

Does Fossil Rent Affect Opinions on Environment

GROUP 30: Laurin Weger, Hussain Miraah Rasheed, Geoge Chika Nnama, Afroza Khatun

Motivation

The fossil fuel industry has invested significant organizational and financial resources to influence public and policy discourse on climate change for decades. To influence public opinion and regulatory frameworks, industry players have launched well-funded lobbying campaigns and organized public relations (PR) campaigns (Knight, 2018). A critical dimension of these campaigns involves the strategic framing of climate responsibility, wherein corporate narratives emphasize individual behavioral change in oppose to systemic accountability for emissions reduction.

Empirical studies of industry communication tactics shows a conscious move towards neoliberal environmental rhetoric. For instance, Supran and Oreskes (2021), carried out a long-term content analysis of ExxonMobil's corporate communications such as internal documents and commercials. Their findings demonstrate that the corporation's external documents (AD's, press briefings, etc.) emphasized individual consumer responsibility while minimizing the fossil fuel industry's role (Supran & Oreskes, 2021).

Such narratives reveal a deliberate attempt to depoliticize climate discourse in order to justify continued fossil fuel extraction. By framing climate change as an issue that can be solved through personal choices (e.g., recycling, reducing plastic usage), industry PR campaigns shift the attention from structural drivers of emissions such as fossil fuel subsidies, weak regulatory standards, and absence of accountability mechanisms (Mann, 2021). This strategy mirrors historical precedence in industries such as tobacco companies' emphasis on personal responsibility for health to deflect scrutiny from the harmful effects of their products (Supran & Oreskes, 2021).

Recent studies have further explored the relationship between fossil fuel rent and public opinion on climate change, revealing a concerning link between fossil industries' financial interests and the shaping of public discourse. Brulle et al., (2019) show that when fossil fuel companies are making record profits, more money is being spent on lobbying and public relations campaigns that minimize the urgency of climate action and change the focus to personal accountability. Additionally, the study of Brulle et al. (2012) shows that during periods of record profits, there is an increase in public relations efforts to emphasize individual action. These findings demonstrate a link between the dissemination of false information regarding climate change and financial gains from fossil fuels.

Given the evidence linking higher fossil fuel profits to an increased spread of misinformation, this study examines whether and how the economic prominence of fossil fuels affects public perception on climate. In particular,

Hypothesis 1 asserts that people will be less inclined to view climate change as a serious threat in nations where the rent from the production of fossil fuels accounts for a larger share of GDP. In parallel,

Hypothesis 2 suggests that public sentiments in these same nations will more closely resemble the narratives of individualism and personal accountability that are pushed by fossil fuel industry PR campaigns.

Data Retrieaval

We use two data sources for our analysis. GDP and fossil rent data from the world bank, survey data on environment-related attitudes from the ISSP environment survey.

For GDP and fossil rent data (as a proxy for dependence on fossil fuel production), we use world bank data API. Fossil rent is defined as follows:

The estimates of natural resources rents are calculated as the difference between the price of a commodity and the average cost of producing it. This is done by estimating the price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs. These unit rents are then multiplied by the physical quantities countries extract or harvest to determine the rents for each commodity as a share of gross domestic product (GDP). [Source: See the details menu on the web pages linked below]

The indicators descriptions and the data are drawn from the world bank: GDP per capita in current US dollars: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>, Fossil petroleum rent as share of GDP: <https://data.worldbank.org/indicator/NY.GDP.PETR.RT.ZS>, Fossil coal rent as share of GDP: <https://data.worldbank.org/indicator/NY.GDP.COAL.RT.ZS>, Fossil gas rent as share of GDP: <https://data.worldbank.org/indicator/NY.GDP.NGAS.RT.ZS>.

For our work flow we use the world bank API using the python library <https://github.com/tgherzog/wbgapi>.

For the analysis of environment-related attitudes, we use the International Social Survey Programme (ISSP): Environment I-IV Cumulation dataset (<https://doi.org/10.4232/1.14332>). This dataset consists of 145 variables collected at four distinct time points: 1993, 2000, 2010, and 2020. The study spans 36 countries, with approximately 1000 respondents participating in each country. The data can be downloaded in spss and stata format.

For convenience, all datasets are provided in our github repository and decompressed when running the jupyter notebook provided.

Data Processing

The fossil dependence data and the GDP per capita data roughly follow a power law distribution (see Figure 1). We apply a log function.

