present an economic analysis of fossil fuel divestment as a strategy for advancing an effective global climate stabilization project. The basic question we ask is: how effective are campaigns to force various entities to sell their fossil fuel stock holdings likely to be in driving down CO₂ emissions? We conclude that divestment campaigns, considered on their own, have not been especially effective as a means of significantly reducing CO₂ emissions, and they are not likely to become more effective over time. We reach this conclusion both through an analysis of the available descriptive data on global divestment patterns as well as an econometric modeling exercise that evaluates the impact of divestment events on the stock market prices of fossil fuel companies. We reach this conclusion while also recognizing that fossil fuel divestment campaigns have several important virtues. Nevertheless, we conclude that most efforts now devoted to divestment campaigns would be better spent on more direct efforts to drive down fossil fuel consumption and CO₂ emissions.

JEL CODES: Q54, B59

Introduction

We know from climate science that humanity faces a potentially existential threat resulting from climate change. The single most important task that needs to be achieved to stabilize the climate is to dramatically reduce emissions of CO₂ generated through burning fossil fuels—oil, coal, and natural gas—to produce energy. Climate change cannot be entirely blamed on we humans consuming oil, coal, and natural gas to generate energy. But people consuming fossil fuels for energy can be blamed for about 80 percent of the problem.¹

This reality raises the urgent question: what are the most effective ways to transform the United States and global economy away from its ongoing dependency on fossil fuels? Throughout the world, a wide range of policies have been debated and, to a lesser extent, implemented, including regulations to limit CO₂ emissions from various sources; subsidies to support investments in both energy efficiency and clean renewable energy sources such as solar and wind power; and putting a price on CO₂ emissions through taxation or a carbon cap. Such measures are having positive impacts where they are being implemented, but not nearly to the extent necessary to reverse the persistent rise of global CO₂ emissions.

In fact, climate stabilization will require that the global mean temperature stabilizes at no more than between 1.5 – 2.0 degrees Celsius above preindustrial levels. To achieve this stabilization point, global CO₂ emissions will need to fall to roughly 7 billion metric tons by 2050 from their current level of 32 billion tons, and continue to fall from there to a zero emissions point within an additional 10-20 years. However, according to the 2017 forecast by the International Energy Agency, if current global policies remain on a steady trajectory through 2040, global CO₂ emissions will instead rise to 43 billion tons. If this is the actual situation in 2040, then there would be virtually no chance to bring global emissions down to 7 billion tons, or any figure close to that, by 2050.²

Clearly, much more effective interventions are urgently needed to successfully drive down CO₂ emissions both in the U.S. and globally. One approach that has gained increasing global support in recent years is divestment—i.e. for all entities that own stocks or bonds in private fossil fuel companies such as Exxon/Mobil, Chevron, or Cloud Peak Energy to sell these assets. Divestment is thus targeted at damaging the reputation and operations of corporations that profit from the sale of oil, coal, and natural gas, as opposed to focusing on enacting public policies capable of driving down CO₂ emissions.

¹ This is based on the most recent figures from World Development Indicators on CO₂ emissions and methane emissions from natural gas production operations as a share of total greenhouse gas emissions (World Bank 2018).

² The IEA forecasting model extends only to 2040. The formal analysis in this paper remains within the parameters of the IEA forecast.

The fossil fuel divestment campaigns are roughly modeled on earlier such campaigns around ending apartheid in South Africa and opposing the sale of tobacco products.

In this paper, we present an economic analysis of fossil fuel divestment as a strategy for advancing an effective global climate stabilization project. Since fossil fuel divestment is an explicitly economic tool for advancing climate stabilization, it readily lends itself to economic analysis. The basic question we ask here is simple: how effective are campaigns to force various entities to sell their fossil fuel stock holdings likely to be in driving down CO₂ emissions?

Our answer is also straightforward. We conclude that divestment campaigns, considered on their own, have not been especially effective as a means of significantly reducing CO₂ emissions, and they are not likely to become more effective over time. We reach this conclusion on the basis of what we believe is the most careful examination to date of the evidence on global fossil fuel divestment activity. Our examination includes both an analysis of the available descriptive data on global divestment patterns as well as an econometric modeling exercise that evaluates the impact of divestment events on the stock market prices of fossil fuel companies.

We reach this conclusion while also recognizing that fossil fuel divestment campaigns have several important virtues. To begin with, they enable activists to fight for goals that can be clearly articulated and achieved within the institutions and communities in which they work and live, as opposed to attempting to influence public policies where the decision-making process is more remote. Divestment campaigns also have a demonstrated record of success in raising consciousness as to the urgency of dramatic action on climate change, and the need to confront the power of the fossil fuel industry as the single greatest barrier to advancing a viable climate stabilization project. (Schifeling and Hoffman 2017). Moreover, the divestment movement helped reframe the climate crisis as a social justice issue requiring collective, grassroots mobilization, especially among college students (Benson and Sarathy 2015; Healy and Debski 2016). These successes parallel the achievements of earlier divestment campaigns around apartheid and tobacco consumption.

Despite these substantial accomplishments, we nevertheless conclude, based on the findings we present here, that most efforts now devoted to divestment campaigns would be better spent on more direct efforts to drive down fossil fuel consumption and CO₂ emissions. This will certainly include campaigns around implementing strong policies in the areas of regulation, subsidies for clean energy, and carbon pricing that can directly drive down fossil fuel consumption and support energy efficiency and clean renewable energy investments. It should also include other forms of direct action, including at institutions where people are connected in their daily lives. For example, college students can demand that their campuses convert to 100 percent renewable sources and high efficiency to produce energy. Communities can similarly insist that their local governments eliminate the use of fossil fuels altogether.

In Section 2 of the paper, we provide general background on the fossil fuel divestment movement and financial conditions for fossil fuel companies. Section 3 presents a range of descriptive evidence on global divestment activity. In section 4, we present our econometric analysis as to how major fossil fuel divestment events have affected stock market prices of fossil fuel firms. Section 5 offers some concluding observations, including on possible ways to redirect the highly valuable efforts of divestment campaigners into activities with greater prospects for advancing the global climate stabilization project.

2. Background on the Fossil Fuel Divestment Movement

The first fossil fuel divestment campaign began in October of 2011 at Swarthmore College, a small elite liberal arts college outside of Philadelphia, Pennsylvania (Swarthmore 2012). While ultimately unsuccessful in getting the college to divest, the campaign caught the attention of other environmentalists, including the well-known environmental journalist, activist, and co-founder of 350.org, Bill McKibben. Following McKibben's publication of a 2012 article in *Rolling Stone* titled "Global Warming's Terrifying New Math," the fossil fuel divestment movement gained major momentum. McKibben's article argued that, in order for global CO₂ emissions to fall sufficiently to stabilize the climate, 80 percent of all existing proven oil, gas and coal reserves will have to remain in the ground. That is, these fossil fuel assets cannot be used to generate energy if climate stabilization is a serious goal. McKibben reached the logical conclusion that the value of these assets for both the public and private entities which own them will have to fall to zero.

The McKibben article generated huge interest, becoming the most widely-read article in *Rolling Stone's* history (Hopke and Hestres 2017). Building from this response, 350.org, the climate justice organization that McKibben helped to found and lead, began mobilizing divestment campaigns widely. Within five months of the publication of McKibben's article, the movement had spread to more than 150 college campuses and continued to grow rapidly from there (Bagley 2012). As of 2016, individuals and institutions across 76 countries had committed to some form of fossil fuel divestment (Arabella 2016).

The conclusion presented in McKibben's article—that most of the world's fossil fuel reserves cannot be burned if humanity is going to seriously attempt to stabilize the climate—is sound. But it does not follow from this conclusion that divestment campaigns are necessarily an effective tool for advancing a viable global climate stabilization agenda.

