# Mutual Reinforcement of Academic Reputation and Fossil Fuel Divestment

## Supplementary Materials

### Sources and Methods

We obtained information about our two main variables of interest – university rankings and commitments to divest from fossil fuel – from Times Higher Education (THE; <https://www.timeshighereducation.com/world-university-rankings>) and gofossilfree.org (GFF; <https://gofossilfree.org/divestment/commitments>), respectively. As noted in the main text, THE includes more universities than any other world ranking (1,527 in 2021). See the section on "Ranking data" below for information about their criteria.

We used news reports, often from the divesting universities themselves, to specify the dates of commitments to divest (sources available from GMM). In some cases, those reports allowed us to correct GFF's information about the partial or full divestment of certain universities. For universities that have upgraded from partial to full divestment, we used the later date, of commitment to fully divest. But we obtained similar results (not shown here) by using the date of the earlier commitment to partially divest. Finally, the most powerful aspect of university divestment is the political impact of a respected institution taking this strong stand for climate justice, rather than the actual selling of stock (Ansar *et al*. 2013, referenced in the main text). Furthermore, over several years of gathering information on universities' commitments to divest, we have encountered just one possible case of failure to follow through. We thus track only commitments to divest (or in a few cases, to remain divested) rather than actual divestment, which can take several years to carry out.

For other potential independent variables, we drew from the National Association of College and University Business Officers (NACUBO; <https://www.nacubo.org/-/media/Nacubo/Documents/EndowmentFiles/2019-NTSE-Endowment-Market-Values--FINAL-February-10-2020.ashx>), the US Federal Election Commission (<https://www.fec.gov/documents/1890/federalelections2016.xlsx>), and Elections Canada (<https://elections.ca/res/rep/off/ovr2019app/51/data_donnees/table_tableau09.csv>).

We performed all our statistical analyses with R Version 4.0.5, and used the Akaike Information Criterion (AIC) to determine whether any given independent variable adds enough explanatory power to justify inclusion in the model (Burnham & Anderson 2004, 2014). To test for an overall correlation between rank and divestment, we performed binomial logistic regressions with divestment as the dependent variable. For the full sample of 1,527 universities ranked by THE in 2021, the independent variables are country and rank.

For 153 universities in the US and Canada, we were able to consider a larger set of potential independent variables, and thus more severely test the link between rank and divestment. From the NACUBO, we obtained data on number of students, endowment size (billion $US), and endowment type ("Private college/university endowment", "Canadian College, university, or system endowment fund", "Combined endowment/foundation", "Institutionally-related", or "Public college, university, or system fund"). To discern whether regional social and political environments influence the choice to divest, we also collected voting data from the 2016 US presidential election and the 2019 Canadian federal election. These datasets provide voting numbers for each party at the level of the state (US) and province (Canada). The US has two major parties amassing the bulk of the vote, whereas Canada has one main federal party on the right of the political spectrum and two on the left. Accordingly, we calculated, for each state and province, the proportion of Republican (US) and Conservative (Canada) votes.

We then used time lags to test specifically for an effect of rank on divestment, and for an effect of divestment on rank. For the former, we performed a binomial logistic regression of divestment on the independent variables country and rank in 2013. THE ranked 400 universities in 2013, which sets the sample size for this analysis.

To test for an effect of divestment on rank, we started with a balanced panel of data for the 347 universities ranked in all years from 2013 through 2021. We then matched non-divesting universities, with replacement, to divesting universities in this panel. Matching provides insight into what would have happened if a "treated" individual had not received a given "treatment" (Morgan & Winship 2014). In this case, the individuals are universities, the "treatment" is divestment from fossil fuel, and the outcome of interest is change in rank. Matching thus sheds light on whether divestment makes a difference to a university's subsequent rankings.

Our criteria for matching are that any matched non-divestor must be (1) in the same country as a given divestor, and (2) closest in rank to that divestor in the year of divestment. This procedure matches one or more non-divesting universities to each of the 84 divesting universities in the panel, with most (68) of these divestors matched to a single non-divestor. Likewise, while some non-divesting universities match more than one divesting university, most (42) of the 67 matched non-divestors are paired with a single divestor. For each divesting university, and each year 2014, 2015,…, 2021, we calculated the difference between the change from the preceding year in the natural logarithm of the divestor's ranking, and the mean of the changes in the logs of its matched non-divestors' rankings over the same time period. We then used the AIC to test whether the mean of these relativized changes in rank differs significantly from zero.