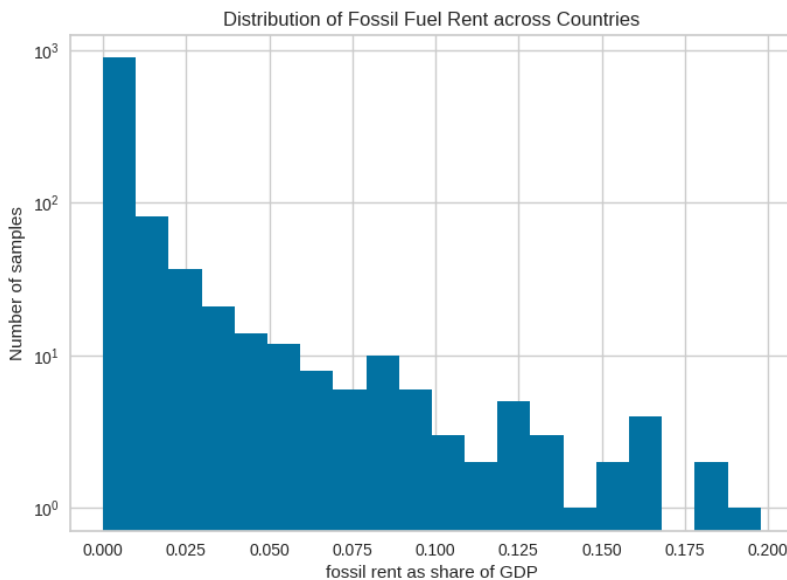


Figure 1: Distribution of various countries' fossil fuel rent as share of GDP with datapoints from 1990 to 2020. The data follows a power law distribution. Note that the survey data is more sparse so only a subset of those datapoints is used in the later analysis. Source: WorldBank.

From the ISSP survey dataset, we select a range of variables related to environmental issues and group them into three categories: (1) Variables related to awareness (e.g. the most important issue in my country is the environment), (2) variables related to attitudes typically promoted by fossil fuel PR (e.g. science will solve environmental problems), and (3) variables related to support for collective action (e.g. the government should make laws regulating business to protect the environment). Most of the variables are likert-scaled (strongly agree to strongly disagree). For each category, we assign weights to each variable, to aggregate weighted mean scores. The aggregated scores are then normalized to mean=0, sigma=1.

After that, we calculate a fourth score category, the difference between the individual action support score and the collective action support score which we normalize as well. We use this score (later referred to as *individual - collective action score*) as a proxy to measure the relative support for narratives of individualism and personal accountability that are pushed by fossil fuel industry PR campaigns.

The changes in the variable responses and the scores over time can be seen in Figure 2.

