

CLIMATE CHANGE REMAINS TOP GLOBAL THREAT ACROSS 19-COUNTRY SURVEY

Introduction and Motivation

On August 31, 2022, the Pew Research Center released a survey emphasizing climate change as the primary global threat across 19 advanced economies in North America, Europe, Israel, and the Asia-Pacific region. The survey specifically asked people across these 19 countries how severe various global threats (climate change, cyberattacks from other countries, the spread of false information, the spread of infectious diseases, and the condition of the global economy) were. I am interested in this research question because it not only establishes the groundwork for future studies but also offers a chance to enhance survey methodologies, particularly by delving into optimal sample sizes, margin of error, and stratification techniques.

Methodology

While I was studying this project, I got to know that, this report holds particular significance, as for non-U.S. data, nationally representative surveys were conducted involving 20,944 adults from February 14 to June 3, 2022, utilizing telephone or face-to-face interviews, depending on the country. For U.S. data, the American Trends Panel survey methodology was used, conducted from March 21 to March 27, 2022, with a total of 3,581 panelists responding out of 4,120 sampled from 11,685 active panelists. The targeted population encompasses adults in 19 advanced economies, spanning North America, Europe, Israel, and the Asia-Pacific region, specifically in Canada, Belgium, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden, the United Kingdom, Japan, Malaysia, Singapore, South Korea, Hungary, Poland, Israel, and the United States. This sampled population comprises individual adults participating in nationally representative surveys conducted across these economies, with each survey focusing on insights from a single participant. In observational studies, the responses and opinions of these individuals are carefully observed and analyzed. The key area of interest lies in the responses provided by survey participants to questions related to their opinions on global threats.

Notably, the survey revealed a distinct gender divide in climate change concerns, with women in 12 countries. I got to know that; women are more likely than men to say that a changing climate is a major threat to their country. In Sweden, 78% of women, compared with 62% of men, say that climate change is a great concern. Double-digit differences of this nature are also present in Australia, the UK, Canada, the Netherlands, Italy, and the U.S. In a handful of countries, those with more education are more concerned about the threat of climate change than those with less education. These differences are significant in Malaysia, Poland, Israel, Australia, South Korea, Belgium, and the U.S. Age is also a factor in views of the climate threat in several countries, but the pattern is somewhat mixed. In Australia, Poland, the U.S., and France, younger people are more likely to be concerned about climate change than their elders. For example, in Australia, 85% of those ages 18 to 29 say that climate change is a major threat, compared with 63% of those 50 and older. On the other hand, older adults in Japan are more concerned about climate change than young people.

They clearly stated that they used stratification in both instances to enhance the precision and reliability of the findings. They did mention that the data is weighted in a multistep process that accounts for multiple stages of sampling and nonresponse that occur at different points in the survey process. Despite the rigor in the survey design, the research acknowledged a notable margin of error attributed to the chosen sample sizes from each country, which was not disclosed in the published paper but said it would be available upon request. In light of this, my research seeks to address a critical gap by posing the question: ***“What is the optimal sample size needed for stratification to achieve a small margin of error at a 95 % confidence level examining the perceptions of global threats in these advanced economies?”***.

Utilizing publicly accessible data to answer my research question, I encountered challenges in comprehensively addressing all 19 countries surveyed. The provided information outlined the sample sizes per country but lacked details. Recognizing the complexities involved, I made a deliberate decision to narrow my focus to a singular country, that is the United States.

Results for the U.S. survey are based on data from the American Trends Panel. The American Trends Panel (ATP), created by the Pew Research Center, is a nationally representative panel of randomly selected U.S. adults. Panelists participate via **self-administered web surveys**. Panelists who do not have internet access at home are provided with a tablet and wireless internet connection. Interviews are conducted in both English and Spanish. The panel is being managed by Ipsos.