### Ranking data

Times Higher Education (THE) lists universities ranked 1-200 individually; in groups of 50 between 200-400, then in groups ranked 401, 501, 601, 801, 1,001. Criteria and weighting, adapted from <https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2020-methodology>:

|  |  |  |
| --- | --- | --- |
| Criterion | Indicators | Weight |
| Teaching | Reputation survey: 15%  Staff-to-student ratio: 4.5%  Doctorate-to-bachelor’s ratio: 2.25%  Doctorates-awarded-to-academic-staff ratio: 6%  Institutional income: 2.25% | 30% |
| Research | Reputation survey: 18%  Research income: 6%  Research productivity: 6% | 30% |
| Citations | Elsevier examined 77.4 million citations to 12.8 million journal articles, article reviews, conference proceedings, books and book chapters published over five years. The data are normalised to reflect variations in citation volume between different subject areas. | 30% |
| International outlook | Proportion of international students: 2.5%  Proportion of international staff: 2.5%  International collaboration: 2.5% | 7.5% |
| Industry income | How much research income an institution earns from industry (adjusted for PPP), scaled against the number of academic staff it employs. | 7.5% |
| Total |  | 100% |

### Main results

The mean rank of divesting universities is 287th out of 1,527 (standard error = 21.0, *n* = 130), whereas the mean rank of non-divesting universities is 669th (*SE* = 8.6, *n* = 1,397). Among the 11 countries with at least one ranked divestor, divestors generally out-rank non-divestors within all except Norway. A binomial logistic model affirms both country and rank as significant predictors of divestment (see Figure 1 in the main text). The coefficient of rank is -0.0029 (*SE* = 0.0005, n = 1,527). Because smaller numbers signify higher ranks, this negative coefficient means that higher-ranked universities divest more frequently than do lower-ranked universities.

We considered state or provincial political orientation, number of students, endowment size, and endowment type as additional independent variables for a sub-sample of 153 universities with data on these variables in the US and Canada. For this sub-sample, voting results – i.e., a state's percentage of votes for Trump in 2016, or a province's for the Conservatives in 2019 – have the tightest correlation with divestment, and so are the first independent variable selected for the model by the AIC. More conservative states and provinces have substantially lower frequencies of divestment by universities within them. The coefficient is -0.092 (*SE* = 0.025). University rank is the only other variable with enough explanatory power for inclusion in the model – once again re-confirming that higher-ranked universities are more likely to divest. The coefficient of rank in this model is -0.0032 (*SE* = 0.0012, *n* = 153).

It remains logically possible that some common cause(s) not included in our analysis completely explain(s) the correlation between rank and divestment. Nonetheless, controlling for the potential confounding variables described above provides some evidence for a direct causal link between the two. We therefore used time lags to clarify the direction of causality. In our lagged binomial model of university divestment, the coefficient of university rank in 2013 is -0.0042 (*SE* = 0.0015, *n* = the 400 universities ranked by THE in 2013). Because all divestments in our database occurred after 2013, this indicates an effect of rank on divestment. We also find evidence for an effect of divestment on rank. Before divestment, universities had no significant tendency to improve or decline in the rankings relative to matched non-divesting universities. The pre-divestment mean relative yearly change in log rank is 0.003 (*SE* = 0.012; *N* = the 84 divesting universities ranked in all years 2013-2021, *T* = 1-7 years prior to divestment, *n* = 370). But after divestment, those same divestors rose in the ranks relative to those same matched non-divestors (mean = -0.022, *SE* = 0.010, *N* = 84, *T* = 1-7 years following divestment, *n* = 302). This coefficient of -0.022 translates into the 2.1% yearly advantage of divestors over matched non-divestors reported in the main text.

### Partial vs. full divestment

The results reported above and in the main text treat divestment as a binary variable. Either a university has committed to divest from fossil fuels, or it has not. As a robustness check, we performed similar analyses that treat divestment as a ternary variable, with "no divestment", "partial divestment", and "full divestment" as possible values. These latter analyses confirm the links between rank and divestment reported above and in the main text.

Partially and fully divesting universities both generally out-rank non-divesting universities. Partial divestors average 211th out of 1,527 (*SE* = 48.5, *n* = 26), and full divestors 306th (*SE* = 23.0, *n* = 104). Both of these mean rankings are much higher than the mean ranking of 669th noted above for non-divestors. A multinomial logistic model affirms rank as a significant predictor of whether a university divests fully, partially, or not at all. In contrast to the binomial model reported above, the AIC does not select the country variable for this multinomial model. The coefficients of rank are -0.0056 for partial divestment (*SE* = 0.0010), and -0.0038 for full divestment (*SE* = 0.0004, *n* = 1,527).