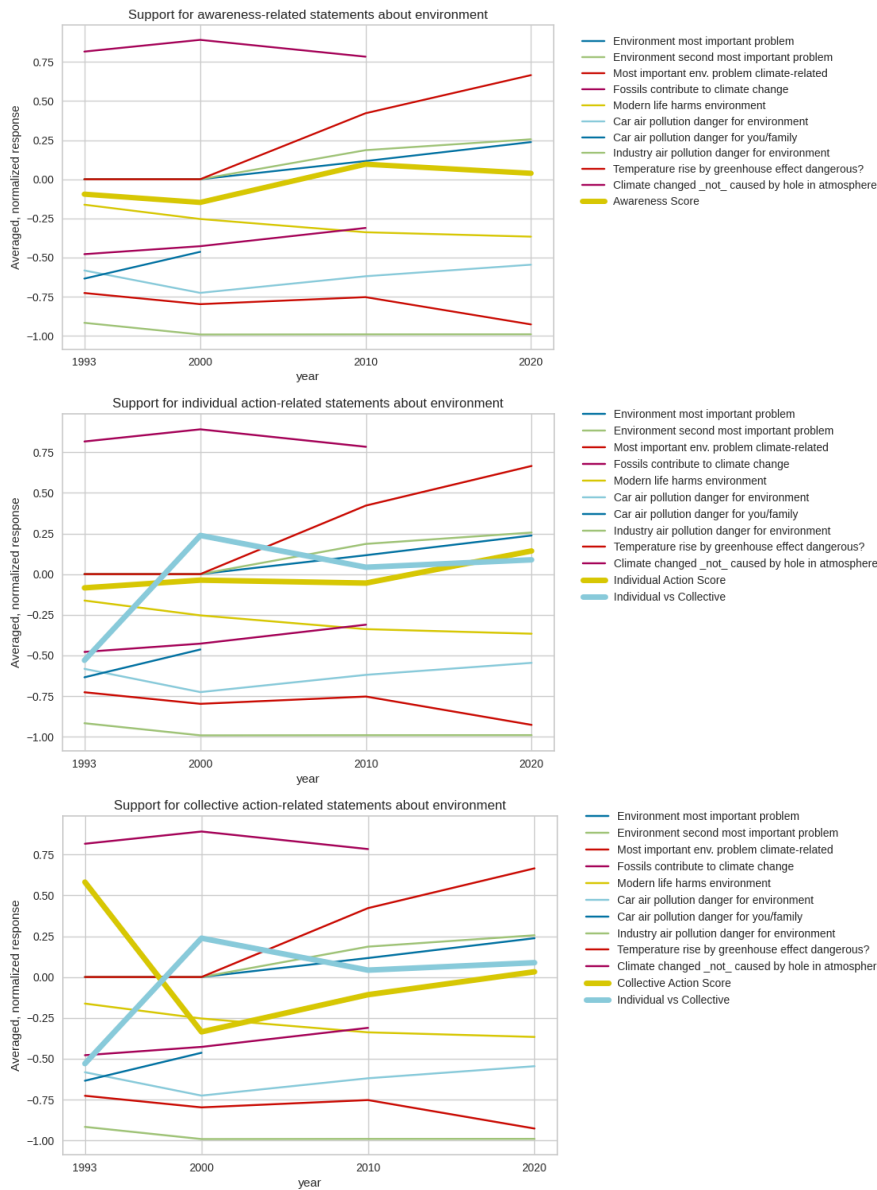


Figure 2: Average responses to different survey questions. Thick lines indicate aggregate scores. All variables are normalized to mean=0 and sigma=1.

Note that not all questions were collected in every survey year.

For each country and year, we calculate the average aggregate scores and the average normalized variables. This way, we are left with 100 rows (data from some countries is not available for all four survey years).

The 100 rows from the ISSP dataset are merged with the world bank dataset by country and year.