Data in the report is drawn from the panel wave conducted from March 21 to March 27, 2022. A total of 3,581 panelists responded out of 4,120 who were sampled, for a response rate of 87%. The cumulative response rate accounting for nonresponse to the recruitment surveys and attrition is 3%. The margin of sampling error for the full sample of 3,581 respondents is plus or minus 2.3 percentage points. Of the **27,414 individuals** who have ever joined the ATP, 11,685 remained active panelists and continued to receive survey invitations at the time this survey was conducted. To ensure high-quality data, the Center's researchers performed data quality checks to identify any respondents showing clear patterns of satisficing. This includes checking for very high rates of leaving questions blank, as well as always selecting the first or last answer presented. As a result of this checking, four ATP respondents were removed from the survey dataset before weighting and analysis.

Some of the weighting variables used are Age, Gender, education, Race, Ethnicity, Years lived in the U.S., Volunteerism, etc. The base weights for panelists recruited in different years are scaled to be proportionate to the effective sample size for all active panelists in their cohort and then calibrated to align with the population benchmarks in the accompanying table to correct for nonresponse to recruitment surveys and panel attrition.

ANALYSIS OF RESULTS

I believe they did well with their methodology and how they followed up to ensure high-quality data removing non-respondents from the survey dataset. Now to answer my research question which ideally wants to look into what sample size would be needed to achieve a better margin of error. To do this, I can start by writing out my margin of error formula below;

$$e = z_{\alpha/2} \sqrt{\left(1 - \frac{n}{N}\right) \frac{S^2}{n}}$$

e = Margin of error

$z_{\alpha/2}$ = critical value that corresponds to a level of significance of 0.05

S^2 = Population Variance

N = Population size

n = Sample size

The only parts of this formula not given by the methodology of the survey were the population size and the variance. However, I will use 27,414 individuals who have joined the ATP as my **Population size here and talk about this in my discussion.**

Solving for my variance,

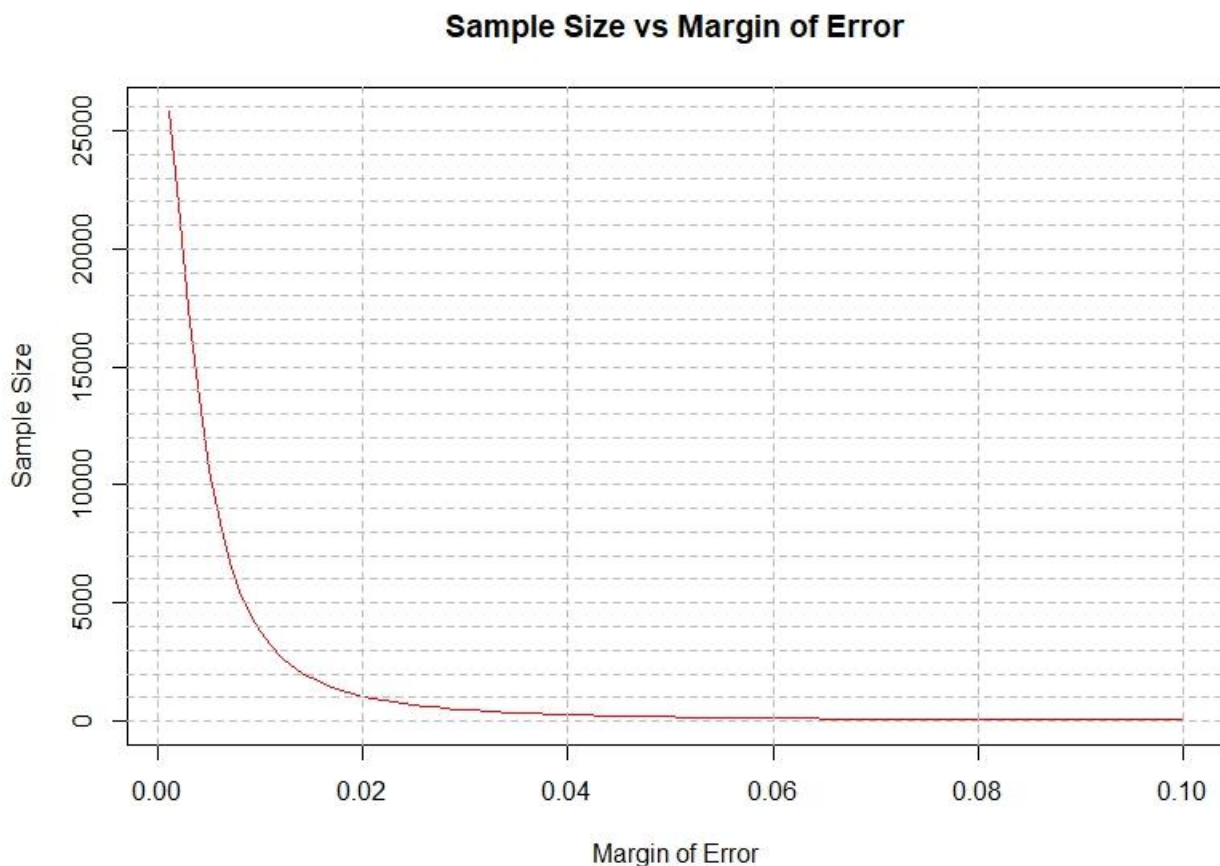
$$S^2 = \frac{e^2 \cdot n}{z_{\alpha/2}^2 (1 - \frac{n}{N})}$$