Considering additional independent variables for universities in the US and Canada, we find again that voting results have the most explanatory power. More conservative states and provinces have substantially lower frequencies of both partial and full divestment by universities within them. Again, we also find university rank to significantly predict divestment, with higher-ranked universities more likely to partially and to fully divest. For this multinomial model the AIC also selects endowment size as an independent variable. Universities with larger endowments are more likely to partially divest, but less likely to fully divest (Table S3).

Having controlled for potential confounding variables, we used time lags to test specifically for effects of rank on divestment and *vice versa*. In our lagged multinomial model of university divestment, the coefficients of university rank in 2013 are -0.0069 for partial divestment (*SE* = 0.0023) and -0.0032 for full divestment (*SE* = 0.0013, *n* = the 400 universities ranked by THE in 2013). Because all divestments in our database occurred after 2013, this indicates effects of rank on both types of divestment. We also find evidence for an effect of full divestment on rank. Following full divestment, universities rose in the ranks relative to matched non-divesting universities (mean relative yearly change in log rank = -0.020, *SE* = 0.013, *N* = the 62 full divestors in the balanced panel, *T* = 1-7 years after divestment, *n* = 205). Following partial divestment, universities trended in the same direction, but not consistently enough given the small sample size, so the AIC does not select partial divestment as a significant predictor of subsequent changes in relative rank.

### References

Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Methods & Research, 33*(2), 261-304. doi:10.1177/0049124104268644

Burnham, K. P., & Anderson, D. R. (2014). *P* values are only an index to evidence: 20th- vs. 21st-century statistical science. *Ecology, 95*(3), 627-630. doi:10.1890/13-1066.1

Morgan, S. L., & Winship, C. (2020). *Counterfactuals and Causal Inference: Methods and Principles for Social Research*. Cambridge: Cambridge University Press.

## Supplementary figures and tables

### Supplementary Figure S1: Annual rates of divestment from fossil fuel by institutions of higher education



### Supplementary Figure S2: Proportion of universities divesting down to each THE rank

The x axis represents Times Higher Education's 2021 world ranking of universities, with lower-ranked universities to the left and higher-ranked universities to the right. The y axis shows the cumulative proportion of universities down to each rank that had committed by the end of 2020 to divest from fossil fuel.



### Supplementary Table S1: Divestment from fossil fuel by institutions of higher education in 13 countries

Includes all such divestment commitments made by the end of 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Partial divestments** | **Full divestments** | **Total** |
| Australia | 3 | 4 | 7 |
| Belgium | 1 | 4 | 5 |
| Canada | 2 | 6 | 8 |
| Denmark | 0 | 1 | 1 |
| Germany | 1 | 1 | 2 |
| Ireland | 0 | 2 | 2 |
| Italy | 0 | 1 | 1 |
| New Zealand | 0 | 3 | 3 |
| Norway | 0 | 3 | 3 |
| Republic of the Marshall Islands | 0 | 1 | 1 |
| Sweden | 1 | 4 | 5 |
| UK | 10 | 73 | 83 |
| USA | 13 | 56 | 69 |
| *World* | *31* | *159* | *190* |