Analysis

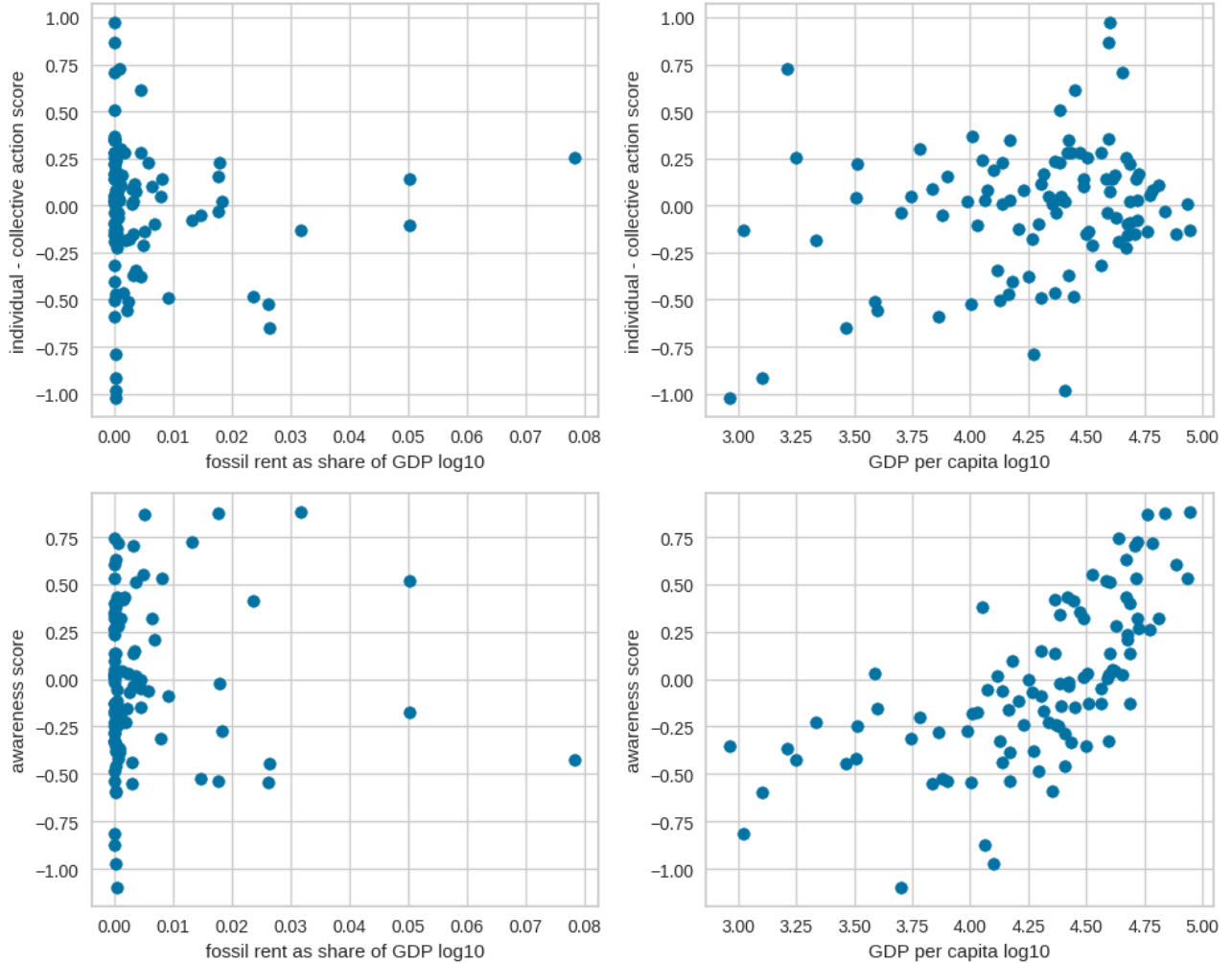


Figure 3: Scatter plots for logged GDP per capita and logged fossil rent (x-axis) vs awareness scores and “individual - collective action” scores (y-axis). Fossil rent plotted against the awareness and “individual - collective action” score do not show clear trends, in comparison to GDP per capita. Comparison to individual survey response questions show similar results.

For our analysis, we use a significance threshold of 0.05.

To test *hypothesis 1*, we analyze the correlation between the fossil rent as share of GDP (logged) and the awareness score that we calculated. We apply Kendall’s Tau rank correlation coefficient, as well as a linear regression model and find no significant correlation.

To test *hypothesis 2*, we analyze the correlation between the fossil rent as share of GDP (logged) and the individual - collective *action* score. As with the test for hypothesis 1, we find no significant correlation.

Additionally, we test if GDP per capita instead of fossil dependence as share of GDP shows significant correlations. In fact, we can see a correlation between GDP per capita and the awareness score. For the linear regression, $R^2=0.44$. Kendall’s $\tau=0.55$. We don’t see a significant correlation between GDP per capita and the individual - collective action score.

For a more intuitive interpretation, the scatter plot in Figure 3 shows correlations for GDP per capita and fossil rent as share of GDP versus the awareness score, and individual - collective action score.

The heat map in Figure 4 shows correlations of other survey responses with fossil rent and GDP per capita. We can see that all fossil rank indicators show poor to no correlation to the survey responses while GDP per capita shows correlations with linear regression R^2 values of up to 0.57 for the question: “Do you think that science will solve environmental problems?”.