$$\frac{(0.023)^2 (3581)}{(1.96)^2 (1 - \frac{3581}{27414})} = 0.567206 = S^2$$

From here we can rearrange the formula to solve for sample size with an input of a desired margin of error.

$$n = \frac{z_{\alpha/2}^2 (S^2)}{e^2 + \frac{z_{\alpha/2}^2 S^2}{N}}$$

To gain a deeper understanding of the relationship between the margin of error and sample size, it can be beneficial to visualize this function by plotting the margin of error on the x-axis and the sample size on the y-axis.



The plot suggests that achieving only marginal reductions in the margin of error would require a substantially larger sample size. For instance, if the Pew Research Center aimed to conduct a survey using the same methodology as before, maintaining a similar variance, and targeting a modest margin of error, such as 0.2%, the necessary sample size would rise significantly to around 25,000. This small margin of error in the survey indicates a high level of precision in the estimate of the population parameter under study that is, the measure of the uncertainty or variability associated with the results due to sampling.

DISCUSSION, LIMITATIONS AND CONCLUSION

This increase in sample size would entail a considerably higher cost for the survey because all respondents were offered a post-paid incentive for their participation. Incentive amounts ranged from \$5 to \$20 depending on whether the respondent belonged to a part of the population that is harder or easier to reach. Differential incentive amounts were designed to increase panel survey participation among groups that traditionally have low survey response propensities. While incentives can be effective in increasing response rates, the fact that respondents were offered varying amounts based on their demographic characteristics may introduce a bias in the sample. The differential incentive amounts designed to target specific groups with traditionally low survey response propensities might lead to an overrepresentation of individuals from certain demographics.

The methodology employed by the Pew Research Center in its survey on global threats across 19 advanced economies exhibits strengths but is not without limitations. Potential sources of **bias include sampling bias**, as efforts to ensure national representativeness may still leave certain groups underrepresented. A notable 87% response rate for the American Trends Panel introduces the possibility of non-response bias, with those opting out potentially holding differing opinions on global threats but was removed as discussed earlier. **Self-administered** web surveys may lead to self-selection bias, attracting individuals with specific characteristics, that is the **27414 panelists to represent the whole of the United States in matters like these**. They should randomly select people from every state in the U.S. to have the true representation of the country. Generalizability to less economically developed regions is limited, and the study's focus on advanced economies may not extend well to a global context. The study's temporal limitations, spanning from February to June 2022, may miss dynamic shifts in public opinion. The undisclosed margin of error and variability in survey methods pose challenges in assessing result precision. Educational and language biases may affect the findings, particularly regarding climate change concerns based on education levels and the use of English and Spanish in interviews. The effectiveness of stratification is contingent on the accuracy of chosen variables, potentially introducing further biases. Researchers and readers should be cognizant of these limitations when interpreting and applying the study's outcomes.

In conclusion, enhancing transparency is paramount; detailed documentation of all research steps, particularly the sampling procedures and adjustments made during the study, would strengthen the study's credibility. Sampling of reasonable size (large size) will therefore lead to small marginal error in any survey to be done in the future to improve the overall validity, reliability, and impact of the research.

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