Ethically motivated owners of fossil fuel stocks and bonds do certainly have the power to sell these assets as a statement of principle and act of protest. At least equally significantly, the public debates that are central to all such divestment campaigns have succeeded in raising awareness of the climate crisis and inspired increasing numbers of people to join the climate justice movement.

These accomplishments are real. Nevertheless, they will have no direct impact on the operations of the fossil fuel corporations as long as investors who are profit-seekers, as opposed to being motivated ethically, are willing to purchase the stocks and bonds that ethically-motivated divestors have been put up for sale. Indeed, the core divestment strategy of selling fossil fuel assets is, at best, incomplete until one also evaluates who will be purchasing these for-sale divested assets and under what circumstances.

It is a truism that profit-seeking investors will continue to purchase these divested fossil fuel assets as long as they can profit from them. Their profit opportunities will not be diminished through the divestment-led sales per se. This is because divestment per se does not affect either the cost structure of the corporations' productive operations or the goods markets in which consumers buy energy. In theory, divestments are capable of exerting a direct impact on the *financial market valuation* of fossil fuel companies, if not their sales on *goods markets*. But it is also likely that any such impacts on financial market valuations will be minimal as long as profit-seeking investors continue to see profit opportunities in owning oil, gas, and coal stocks.

The critical question then becomes: what can succeed in cutting into the profitability of fossil fuel corporations? The short answer includes the following: policies that raise the costs of producing and consuming fossil fuels, such as a carbon tax; regulations that establish tight and binding limits on allowable emissions; and various sorts of subsidies and supports for energy efficiency and clean renewable energy as viable substitutes for fossil fuel energy. Such policies raise the costs of both producing and consuming fossil fuel energy, and lower the costs of substituting energy efficiency and clean renewable energy for fossil fuels. The profitability of firms producing and selling oil, coal and natural gas will decline as a result, while opportunities for clean energy will correspondingly rise.

Coal companies in the U.S. and elsewhere have faced direct challenges to their profitability for decades. The emergence of low-cost natural gas supplies extracted through fracking has created an affordable substitute for coal as a raw material in generating electricity. Coal companies have been further burdened by environmental regulations that have raised their production costs. The competition created by low-cost natural gas supplies has prevented the coal companies from passing on their increased regulatory costs to consumers through raising consumer prices. The coal companies' profits have consequently been squeezed. These companies are now mostly generating losses. Profit-seeking investors have moved out of coal, and share prices have fallen. To date, oil and gas companies have not faced challenges to their profitability at a comparable scale. They remain generally profitable.

We can obtain a sense of these broad patterns in Table 1, which provides evidence on net income between 2012 – 2015 for the five largest U.S. oil/gas and coal companies respectively. As the table shows, there are large variations in the profitability of the individual companies, both in oil/gas and coal. But the overall patterns are clear. Over 2012 – 2015, the largest oil/gas companies earned a total of \$203.8 billion in net income while the largest coal companies lost \$17.2 billion. Moreover, Peabody Energy, Arch

Coal and Alpha Coal have all been in and out of bankruptcy in recent years. Coal-fired power plants have also been shutting down steadily, despite pledges of support from the Trump Administration (Campbell and Lustig 2018).

TABLE 1 BELONGS HERE

In short, the simple logic of a fossil fuel divestment campaign suggests that it is not likely to produce a major impact on the operations of fossil fuel companies on its own, much less lead to major reductions in global CO₂ emissions on its own. The coal industry is in a steady trajectory of decline, but the divestment movement is not likely to have impacted this trend significantly.

We now turn to examining a range of empirical evidence that will enable us to evaluate these issues more systematically.

3. Descriptive Evidence on Global Divestment Activity

Our starting point for estimating global divestment levels among all entities is the valuable dataset produced by GoFossilFree.org (GFF). The GFF dataset includes information for each entity that has either already divested or has committed to divest its portfolio of fossil fuel assets. These entities include asset management firms, pension funds, religious institutions, educational institutions, and government bodies such as municipalities (primarily in France). The information provided by GFF includes: the home countries of each entity; the total assets under management at the time of the divestment commitment; and the extent of the divestment commitment.

As an initial matter, it is critical to be clear on the distinction between the assets under management of an entity committed to divestment and the actual level of divestment by that entity. As an example, CalPERS (the California Public Employees Retirement System) manages the largest public pension fund in the United States. It has about \$350 billion in assets under management as of February 2018. On Oct. 8, 2015, CalPERS committed to divest its coal holdings of \$83 million. Thus, its level of divestment out of coal, at \$83 million, amounts to about 0.02 percent of its total assets under management.

It is equally important to be clear on distinctions in terms of divestment commitments levels among various entities, since these commitment levels do vary significantly. We list different commitment levels in Table 2. As we see there, we divide commitment levels into two broad categories, "limited" and "full" divestment commitments. Under limited commitments, we include three more specific categories—divestment from 1) coal only; 2) coal and tar sands only; and 3) some other mix of fossil fuel divestments, such as coal plus some natural gas, or (as is often the case) a limited portion of coal companies. Under full divestment commitments, we include entities that have either: 1) already fully divested themselves of all their fossil fuel holdings; or 2) formally committed to doing so.

TABLE 2 BELONGS HERE

The GFF database includes some ambiguities and gaps which we have addressed to the extent possible. First, GFF states that all of the divestment commitments that it reports in its dataset are “binding.” But we found that not all commitments are in fact binding. For example, city councils of some municipalities have voted to divest. But the final decision to sell off fossil fuel assets rests with the fund managers, not the council itself. We were also unable to consistently establish whether some entities have already divested, are in the process of divesting, or have yet to initiate the asset sale process. Additionally, for some entities, figures for commitment dates, commitment levels, and amount of assets under management are unavailable.

We have referenced additional sources beyond the GFF to fill in the data gaps to the extent possible.³ Specifically, we obtained additional information on both the level of divestment commitment as well as total assets under management for two sets of large entities within the overall GFF database. These are: 1) entities with assets under management of \$1 billion or more that have made full divestment commitments; and 2) entities with assets under management of \$90 billion or more that have made limited divestment commitments.

Composition of Divesting Entities

Table 3 presents summary statistics on entities in the GFF dataset that have divested at any commitment level as of March 26, 2018. As the table shows, there are a total of 796 entities in this dataset. Of these 796 entities, we have figures on assets under management for a total of 480 of them i.e. 60.3 percent of the entities listed by GFF. From the available data, we assess that the remaining 316 entities, for which we do not have figures on assets under management, hold insignificant amounts of assets under management.⁴ Even in the aggregate, the level of assets under management for all 249 entities is modest, almost certainly less than \$15 billion.⁵

TABLE 3 BELONGS HERE

Focusing on the 480 entities for which we do have data on assets under management, the total assets under management for these entities, as we show in Table 3, amounts to \$6.5 trillion. But, critically, we also see in Table 3 that total assets under management are highly concentrated in a small number of the overall pool of 480 entities. Specifically, 15 entities—only 1.9 percent of the 796 entities with some known level of divestment commitment—account for \$5.7 trillion of the \$6.5 trillion of assets

³ These references are documented in detail in Appendix 1.

⁴ The one exception among this group of entities would be the city of Paris. But data on assets under management for Paris are unavailable. Moreover, the extent of the divestment commitment by Paris remains unclear as of this writing.

⁵ Median assets under management is \$35.7 million. Multiply this by the 316 entities gives us \$11.3 billion. However, this is likely an overestimate based on the types of entities represented among the 316 entities (e.g., disproportionate number of small churches and municipalities).

under management that we can identify. That is, these 15 entities account for about 88 percent of all the assets under management among the 480 entities that GFF has identified as having taken some divestment action and for which assets under management data are available. Only one of these entities (the New York City pension fund system) committed to full divestment, leaving 14 entities with limited commitments accounting for 85% of the \$6.5 trillion in assets under management.

Working from these figures in Table 3, we can usefully divide all divesting entities into three broad categories:

- 1) The 14 largest entities with limited commitment levels, which account for roughly 85 percent of all assets under management among divesting entities.
- 2) The remaining smaller entities—aside from the 14 largest entities—committed to limited divestment levels; and
- 3) All entities commitment to full divestment levels.