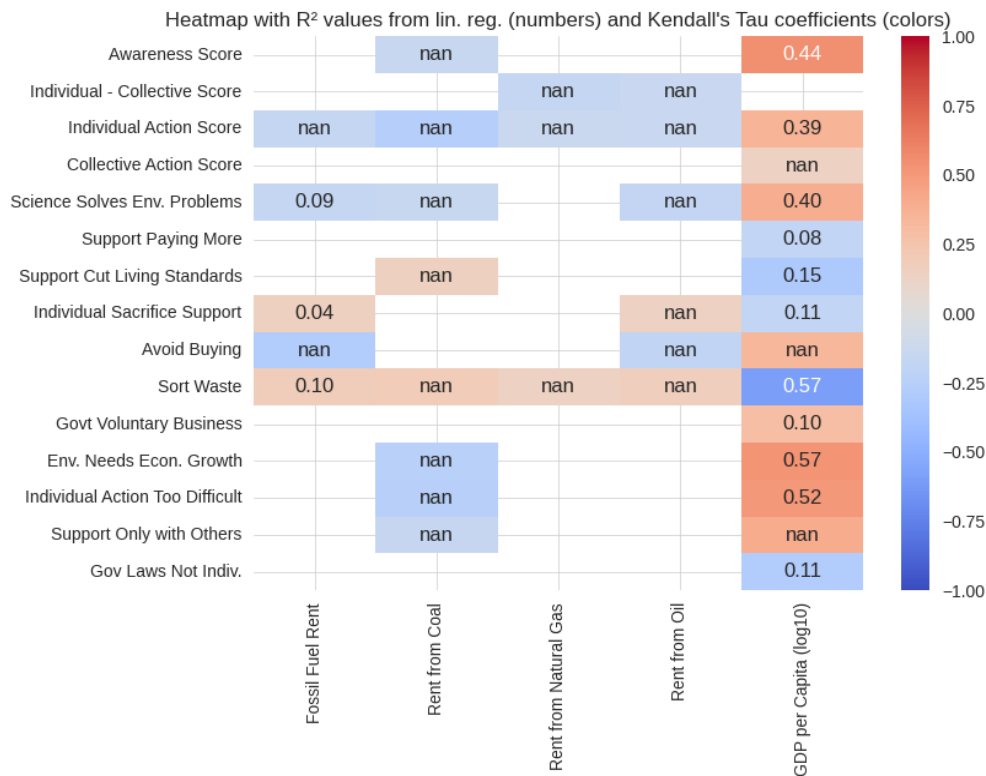


Figure 4: Survey-responses and aggregated scores on the x-axes. Fossil fuel and GDP per capita values on the y-Axis. Color indicates Kendall's Tau coefficient values where $p < 0.05$. The numbers indicate R^2 linear regression values, where $p < 0.05$.

Conclusion

The findings of this study go against the results of other similar studies which show that economic reliance on fossil fuel of a nation reduces peoples’ awareness of climate change or shapes preferences for individual climate action over support for collective action. There was no conclusive evidence linking fossil fuel rent to climate attitudes. However, we could find a correlation between environmental awareness and GDP per capita. In contrast, we could not find a correlation between GDP and individual – collective action scores. These findings suggest that public opinions on environmental issues are more impacted by socio-cultural and economic variables than fossil rent as share of GDP.

Critique

One of the limitations in our study is that our proxies are weak. We assume that countries with high fossil rent are countries that spend a lots of money on PR. Then we assume that this PR efforts are spent on changing attitudes towards issues asked in the survey. And then we assume that the PR works. The breaking point in this may be broken at one or all of those assumptions. It is therefore

hard to make a general falsification of previous research results. (Also, big fossils are present in almost all countries in the world – one could argue that fossil PR is so global that opinions have been more or less equally affected and thus measuring by country might not be possible). Also, fossil rent or fossil production dependence might have a time-lagged correlation which we did not measure either.

We were left with 100 data points which is not a lot for statistical analysis, especially for methodologies taking control variables into account. Additionally, we did not account for new countries joining the survey in our analysis, which could have given us more data points. On the other hand, fossil rent might not be a good proxy since most countries do not produce fossil fuels at all (or very little). We would need other surveys or other approaches to measure awareness as well as support for individual vs collective action. Furthermore, categorizing the variables in either awareness-related, collective action-related, and individual action-related was based on our good guess. A more standardized, sophisticated approach could improve the data quality.

Notes

All code and data available on our git repository for reproduction. <https://github.com/Laurin-W/foundations-final-project/>

There, you find this report and the research poster.

With the jupyter notebook you can run and reproduce our results with a single click.

References

- Brulle, R. J., Aronczyk, M., & Carmichael, J. (2019). Corporate promotion and climate change: an analysis of key variables affecting advertising spending by major oil corporations, 1986–2015. *Climatic Change*, 159(1), 87–101. <https://doi.org/10.1007/s10584-019-02582-8>
- Brulle, R. J., Carmichael, J., & Jenkins, J. C. (2012). Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the U.S., 2002–2010. *Climatic Change*, 114(2), 169–188. <https://doi.org/10.1007/s10584-012-0403-y>
- Knight, K. W. (2018). Does fossil fuel dependence influence public awareness and perception of climate change? a Cross-National investigation. *International Journal of Sociology*, 48(4), 295–313. <https://doi.org/10.1080/00207659.2018.1515702>
- Mann, M. E. (2021). *The new climate war: The Fight to Take Back Our Planet*. PublicAffairs.
- Supran, G., & Oreskes, N. (2021). Rhetoric and frame analysis of ExxonMobil’s climate change communications. *One Earth*, 4(5), 696–719. <https://doi.org/10.1016/j.oneear.2021.04.014>