### Supplementary Table S2: Divesting universities ranked by Times Higher Education

While 190 institutions of higher education had committed to divest from fossil fuel by the end of 2020, only 130 of these appear among the 1,527 universities in these world rankings.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2021 ranking** | **University** | **Country** | **Year of divestment** | **Type of divestment** |
| 1 | University of Oxford | United Kingdom | 2020 | Full |
| 2 | Stanford University | United States | 2014 | Partial |
| 6 | University of Cambridge | United Kingdom | 2020 | Full |
| 7 | University of California, Berkeley | United States | 2019 | Full |
| 8 | Yale University | United States | 2016 | Partial |
| 12 | Johns Hopkins University | United States | 2017 | Partial |
| 13 | University of Pennsylvania | United States | 2020 | Partial |
| 15 | University of California, Los Angeles | United States | 2019 | Full |
| 16 | UCL | United Kingdom | 2019 | Full |
| 17 | Columbia University | United States | 2021 | Full |
| 19 | Cornell University | United States | 2020 | Partial |
| 27 | London School of Economics and Political Science | United Kingdom | 2015 | Partial |
| 29 | University of Washington | United States | 2015 | Partial |
| 30 | University of Edinburgh | United Kingdom | 2018 | Full |
| 33 | University of California, San Diego | United States | 2019 | Full |
| 34 | University of British Columbia | Canada | 2019 | Full |
| 35 | King’s College London | United Kingdom | 2017 | Full |
| 45 | KU Leuven | Belgium | 2016 | Full |
| 48 | University of Illinois at Urbana-Champaign | United States | 2020 | Full |
| 51 | University of Manchester | United Kingdom | 2020 | Full |
| 51 | University of Sydney | Australia | 2015 | Partial |
| 54 | Boston University | United States | 2016 | Partial |
| 59 | Australian National University | Australia | 2014 | Partial |
| 61 | Brown University | United States | 2020 | Full |
| 64 | Monash University | Australia | 2016 | Partial |
| 64 | University of California, Davis | United States | 2019 | Full |
| 68 | University of California, Santa Barbara | United States | 2019 | Full |
| 77 | University of Warwick | United Kingdom | 2015 | Full |
| 84 | University of Copenhagen | Denmark | 2016 | Full |
| 90 | University of Maryland, College Park | United States | 2016 | Full |
| 91 | University of Bristol | United Kingdom | 2018 | Full |
| 92 | University of Glasgow | United Kingdom | 2014 | Full |
| 98 | University of California, Irvine | United States | 2019 | Full |
| 103 | Ghent University | Belgium | 2017 | Full |
| 103 | Lund University | Sweden | 2015 | Partial |
| 110 | Queen Mary University of London | United Kingdom | 2016 | Full |
| 120 | Georgetown University | United States | 2020 | Full |
| 121 | University of Sheffield | United Kingdom | 2015 | Full |
| 127 | University of Oslo | Norway | 2016 | Full |
| 127 | University of Southampton | United Kingdom | 2016 | Full |
| 130 | University of Göttingen | Germany | 2018 | Full |
| 133 | University of York | United Kingdom | 2019 | Full |
| 145 | University of Ottawa | Canada | 2016 | Partial |
| 147 | University of Auckland | New Zealand | 2019 | Full |
| 149 | Durham University | United Kingdom | 2018 | Full |
| 155 | Trinity College Dublin | Ireland | 2016 | Full |
| 158 | University of Nottingham | United Kingdom | 2018 | Full |
| 160 | University of Leeds | United Kingdom | 2019 | Partial |
| 160 | University of Sussex | United Kingdom | 2018 | Full |
| 163 | University of Liverpool | United Kingdom | 2019 | Full |
| 178 | Newcastle University | United Kingdom | 2016 | Partial |
| 183 | Stockholm University | Sweden | 2016 | Full |
| 186 | Queensland University of Technology | Australia | 2016 | Full |
| 187 | George Washington University | United States | 2020 | Full |
| 191 | Cardiff University | United Kingdom | 2018 | Full |
| 195 | University of Münster | Germany | 2018 | Partial |
| 200 | Queen’s University Belfast | United Kingdom | 2017 | Full |
| 200 | University of East Anglia | United Kingdom | 2017 | Full |
| 201 | Brandeis University | United States | 2018 | Partial |
| 201 | Chalmers University of Technology | Sweden | 2015 | Full |
| 201 | La Trobe University | Australia | 2016 | Full |
| 201 | Université Libre de Bruxelles | Belgium | 2019 | Full |
| 201 | University of Bath | United Kingdom | 2018 | Full |
| 201 | University of California, Santa Cruz | United States | 2019 | Full |
| 201 | University of Dundee | United Kingdom | 2020 | Full |
| 201 | University of Hawai’i at Mānoa | United States | 2015 | Full |
| 201 | University of Massachusetts | United States | 2016 | Full |
| 201 | University of Otago | New Zealand | 2016 | Full |
| 201 | University of Reading | United Kingdom | 2020 | Full |
| 201 | University of St Andrews | United Kingdom | 2016 | Full |