The 14 Largest Divestment Entities with Limited Commitments. Table 4 lists the 14 largest global entities that have made limited divestment commitments. The table shows both the level of assets under management for these entities and their divestment commitment levels. As noted above, all of these entities have made limited divestment commitments only, some specifics of which we present in Table 4.

TABLE 4 BELONGS HERE

For all of these entities, the figures on assets under management come directly either from the GFF database or other published sources. For the figures on divestment levels, the figures come from other published sources for 9 of the 14 entities. With five of the entities—Aegon, Aviva, Lloyd's, Bank J. Safra Sarasin, and Swiss Reinsurance Company—no published data were available on divestment commitment levels. We therefore extrapolated figures for these five entities based on data for the other 9 divesting entities.⁶

As Table 4 shows, the entity with the largest divestment commitment is the Government Pension Fund Global. This is a Norwegian pension management fund, with total assets under management amounting to \$890 billion at the time of the divestment commitment (June 5, 2015). Their total divestment, which is for coal only, is \$9 billion, i.e. 1 percent of their total assets under management. The next largest divesting entity is AXA Investment Managers (IM), a French asset management firm. The total assets under management by AXA IM was \$782 billion at the time of the divestment commitment (Apr. 25, 2017). Their divestment commitment was for \$209 million, i.e. about 0.03 percent of their total assets under management. AXA IM's level of commitment was a coal-only divestment.

⁶ Appendix 1, again, provides full references to our data sources. Appendix 2 describes our extrapolation methods.

Overall, we estimate the total funds divested from the 14 largest divesting entities to be \$21.7 billion. This amounts to roughly 0.4 percent of their total assets under management. The level of their divestment commitments range between 0.01 and 1.17 percent of their assets under management.

Smaller Entities with Limited Divestment Commitments. As we show in Table 5, there are a total of 94 entities in this category of entities with limited divestment commitments. These smaller divesting entities control a total of \$675 billion under management. We do not have direct figures on the extent of total coal and tar sands stocks for which they had divested. But to approximate, we assume that the pre-divestment portfolio of these firms is the same as that for the 9 large firms listed in Table 4 for which we do have data. That overall level of holdings was 0.43 percent of the total portfolio. We therefore assume that the level of divestment for these entities is 0.43 percent of their total assets under management. This implies that the level of limited divestments by these firms amounts to \$2.9 billion.

TABLE 5 BELONGS HERE

Entities with Full Divestment Commitments. Table 6 presents figures on these entities. As we see, most of the entities in the GFF dataset—671 of 796 in total—are committed at this full divestment level. Of those 671 entities, we have asset information on 372 of them. The assets under management for these firms amounts to \$290 billion, i.e. only 3.2 percent of the total assets under management for both the limited and full divestment entities. Moreover, of these entities with full divestment commitments, two of them—New York City pension funds and MP Pension Fund—manage \$208 billion, or 71.3 percent of the total assets under management for entities committed to full divestment. These two entities have committed to divesting \$5.2 billion from fossil fuels.

Using data on the fossil fuel industry's share of the global stock market (See Appendix B), we estimate the total funds divested from the other 371 entities fully divesting to be \$6.3 billion. That amounts to a total of \$11.5 billion for all entities that have divested fully, including the \$5.2 billion from New York City and MP Pension Fund as well as the \$6.3 billion from all other fully divesting entities.

TABLE 6 BELONGS HERE

Summary of Descriptive Evidence. As we have seen, the data we have been able to compile on global fossil fuel divestment activity are incomplete. In particular, we have data on assets under management for only about 60 percent of all entities listed in the GFF database. Of these entities, we have documented data on divestment levels for only 11 entities in total. However, these 11 entities do account for roughly 63 percent of all assets under management for all divesting entities. We are also confident that our methods of estimating divestment levels for the remaining firms are broadly reliable. Our basic approach is to assume that the levels of fossil fuel asset holdings prior to divestment for the divesting entities broadly matches the fossil fuel asset holdings for all entities in global financial markets.

Based on the data we have compiled and estimated on assets under management and divestment levels, the main patterns we observe are as follows:

1. Virtually all of the entities that have committed to divestment at any level are very small, as measured by assets under management;
2. Most of the entities are committed at full divestment levels. But here as well, virtually all of the entities committed to full divestment are small.
3. Fifteen large entities dominate the overall pool of divesting entities, as measured both directly by assets under management, and, through our estimations, by levels of divestment. Moreover, all but one of these 15 large entities have made only limited divestment commitments.

Table 7 summarizes the estimates we have derived for overall levels of divestment. As we see in Panel A of Table 7, we estimate that total divestment commitments as of March 2018 amount to \$36.1 billion. Of this total, \$21.7 billion, or about 60 percent, are the divestments committed by the 14 largest entities with limited divestment commitments.

TABLE 7 BELONGS HERE

In Panel B, we show these divestment commitment levels as a share of the market value of fossil fuel assets in all global financial markets, using figures from 2014. As we see, the \$24.6 billion in limited divestment commitments, including the commitments of both the 14 largest entities and the 94 smaller entities, amounts to 10.6 percent of the \$233 billion in total market value for global coal corporations. The full divestment commitments of \$11.5 billion amount to 0.2 percent of total market value for all global fossil fuel companies. The \$36.1 billion in total divestment commitments—including all limited and full commitments—amounts to 0.7 percent of the total market value of global fossil fuel companies as of August 2014 (Bullard 2014).

4. Econometric Analysis of Divestment Events

In this section, we conduct time-series econometric analysis to assess the impact of specific divestment events on the stock market share prices of oil/gas and coal companies respectively. Our modeling approach is a standard “events study” methodology.⁷ The dependent variables in the regressions are the share prices of the oil/gas and coal companies, measured according to three alternative specifications. In terms of explanatory variables, we run a first set of regressions with variables that typically influence fossil fuel share prices. We then run a second set of regressions, in which we add the divestment events as additional dummy variables in the time series

⁷ The econometrics of event studies in the finance literature are well summarized in Campbell, Lo and MacKinlay (1997), Chapter 4.

models. Through this approach, we are able to formally test the extent to which any given divestment event affects fossil fuel share prices, after controlling for the effects of explanatory variables that are typically significant. We are also able to measure the extent to which all the divestment events, considered cumulatively, are influencing fossil fuel share prices.

As we have shown in the previous section, the assets under management of divesting entities are heavily concentrated in a small number of large entities. Given this, we are able to concentrate our regression analysis on these largest divestment commitments to estimate the overall impact of divestments on the share prices of fossil fuel companies. With respect to oil and gas divestments, the 11 divestment commitments we use in our event study account for roughly 78 percent of all assets that have been divested, with the New York City pension fund system accounting for 65% on its own. With coal, the 12 divestment commitments we use in our event study similarly account for about 78 percent of all assets that have been divested.

Our basic model is a single equation:

$$\text{Fossil Fuel Share Prices} = \beta_0 + \beta_1(\text{Fossil Fuel Commodity Price Index})_t + \beta_2(\text{S\&P 500 Fossil Fuel Free Index})_t + \beta_3(\text{Divestment Events})_t + \varepsilon_t$$

This equation tests how much variation the share prices of either oil/gas or coal companies are affected by the following:

1. Changes in the market prices of oil/gas or coal respectively in goods markets;
2. Changes in overall stock market prices exclusive of the fossil fuel share prices; and
3. Any of the 11 divestment events with respect to oil and gas stock holdings or the 12 divestment events for the coal companies.

The specific variables we use in these regression models are as follows:

Oil and Gas Share Price Analysis

1. *Share price.* We specify this through three data series, running separate regressions with each data series as the dependent variable:
 - The Dow Jones US Oil & Gas Index;
 - The Royal Dutch Shell share price;
 - The Exxon/Mobil share price.
2. *Goods Market Price Index.* Two benchmark oil and gas prices in the U.S.—the West Texas Intermediate oil price and the Henry Hub natural gas price.
3. *S&P 500 Fossil Fuel Free Index.* This is an S&P stock market index that excludes all fossil fuel firms, but otherwise incorporates a broad set of 500 publicly-listed corporations.

4. *Divestment Events.* Dummy variables for the dates of 11 of the largest full divestment commitments.⁸ We list these 11 divestment commitment events in Table 8. We include the divestment commitments from Syracuse University and the Guardian Media Group as one event since they occurred within one day of each other, i.e. 3/31/15 and 4/1/15.

TABLE 8 BELONGS HERE

Coal Share Price Analysis

1. *Share price.* We specify this through three data series, again running separate regressions with each data series as the dependent variable:
 - The Dow Jones US Coal Index;
 - The Cloud Peak Energy share price;
 - The Alliance Resource Partners share price.
2. *Coal Goods Market Prices.* We include here four separate coal prices: 1) an Appalachian price, derived averaging separate prices for Central and Northern Appalachia; 2) the Illinois Basin price; 3) the Powder River Basin price; and 4) the Uinta Basin price.⁹
3. *S&P500 Fossil Fuel Free Index.* As described above for the oil/gas regression variables.
4. *Divestment Events.* Dummy variables for the dates of 12 of the largest coal divestment commitments.¹⁰ We list these 12 divestment commitments in Table 9. We include the divestment commitments from CalPERS and the California State Teachers' Retirement System (CalStrs) as one event since they occurred on the same day, Oct. 8, 2015. Similarly, we considered the coal divestments by PFZW and Allianz Group as one divestment event, since they occurred in consecutive weeks, Nov. 16, 2015 and Nov. 23, 2015 (coal price data are reported weekly).

TABLE 9 BELONGS HERE

Adjustments with Data and Models

⁸ We excluded four divestment commitments because we either did not know the commitment date, could not verify the commitment from a published source outside of GFF, or the commitment date was too recent (e.g., MP Pension Fund divested 3/26/18, as we were completing this version of the paper).

⁹ We experimented with different combinations of coal prices in the regressions but decided to keep them all because there wasn't one single price that could serve adequately as a benchmark. Moreover, the statistical significance of the event dummies was essentially the same across the different combinations.

¹⁰ We excluded three divestment commitments because we didn't know the commitment date, or the details surrounding the commitment were ambiguous.

We ran the model using ordinary least squares with heteroskedastic-consistent standard errors to control for heteroskedasticity. Most variables with both sets of data include stochastic unit roots, as measured by Augmented Dickey Fuller tests. We therefore converted the variables into stationary series through taking first differences in all cases.

Results of Oil & Gas Share Price Analysis

We show the results for oil and gas share prices in Tables 10 & 11. There we report results for 12 separate regressions. In regressions R1-3, we show results for our three different measures of oil/gas share prices as the dependent variable. For the explanatory variables in these regressions, we include only the oil goods market price index, and the S&P 500 fossil free share price index. In regressions R4 – 6, we then include the natural gas goods market price index as an explanatory variable. In regressions R7 – 9, we work with the same three oil/gas share prices as dependent variables, and we again exclude the natural gas goods market price as an explanatory variable. But in regressions R7 – 9, we now include the 10 divestment events as dummy variables, along with the oil goods market price and the S&P 500 fossil free index. In regressions R10 – 12, we include the natural gas goods market price index, along with all the other explanatory variables, including the 10 divestment event dummies.

TABLES 10 & 11 BELONG HERE

The results for regressions R1-6, which do not include the divestment dummies, are consistent. Both the oil goods market price and the S&P 500 fossil free index have large statistically significant effects on oil/gas share prices, with the anticipated positive signs in all 6 regressions. Natural gas goods market prices do not produce any additional statistically significant explanatory power. The magnitude of the positive effects do vary, depending on whether the dependent variable is the overall oil/gas share price index or the specific share prices for Shell and Exxon respectively. Not surprisingly, the coefficient values, t-statistics, and R^2 values are all much higher with the broad oil/gas share price index as the dependent variable. When we use the specific share prices for Shell and Exxon as dependent variables, there will be more firm-specific influences on these share prices that are not included in our explanatory variables.

In regressions R7 – 12, we see that adding the 10 divestment event dummies as explanatory variables does not alter the oil/gas share price in any significant way relative to what we see in regressions R1-6. That is, the coefficient values for all the divestment event dummies are either statistically insignificant or, in two cases only, significant at the 5 percent level, but in the theoretically unanticipated positive direction. That is, in regressions R9 and R12, with the Exxon share price as the dependent variable, the HCF and CIFF divestment event dummies are statistically significant explanatory variables, shown to be contributing *positively* to the Exxon share price. These positive coefficients are almost certainly capturing some other unspecified influence on Exxon's share price. But in any case, we do not have an explanation as to why these divestment events would contribute toward *increasing* Exxon's share price.

With these regressions, we are also able to test whether the divestment events may, in combination, have had a cumulative impact on oil/gas share prices, even if no single event has a significant effect. We can test for this possible effect through the F-statistics for each regression, which are measuring whether the coefficients on all the divestment event dummies are statistically significant in combination. In fact, as we see, the F-statistics for each of the regressions R7 – 12 are strongly insignificant.

Overall then, the results from regressions R1-12 consistently show that the divestment events had no negative impact on the share prices for oil/gas firms. Neither the share prices as measured by the oil/gas price index nor the individual share prices for Shell or Exxon have been negatively affected by either any single divestment event or by the combined impact of all the divestment events included in our model.

Coal Share Price Analysis

We present our regression results for the coal share prices in Tables 12 and 13, including regressions R13 – 24. We present these results within a framework similar to that with the oil/gas regressions. That is, we include three separate dependent variables, the Dow Jones Coal share price index as well as the share prices for Cloud Peak and Alliance. Regressions R13 – 15 include only coal goods market prices and the S&P 500 Fossil Free price index as explanatory variables. Regressions R16 – 18 then include both the natural gas price and oil price in goods markets as additional explanatory variables. We would expect price increases in oil and gas to positively influence coal share prices, by making coal more competitive as a substitute energy source.

TABLES 12 & 13 BELONG HERE

With regressions R13 – 18, variation in the coal goods market prices do not influence coal share prices in any consistent pattern. In most cases, the coefficients on the price variables are insignificant. The signs are also not consistently positive, as would be expected. One interpretation of this pattern is that they reflect the general difficulties that the coal industry has experienced for roughly the past two decades, as we discussed in section 2. The impact of these broader problems could be frequently exerting greater influence on share prices than the positive influences that we would expect commodity prices to have on share prices.

By contrast, we do see in regressions R13 – 18 that the S&P 500 Fossil Free Index is exerting a consistently positive influence on coal share prices. The coal share prices do also respond positively to increases in both natural gas and oil prices, as expected. These effects are especially strong with the broader Dow Jones share price index included as the dependent variable.

As with the oil/gas regressions, we next use the independent variables in regressions R13 – 18 as control variables to test whether the coal divestment events provide any additional explanatory power in the regressions. With these regressions, there is some modest evidence that coal share prices have been impacted by divestment

events, though not on a consistently negative basis, as we would expect. Thus, we see that the AXA-SA divestment event in May of 2015 does produce a statistically significant negative effect on both the Dow-Jones Coal share index and on the Cloud Peak share price. The University of California divestment event in September of 2009 generates a statistically significant negative effect on the Cloud Peak and Alliance share prices. Other divestment events in our model also generate negative coefficients, though none that are statistically significant. But in addition, the Nordea, Aviva, CalPension and PFZW/Allianz divestment events all generate positive coefficients on the dummy variables, though none that are statistically significant.