| 251 | Laval University | Canada | 2017 | Full |
| 251 | Simon Fraser University | Canada | 2019 | Partial |
| 251 | Swansea University | United Kingdom | 2019 | Full |
| 251 | University of California, Riverside | United States | 2019 | Full |
| 251 | University of Surrey | United Kingdom | 2015 | Full |
| 251 | Vrije Universiteit Brussel | Belgium | 2018 | Partial |
| 301 | Anglia Ruskin University ARU | United Kingdom | 2018 | Full |
| 301 | National University of Ireland, Galway | Ireland | 2016 | Full |
| 301 | Syracuse University | United States | 2015 | Full |
| 301 | University of California, Merced | United States | 2019 | Full |
| 301 | University of Essex | United Kingdom | 2019 | Full |
| 301 | University of Kent | United Kingdom | 2016 | Full |
| 301 | University of Oregon | United States | 2016 | Full |
| 301 | University of Stirling | United Kingdom | 2019 | Full |
| 351 | Heriot-Watt University | United Kingdom | 2015 | Partial |
| 351 | Loughborough University | United Kingdom | 2018 | Full |
| 351 | Northumbria University | United Kingdom | 2018 | Full |
| 351 | Swedish University of Agricultural Sciences | Sweden | 2016 | Full |
| 351 | Swinburne University of Technology | Australia | 2015 | Full |
| 351 | Umeå University | Sweden | 2017 | Full |
| 351 | University of Liège | Belgium | 2017 | Full |
| 351 | University of Tasmania | Australia | 2020 | Full |
| 401 | American University | United States | 2020 | Full |
| 401 | Aston University | United Kingdom | 2019 | Full |
| 401 | Bangor University | United Kingdom | 2020 | Full |
| 401 | Bournemouth University | United Kingdom | 2016 | Full |
| 401 | Goldsmiths, University of London | United Kingdom | 2019 | Full |
| 401 | Norwegian University of Science and Technology | Norway | 2016 | Full |
| 401 | Oregon State University | United States | 2017 | Full |
| 501 | Keele University | United Kingdom | 2019 | Full |
| 501 | SOAS University of London | United Kingdom | 2015 | Full |
| 501 | University of Guelph | Canada | 2020 | Full |
| 501 | University of Lincoln | United Kingdom | 2016 | Full |
| 501 | University of Portsmouth | United Kingdom | 2016 | Partial |
| 501 | University of the West of Scotland | United Kingdom | 2016 | Full |
| 501 | Victoria University of Wellington | New Zealand | 2014 | Full |
| 601 | Birmingham City University | United Kingdom | 2015 | Partial |
| 601 | Concordia University | Canada | 2019 | Full |
| 601 | Creighton University | United States | 2020 | Full |
| 601 | De Montfort University | United Kingdom | 2019 | Full |
| 601 | Glasgow Caledonian University | United Kingdom | 2017 | Full |
| 601 | Lakehead University | Canada | 2020 | Full |
| 601 | Manchester Metropolitan University | United Kingdom | 2016 | Full |
| 601 | Norwegian University of Life Sciences | Norway | 2016 | Full |
| 601 | Nottingham Trent University | United Kingdom | 2016 | Full |
| 601 | Oxford Brookes University | United Kingdom | 2015 | Full |
| 601 | Ulster University | United Kingdom | 2019 | Full |
| 601 | Université du Québec | Canada | 2019 | Full |
| 601 | University of Greenwich | United Kingdom | 2016 | Partial |
| 601 | University of Huddersfield | United Kingdom | 2017 | Full |
| 601 | University of Maryland, Baltimore County | United States | 2016 | Full |
| 801 | Cardiff Metropolitan University | United Kingdom | 2016 | Full |
| 801 | Sheffield Hallam University | United Kingdom | 2016 | Full |
| 801 | The New School | United States | 2015 | Full |
| 801 | University of Bedfordshire | United Kingdom | 2015 | Full |
| 801 | University of Hertfordshire | United Kingdom | 2015 | Partial |
| 801 | University of Roehampton | United Kingdom | 2020 | Full |
| 801 | University of Westminster | United Kingdom | 2015 | Partial |
| 1001 | Canterbury Christ Church University | United Kingdom | 2017 | Full |
| 1001 | University of Chester | United Kingdom | 2017 | Full |

### Supplementary Table S3: Parameter estimates for multinomial logistic model of divestment from fossil fuel by universities in the US and Canada

Standard errors in parentheses. The negative coefficients in the first row of numbers show that universities in states and provinces with higher proportions voting conservative divest less frequently. Since smaller numbers denote higher ranks, the negative coefficients in the second row indicate that higher-ranked universities divest more frequently. Finally, the coefficients in the third row entail that universities with larger endowments partially divest more frequently, but fully divest less frequently.

|  |  |  |
| --- | --- | --- |
|  | *Value of independent variable* | |
| **Independent variable** | **Partial divestment** | **Full divestment** |
| Regional politics | -0.066 (0.040) | -0.089 (0.027) |
| University rank | -0.010 (0.005) | -0.0036 (0.0017) |
| Endowment size | 0.037 (0.042) | -0.34 (0.23) |