The F-statistic measuring the combined effects of all divestment effects on coal share prices are statistically significant, indicating that the divestment events are having a measurable cumulative impact on coal share prices. However, because the signs on the individual coefficients do not have a consistent pattern—either positive or negative—we cannot draw an overall conclusion that the divestment events are generating a consistently negative impact on coal share prices, as we would anticipate theoretically.

The long-term decline in the coal industry, as discussed above, has had a major negative effect on the share prices of coal firms. Beyond this, we do see some evidence that the coal divestment events have contributed in some cases to lowering coal share prices. This evidence is relatively weak and mixed. But it still contrasts with our results for the oil/gas industry, where we saw no evidence at all that divestment events negatively impacted share prices.

One major difference with the coal divestments is that, as we have seen, the relative magnitude of these divestments has been far greater than has been the case with oil and gas. Specifically, as we saw in Table 7, the full divestment events, including oil and gas divestments, amounted to about 0.2 percent of the overall market value for oil/gas stocks. The coal divestments, by contrast, amounted to over 10 percent of the market value of coal stocks. In addition, the oil/gas industry has remained broadly profitable while the coal industry has been experiencing decline.

5. Concluding Considerations

The evidence we have presented in sections 3 and 4 strongly supports our basic argument that fossil fuel divestment campaigns, considered on their own, are not capable of serving as a major force to directly drive down global CO₂ emissions. We reach these conclusions while still fully recognizing that divestment campaigns have had a significant positive impact in terms of increasing awareness of the climate crisis, and building support for organizing efforts throughout the U.S. and around the world.

Given the accomplishments of the divestment movement in terms of raising awareness and motivating activism, the question we wish to consider by way of conclusion is whether there are ways in which these strengths could be channeled more effectively—that is, in support of initiatives that could be capable of contributing significantly toward driving down global CO₂ emissions.

One consideration would be to broaden the goals of the movement from divestment to *divestment/reinvestment*. That would entail matching each entity's sale of fossil fuel assets with equivalent *purchases* of assets, or similar forms of financial support, in enterprises engaged in building the green energy economy. This could involve providing equity investments or credit on relatively generous terms to private companies involved in raising energy efficiency standards in the operations of buildings, transportation systems and industrial equipment; and, equally, in increasing the supply of cost-competitive solar, wind, geothermal, small-scale hydro, and clean bioenergy. It could also mean providing financing for public sector projects through, for example, low-interest rate municipal bonds. The funds generated by such bonds could be used, for example, to purchase electrical vehicles for public transit fleets or to raise energy efficiency standards in publicly-owned buildings. Colleges and universities committed to divestment could redirect funds generated by sales of their fossil fuel assets to financing low- to zero emissions energy infrastructures on their own campuses.

In short, there are many ways through which such divestment/reinvestment initiatives could support cuts in CO₂ emissions and help build a positive green economy agenda. However, as with the divestment campaigns, there is no possibility for all such divestment/reinvestment initiatives to be anywhere near adequate when measured against the level of investment funding needed to drive down CO₂ emissions sufficiently to achieve climate stabilization. This becomes clear when we consider our estimates in section 3 that, as of March 2018, the total level of divestment had reached around \$36 billion. Let us assume, optimistically, that all \$36 billion in investment funds would then be reinvested in clean energy projects.

This \$36 billion would have to be compared with the level of clean energy investments needed, either at the global or U.S. level, to put the globe, or the U.S. alone, on a viable climate stabilization path. According to research produced by one of us (Pollin) with co-authors, the level of investments in energy efficiency and renewable energy that would be needed to drive down CO₂ emissions in the range of 60 percent by 2040 would entail expenditures of between 1.5 – 2 percent of GDP per year.¹¹ With global GDP as of 2016 at \$76 trillion, that would imply that about \$1.5 trillion in clean energy investments are needed at the level of the 2016 economy, with this investment level then growing annually in correspondence with increases in global GDP. If we limited our increasing to the U.S. economy only, this same calculation would entail a level of U.S. clean energy investments at about \$350 billion as of 2016, with the figure, again, rising annually in correspondence with increasing U.S. GDP. Thus, the \$36 billion total that has been divested cumulatively as of 2016, if reinvested in full in clean energy projects, would cover about 10 percent of what is needed for the U.S alone, and in 2016 alone, for the U.S. to be taking the first significant steps onto a stabilization path.

We therefore must come back to emphasizing a program of action that is capable of succeeding in delivering a viable climate stabilization project. The type of grassroots

¹¹ See Pollin (2015) for background and a derivation of this overall result.

organizing that has characterized the fossil fuel divestment movement is, without question, essential to any such program, especially in overcoming powerful fossil fuel corporate interests. The question, again, is where best to channel these organizing efforts. As we have said above, a successful climate stabilization project must include policies that raise the costs of producing and consuming fossil fuels, such as a carbon tax; regulations that establish tight and binding limits on allowable emissions; and substantial subsidies for energy efficiency and clean renewable energy investments. Such policies need to be enacted in all regions of the world, and then need to be enforced, once enacted.

People who have committed themselves to divestment campaigns can make major contributions through channeling their commitments into fighting on behalf of such a policy framework. We emphasize that shifting the focus away from divestment campaigns will by no means let fossil fuel companies off the hook. Quite the contrary. The urgent goal is now to advance a policy framework that will build the global green energy infrastructure that we urgently need. If successful, this project of building this green energy infrastructure will also necessarily entail eliminating the production and sale of fossil fuel energy as a profitable business enterprise.

Appendix 1: Data Sources

This appendix includes all the references used in cleaning and supplementing the GoFossilFree.org data, as well as detailed information on the stock price/index and commodity price variables used in the event study.

References used for Data Cleaning. We only looked into the large entities, which included entities with limited commitments that managed at least \$90 billion in assets, and entities with full divestments that managed at least \$1 billion in assets.

References for Limited Divestment Commitments	
Entity	References
Government Pension Fund Global	Carrington 2015b; Schwartz 2015b
AXA Investment Managers	Paredes-Vanheule 2017; Sharman 2017
Allianz SE	Allianz SE 2015; Arabella Advisors 2016
AXA SA	Clark 2015a
Aviva	Arabella Advisors 2016; Clark 2015b
Aegon	Aegon 2016; USSEC 2016
Lloyd's Corporation	Moorcraft 2017
CalPERS	CalPERS Investment Committee 2015; Kozlowski 2015; Starkman 2015
Nordea Asset Management	Marriage 2015; Nordea Asset Management 2015
CalSTRS	Ricardo 2016; Ricardo 2017
Pensionfonds Zorg en Welzijn (PFZW)	Reuters Staff 2015b
Bank J. Safra Sarasin	J. Safra Sarasin 2018; Weber et al. 2017
Swiss Reinsurance Company Ltd	Swiss Re 2018; Unfriend Coal 2017
University of California	Hirji 2015; Howard 2015b; Riley 2017
Other Sources Used	Cowie 2014; Fossil Free USA 2017; McIlroy 2015; Mertens 2015; Pielichata 2017; Weiner 2018

References for Full Divestment Commitments	
Entity	References
New York City pension fund system	Office NYC Comptroller 2018
MP Pension Fund	Leaper 2018; Pielichata 2018
Oslo Pensjonsforsikring	Bloomberg 2015; Reuters Staff 2015a
Ireland	Colm 2017; Osborne 2017
District of Columbia Retirement Board	Bradford 2016a; Hirji 2016
Children's Investment Fund Foundation (CIFF)	CIFF 2015
Amalgamated Bank	Stewart 2016

Protestant Church Hessen-Nassau (EKHN)	EKHN 2015
Medibank	Medibank 2017
HCF	HCF Group 2016; Slezak 2017
London Borough of Southwark Pension Fund	Colley 2017; Fossil Free UK 2016
Oakland	Solitei 2014; 350.org 2014
Guardian Media Group	Carrington 2015a; Rusbridger 2015
Syracuse University	Howard 2015a; Schwartz 2015a
Australian Ethical	Australian Ethical 2016; Rose 2016
Copenhagen	Neslen 2016
Other references	Bradford 2016b; Connolly 2016; Hughes 2017; Kommuninvest 2016

Information on Event Study Variables. We used opening prices for all stock price and index data. Coal stock prices are end of week opening prices, and coal commodity prices are weekly averages. Our data spans Dec. 30, 2011 to March 23, 2018 (Dec. 30, 2011 is the first day for which the S&P 500 Fossil Fuel Free Index was available).

References for Event Study Variables	
Variable	Reference
Dow Jones US Oil & Gas Index	S&P Dow Jones 2018a
Dow Jones US Coal Index	Investing.com 2018
S&P 500 Fossil Fuel Free Index	S&P Dow Jones 2018b
Royal Dutch Shell share price	Yahoo Finance 2018d
Exxon/Mobil share price	Yahoo Finance 2018c
Cloud Peak Energy share price	Yahoo Finance 2018b
Alliance Resource Partners share price	Yahoo Finance 2018a
Oil price	FRED 2018
Natural gas price	EIA 2018b
Coal prices	EIA 2018a
Divestment events	See first two panels above in this appendix

Appendix 2: Methodology for Estimating Funds Divested

The 14 Largest Divestment Entities with Limited Commitment Levels. The largest 14 entities with limited commitment levels account for about 85 percent of total assets under management, and thus gained fairly widespread media attention. Researching each of these events individually (see Appendix 1 for references), we were able to find estimates of commitment levels for nine of them.¹²

For the remaining five entities, we considered two methods. First—the method that we decided to use—we looked just at the nine entities for which we had data on funds divested. Dividing their funds divested by assets under management (\$16.7 billion/\$3.902 trillion), we found that their overall share of funds invested in coal prior to divestment was about 0.43 percent (Gofossilfree.org 2018; Appendix 1). We then multiplied 0.43 percent by the assets under management of Aegon, Lloyd's Corporation, Bank J. Safra Sarasin, and Swiss Reinsurance Company Ltd (results shown in column 4 of Table 4). For Aviva—the last of the largest 14 entities with limited commitment levels—we multiplied assets under management by 0.43 percent, and then multiplied that result by 0.2. The reason for this adjustment in our calculations for Aviva is that Aviva did not fully divest from coal. Rather, they put 40 coal companies on notice, threatening to divest only if those companies did not show that they were accounting for climate change in their business models. Eight of those companies refused to engage with Aviva, two of which Aviva said they may divest from (Aviva 2017; Cadle 2016). Therefore, we assume they will divest from the eight companies they put on notice, which is 20 percent of the coal companies in which they invested.

The second method of estimation we considered consisted of multiplying each company's assets under management by the global coal industry's share of total value of the global stock markets. We were unable to find figures on the coal industry's share of the global bond market, so we assumed that this figure was the same share as that for the global stock market. In 2014, the market capitalization of coal was \$233 billion (Bullard 2014), and the market capitalization of world stock markets was \$63.3 trillion (World Bank 2017). Dividing the former by the latter results in 0.37 percent (i.e., the coal industry makes up 0.37 percent of the stock market), which is slightly less than the 0.43 percent we used in method one.

We chose to work with our first estimation method, in the interests of, if anything, overstating rather than understating the level of fossil fuel divestments.

Smaller Entities with Limited Divestment Commitments. As stated in the paper, we applied method one from above to the 94 smaller entities with limited divestment commitments.

¹² The nine entities include Government Pension Fund Global, AXA Investment Managers, Allianz SE, AXA SA, CalPERS, Nordea Asset Management, CalSTRS, PFZW, and University of California (see Table 4 for level of funds divested).

Entities with Full Divestment Commitments. The largest two entities committed to full divestments are the New York City pension fund system and MP Pension Fund. By researching each of these commitments we found that they were divesting a combined \$5.2 billion, or 2.5 percent of their \$208 billion in assets under management (see Appendix 1 for references). Because these were the only two entities for which we had data on funds divested, we did not believe it was appropriate to apply the 2.5 percent figure to the remaining 371 entities. Ansar et al. (2013) found that educational institutions and pension funds generally hold 3 percent-7.5 percent of assets under management in fossil fuels (includes both stocks and bonds). However, these are not the only types of institutions divesting. Thus, to estimate funds divested of the 371 smaller entities, we multiplied their assets under management by the global fossil fuel industry's share of world stock markets. In 2014, the market capitalization of the fossil fuel industry was \$4.9 trillion (Bullard 2014), and the market capitalization of global stock markets was \$63.3 trillion (World Bank 2017). Dividing the former by the latter, we found that the fossil fuel industry's share of global stock markets is 7.7 percent. Multiplying 7.7 percent by the assets under management of the 371 smaller entities (\$82 billion) leads to an estimate of \$6.3 billion of funds divested. This figure is, again, likely to overstate rather than understate the true level of divestment.

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Table 1.
Net Income for Major U.S. Oil/Gas and
Coal Companies, 2012 - 2015

Oil/Gas Companies	
■ Exxon/Mobil	\$131.2 billion
■ Chevron	\$71.9 billion
■ Conoco-Phillips	\$19.8 billion
■ Anadarko	-\$5.0 billion
■ Devon	-\$13.7 billion
Oil/Gas Total	\$203.8 billion
Coal Companies	
■ Peabody Energy	-\$3.9 billion
■ Arch Coal	-\$4.8 billion
■ Cloud Peak Energy	\$100 million
■ Alpha Natural Resources	-\$10.1 billion
■ Alliance Resource Partners	\$1.5 billion
Coal Total	-\$17.2 billion

Sources: Pollin and Callaci 2016, Tables 5 and 6.

Table 2.
Commitment Levels among Divesting Entities

Limited Divestment Commitments

- Coal only
- Coal and tar sands only
- Partial commitments from varied fossil fuel assets

Full Divestment Commitments

- Fully divested from all fossil fuel assets
- Committed to full divestment

Source: Gofossilfree.org 2018

Table 3.
Entities at All Divestment Commitment Levels and
Assets under Management Data, as Available

	Number of Entities	Assets under Management
All entities with known commitment types	796 entities	Not available for 316 entities
All entities with Assets under Management Data	480 entities <i>(60.3% of total entities)</i>	\$6.5 trillion
Largest Entities, with +\$90 billion in assets under management	15 <i>(1.9% of total entities)</i>	\$5.7 trillion <i>(88.0% of assets under management)</i>
Largest Entities (+\$90 billion in assets under management) with limited commitment levels	14 <i>(1.8% of total entities)</i>	\$5.5 trillion <i>(85% of assets under management)</i>

Sources: Gofossilfree.org 2018; Appendix 1

Table 4.
Largest Divesting Entities with Limited Divested Commitments

Entity	1)Home Country of Entity	2) Assets under Management (at time of divestment)	3)Funds Divested or Committed (at time of divestment)	4)Level of Divestment Commitment	5) Date of Divestment Commitment	5)Divestment Commitment as share of Assets Under Management (= column 3/2)
1.Government Pension Fund, Global	Norway	\$890 billion	\$9.0 billion	Coal Only	6/5/2015	1.01%
2.AXA Investment Managers	France	\$782 billion	\$209 million	Coal Only	4/25/2017	0.03%
3.Allianz SE	Germany	\$668 billion	\$4.38 billion	Coal Only	11/23/2015	0.66%
4.AXA SA	France	\$589 billion	\$590 million	Coal Only	5/22/2015	0.1%
5.Aviva	UK	\$572 billion	\$492 million	Coal Only	7/24/2015	0.09%
6.Aegon	Netherlands	\$382 billion	\$1.64 billion	Coal Only	5/25/2016	0.43%
7.Lloyd's Corporation	UK	\$378 billion	\$1.63 billion	Coal Only	11/17/2017	0.43%
8.CalPERS	USA	\$289 billion	\$83 million	Coal Only	10/8/2015	0.03%
9.Nordea Asset Management	Sweden	\$228 billion	\$100 million	Coal Only	1/17/2015	0.04%
10.CalSTRS	USA	\$186 billion	\$10 million	Coal Only	10/8/2015	0.01%
11.PFZW	Netherlands	\$172 billion	\$2.01 billion	Partial (100% coal, 30% other fossil fuels)	11/16/2015	1.17%
12.Bank J. Safra Sarasin	Switzerland	\$150 billion	\$643 million	Coal Only	3/2017	0.43%
13.Swiss Reinsurance Company Ltd	Switzerland	\$130 billion	\$559 million	Coal Only	2016	0.43%
14.University of California	USA	\$98 billion	\$350 million	Coal & Tar Sands	9/29/2015	0.36%
TOTAL	---	\$5.5 trillion	21.7 billion	---	---	0.39%

Sources: Gofossilfree.org 2018; Appendices 1 and 2.

Table 5.
Smaller Entities with Limited Divestment Commitments

Total number of entities	94
Assets under management	\$675 billion
Estimated level of divestment	\$2.9 billion
Estimated divestment level as share of assets under management	0.43%

Sources: Gofossilfree.org 2018; Appendices 1 and 2.

Table 6.
Entities with Full Divestment Commitments

Total number of entities	671
Entities with assets under management data	372
Assets under management for 373 entities with data	\$290 billion
Assets under management for 2 largest entities (NYC Pension Funds & MP Pension Fund)	\$208 billion <i>(= 71.8% of assets under management for entities with data)</i>
Divestment level of 2 largest entities	\$5.2 billion
Average divestment level as share of assets under management for 2 largest entities	2.5%
Estimated divestment levels for 371 smaller entities with asset under management data	\$6.3 billion
Estimated divestment level as share of assets under management for 371 smaller entities	7.7%
Total divestment level	\$11.5 billion

Sources: Gofossilfree.org 2018; Appendices 1 and 2.

Table 7.
Overall Level of Divestment Commitments for All Entities with
Assets under Management Data

A) Divestment Commitments

1) Limited Divestment Commitments -- 106 entities	\$24.6 billion
■ 14 largest entities	\$21.7 billion
■ 94 smaller entities	\$2.9 billion
3) Full Divestment Commitments -- 348 entities	\$11.5 billion
■ 2 largest entities	\$5.2 billion
■ 346 smaller entities	\$6.3 billion
Total Divestment Commitments (= rows 1+5)	\$36.1 billion

B) Divestment Commitments as Share of Global Fossil Fuel Assets

-- Global Fossil Fuel Assets at \$4.88 trillion as of 2014

\$24.6 Billion in Limited Divestment Commitments as share of \$233 billion Coal Market Value	10.6% (= \$24.6 billion / \$233 billion)
\$11.5 Billion in Full Divestment Commitments as share of \$4.88 trillion in Total Fossil Fuel Market Value	0.2% (= \$11.5 billion / \$4.88 trillion)
\$36.1 Billion in Total Divestment Commitments as share of \$4.88 trillion in Total Fossil Free Market Value	0.7% (= \$36.1 billion / \$4.88 trillion)

Sources: Tables 4-6; Bullard 2014

Table 8.
List of Divestment Events for Oil & Gas Study

Entity	1) Home Country of Entity	2) Assets under Management (at time of divestment)	5) Date of Divestment Commitment
NYC Pension Funds	USA	\$189 billion	1/10/2018
Oslo Pensjonsforsikring	Norway	\$9.3 billion	10/19/2015
Ireland	Ireland	\$8.5 billion	1/27/2017
Children's Investment Fund Foundation (CIFF)	UK	\$4.7 billion	9/22/2015
Amalgamated Bank	USA	\$4.0 billion	9/21/2016
Protestant Church Hessen-Nassau	Germany	\$3.1 billion	11/30/2015
Medibank	Australia	\$1.9 billion	11/13/2017
HCF	Australia	\$1.5 billion	2/9/2017
London Borough of Southwark Pension Fund	UK	\$1.5 billion	12/13/2016
Guardian Media Group	UK	\$1.2 billion	4/1/2015
Syracuse University	USA	\$1.2 billion	3/31/2015
TOTAL	---	\$226 billion	---

Sources: Gofossilfree.org 2018; Appendix 1.

Table 9.
List of Divestment Events for Oil & Gas Study

Entity	1) Home Country of Entity	2) Assets under Management (at time of divestment)	5) Date of Divestment Commitment
Government Pension Fund, Global	Norway	\$890 billion	6/5/2015
AXA Investment Managers	France	\$782 billion	4/25/2017
Allianz SE	Germany	\$668 billion	11/23/2015
AXA SA	France	\$589 billion	5/22/2015
Aviva	UK	\$572 billion	7/24/2015
Aegon	Netherlands	\$382 billion	5/25/2016
CalPERS	USA	\$289 billion	10/8/2015
Nordea Asset Management	Sweden	\$228 billion	1/17/2015
NYC Pension Funds	USA	\$189 billion	1/10/2018
CalSTRS	USA	\$186 billion	10/8/2015
PFZW	Netherlands	\$172 billion	11/16/2015
University of California	USA	\$98 billion	9/29/2015
TOTAL	---	\$226 billion	---

Sources: Gofossilfree.org 2018; Appendix 1.

Table 10.
Regression Results: Oil & Gas (excluding divestment events)

	(R1)	(R2)	(R3)	(R4)	(R5)	(R6)
	<i>D.Jones_Oil/Gas</i>	<i>Shell</i>	<i>Exxon</i>	<i>D.Jones_Oil/Gas</i>	<i>Shell</i>	<i>Exxon</i>
<i>Oil_Price</i>	2.816*** (19.11)	0.138*** (5.61)	0.135*** (6.51)	0.591*** (18.89)	0.138*** (5.61)	0.134*** (6.50)
<i>Nat_Gas_Price</i>				-0.0409 (-0.31)	0.0252 (0.27)	0.00302 (0.03)
<i>SP500_FFF</i>	0.317*** (25.46)	0.0130*** (5.53)	0.0120*** (4.69)	0.0671*** (26.18)	0.0130*** (5.52)	0.0121*** (4.69)
<i>_cons</i>	-0.210 (-1.82)	-0.0145 (-0.68)	-0.0140 (-0.65)	-0.0358 (-1.48)	-0.0147 (-0.69)	-0.0139 (-0.64)
N	1564	1564	1564	1562	1562	1562
R-sq	0.637	0.092	0.081	0.637	0.092	0.081

Table 11.
Regression Results: Oil & Gas (including divestment events)

	(R7)	(R8)	(R9)	(R10)	(R11)	(R12)
	<i>D.Jones_Oil/Gas</i>	<i>Shell</i>	<i>Exxon</i>	<i>D.Jones_Oil/Gas</i>	<i>Shell</i>	<i>Exxon</i>
<i>Oil_Price</i>	2.821***	0.138***	0.135***	2.819***	0.138***	0.135***
	(19.15)	(5.61)	(6.52)	(19.13)	(5.60)	(6.51)
<i>Nat_Gas_Price</i>				-0.211	0.0205	-0.00459
				(-0.33)	(0.22)	(-0.04)
<i>SP500_FFF</i>	0.316***	0.0128***	0.0117***	0.316***	0.0128***	0.0117***
	(25.33)	(5.41)	(4.58)	(25.29)	(5.40)	(4.57)
<i>Syracuse/Guardian</i>	-0.719	-0.0967	-0.0974	-0.718	-0.0967	-0.0974
	(-1.66)	(-1.07)	(-1.05)	(-1.66)	(-1.07)	(-1.05)
<i>CIFF</i>	1.969	0.500	0.566*	1.966	0.501	0.566*
	(1.56)	(1.71)	(2.08)	(1.56)	(1.71)	(2.08)
<i>Oslo_Pension</i>	-1.238	-0.572	-0.479	-1.238	-0.572	-0.479
	(-0.80)	(-1.70)	(-1.36)	(-0.79)	(-1.70)	(-1.36)
<i>Church_HN</i>	-0.166	0.178	0.0117	-0.163	0.178	0.0119
	(-0.16)	(0.90)	(0.05)	(-0.15)	(0.90)	(0.05)
<i>Amalgamated_Bank</i>	0.680	0.0911	0.122	0.680	0.0911	0.122
	(0.92)	(0.64)	(0.87)	(0.92)	(0.64)	(0.87)
<i>Southwark_Pension</i>	-1.696	-0.0673	-0.352	-1.700	-0.0669	-0.353
	(-1.86)	(-0.45)	(-1.79)	(-1.86)	(-0.45)	(-1.79)
<i>Ireland</i>	-0.969	-0.249	-0.209	-0.971	-0.249	-0.210
	(-0.66)	(-1.19)	(-0.86)	(-0.66)	(-1.18)	(-0.86)
<i>HCF</i>	1.570	0.265	0.425*	1.575	0.265	0.425*
	(1.16)	(1.34)	(2.21)	(1.16)	(1.34)	(2.22)
<i>Medibank</i>	0.275	0.0328	0.0613	0.331	0.0279	0.0720
	(0.40)	(0.39)	(0.69)	(0.46)	(0.32)	(0.77)
<i>NYC_Pension</i>	-0.325	-0.169	-0.286	-0.384	-0.164	-0.297

	(-0.32)	(-1.11)	(-1.64)	(-0.37)	(-1.07)	(-1.68)
<i>_cons</i>	-0.0374	-0.0183	-0.00148	-0.0377	-0.0183	-0.00149
	(-0.24)	(-0.64)	(-0.05)	(-0.24)	(-0.64)	(-0.05)
N	1564	1564	1564	1562	1562	1562
R-sq	0.639	0.098	0.091	0.640	0.098	0.091
F stat (divestment events = 0)	1.270	0.900	1.573	1.272	0.879	1.583
Prob > F	0.242	0.532	0.109	0.241	0.553	0.106

Table 12.
Regression Results: Coal (excluding divestment events)

	(R13)	(R14)	(R15)	(R16)	(R17)	(R18)
	<i>D.Jones_Coal</i>	<i>Cloud_Peak</i>	<i>Alliance</i>	<i>D.Jones_Coal</i>	<i>Cloud_Peak</i>	<i>Alliance</i>
<i>Appalachia_Price</i>	-0.141 (-0.33)	-0.00172 (-0.05)	0.209* (2.05)	-0.476 (-1.16)	-0.0189 (-0.51)	0.197 (1.92)
<i>Powder_River_Price</i>	-0.309 (-0.34)	-0.0597 (-0.68)	-0.410 (-1.48)	0.189 (0.22)	-0.0304 (-0.36)	-0.386 (-1.40)
<i>Illinois_Price</i>	1.189* (2.24)	0.0702 (1.59)	-0.0682 (-0.64)	1.096* (2.01)	0.0623 (1.45)	-0.0762 (-0.69)
<i>Uinta_Price</i>	0.0198 (0.03)	0.0133 (0.19)	0.0755 (0.62)	-0.0113 (-0.02)	0.00566 (0.08)	0.0657 (0.54)
<i>SP500_FFF</i>	0.0509*** (4.36)	0.00512*** (4.41)	0.0123*** (4.69)	0.0487*** (4.32)	0.00475*** (4.07)	0.0119*** (4.40)
<i>Nat_Gas_Price</i>				3.228* (2.41)	0.254 (1.56)	0.205 (0.71)
<i>Oil_Price</i>				0.369** (3.04)	0.0241 (1.73)	0.0221 (0.78)
<i>_cons</i>	-0.694* (-2.04)	-0.0651 (-1.89)	-0.105 (-1.49)	-0.630 (-1.88)	-0.0641 (-1.87)	-0.105 (-1.48)
N	314	314	314	312	312	312
R-sq	0.073	0.059	0.090	0.125	0.079	0.092

Table 13.
Regression Results: Coal (including divestment events)

	(R19)	(R20)	(R21)	R22)	(R23)	(R24)
	<i>D.Jones_Coal</i>	<i>Cloud_Peak</i>	<i>Alliance</i>	<i>D.Jones_Coal</i>	<i>Cloud_Peak</i>	<i>Alliance</i>
<i>Appalachia_Price</i>	-0.302 (-0.66)	-0.0156 (-0.41)	0.182 (1.70)	-0.642 (-1.48)	-0.0305 (-0.81)	0.172 (1.60)
<i>Powder_River_Price</i>	0.0579 (0.06)	-0.0312 (-0.31)	-0.434 (-1.50)	0.531 (0.56)	-0.00521 (-0.05)	-0.411 (-1.45)
<i>Illinois_Price</i>	1.007 (1.72)	0.0510 (1.09)	-0.145 (-1.11)	0.905 (1.49)	0.0435 (0.92)	-0.153 (-1.14)
<i>Uinta_Price</i>	-0.0369 (-0.06)	0.00161 (0.02)	0.120 (0.95)	-0.0474 (-0.09)	-0.00374 (-0.05)	0.112 (0.88)
<i>SP500_FFF</i>	0.0517*** (4.40)	0.00527*** (4.59)	0.0128*** (4.81)	0.0508*** (4.44)	0.00489*** (4.18)	0.0123*** (4.38)
<i>Nat_Gas_Price</i>	---	---	---	3.304* (2.40)	0.250 (1.48)	0.202 (0.68)
<i>Oil_Price</i>	---	---	---	0.339** (2.69)	0.0231 (1.58)	0.0242 (0.81)
Nordea	0.790 (0.61)	0.0174 (0.12)	-0.686 (-1.76)	0.425 (0.35)	-0.00799 (-0.06)	-0.713 (-1.82)
AXA_SA	-4.569* (-2.36)	-0.337* (-2.29)	0.0936 (0.15)	-3.748 (-1.74)	-0.282* (-2.07)	0.137 (0.22)
Gov_Pension_Fund	1.466 (0.73)	0.0620 (0.37)	-0.453 (-0.69)	1.007 (0.43)	0.0352 (0.21)	-0.460 (-0.66)
Aviva	3.613 (1.65)	0.605** (2.71)	1.630** (2.86)	3.732 (1.78)	0.603** (2.76)	1.615** (2.71)
Univ_CA	-3.702 (-1.69)	-0.546* (-2.09)	-1.293* (-2.28)	-3.956 (-1.96)	-0.550* (-2.24)	-1.292* (-2.25)
CalPension	2.100	0.236	0.112	2.477	0.262	0.142

	(1.04)	(0.97)	(0.20)	(1.27)	(1.13)	(0.26)
PFZW_Allianz	2.094	0.0240	0.520	1.671	-0.0138	0.476
	(1.24)	(0.18)	(1.00)	(1.04)	(-0.11)	(0.93)
Aegon	-0.761	0.0577	0.164	-0.727	0.0602	0.170
	(-1.05)	(0.56)	(0.48)	(-0.99)	(0.58)	(0.51)
AXA_IM	0.274	-0.0469	-0.215	0.493	-0.0515	-0.230
	(0.38)	(-0.45)	(-1.03)	(0.80)	(-0.48)	(-1.09)
NYC_Pension	-0.548	-0.0480	0.0438	-0.00980	-0.0637	0.0104
	(-0.47)	(-0.32)	(0.13)	(-0.01)	(-0.43)	(0.03)
_cons	-1.144	-0.0984	-0.0335	-1.066	-0.0908	-0.0242
	(-1.86)	(-1.65)	(-0.30)	(-1.72)	(-1.52)	(-0.21)
N	314	314	314	312	312	312
R-sq	0.095	0.077	0.127	0.145	0.095	0.129
F stat (divestment events = 0)	2.467	4.330	1.736	2.089	4.996	1.678
Prob > F	0.00755	0.0000115	0.0722	0.0253	0.00000104	0.0852