EJW
ECON JOURNAL WATCH
Scholarly Comments on Academic Economics

ECON JOURNAL WATCH 22(1)
March 2025: 142–152

Reflection after Five Papers about Climate Change

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LINK TO ABSTRACT

The silence of these writers is dreadfully expressive.
—Edmund Burke (1999/1795, 3:380)

During 2022, 2023, and 2024, I published five papers in *Econ Journal Watch* (EJW) critiquing claims that higher temperatures will lower the rate of economic growth (Barker 2022a; 2023a; 2023c; 2024a; 2024c). All of the commented-on authors were contacted by email and given an open-ended opportunity to respond, and none of them have done so. The invitation remains open. EJW lists some of the authors who have not responded to critiques in a listing titled "Sounds of Silence" (**link**).

Besides being contacted directly, the commented-on authors would have known of my critiques because they were widely publicized. My EJW articles have been downloaded more than 25,000 times. Moreover, for each of my five articles I wrote an accompanying op-ed, three published in the *Wall Street Journal* (Barker 2023b; 2023d; 2024b) and two at the American Institute for Economic Research (Barker 2022b; 2024d). In addition, I gave dozens of interviews on radio stations and podcasts. I also testified about my results to the U.S. Senate Budget Committee (Barker 2023e). The commented-on authors cannot claim that they were unaware of my critiques.

Not only have the commented-on authors ignored my work, but recent surveys of literature on the effect of climate on the economy that cite the commented-on papers do not cite my critiques (Bilal and Stock 2025; Brecken-

1. Views expressed in this comment are my own and not those of the Iowa Board of Regents or any other organization I am affiliated with.

felder et al. 2023).

In this paper I explain why the relationship between temperature and GDP growth is important and describe my critiques. Then I reflect on the lack of response by the commented-on authors and others.

Importance of the question

Climate change is often described as the most important threat facing humanity and, supposedly, most scientists agree (Cook et al. 2013; IPCC 2021). In response, trillions of dollars are being spent to transform the world economy (IEA 2024; UNCTD 2024), with much more spending proposed (McKinsey 2022). Questioning the size and urgency of the response to climate change is often met with derision, and some even argue that such arguments should be suppressed or prosecuted.[2] Attempts to limit debate are dangerous because the appropriate response to climate change should be based on careful assessments of costs and benefits. Assessments that selectively discard data and analysis will be unreliable. The critical question is whether the gigantic expenditures that have been proposed are justified. To know the answer, we must have credible estimates of the economic harm of not reducing greenhouse gas emissions.

A widely accepted estimate of the economic effect of climate change comes from Nobel Prize-winning economist William Nordhaus (2018). He estimated that a rise in the global average temperature of six degrees Fahrenheit, which is at the extreme end of potential outcomes, will cause year-2100 GDP to be lower by approximately 2.6 percent. However, real global GDP per capita has been rising by just over 2 percent per year for the past 50 years, and if that continues, year-2100 GDP will be about five times higher than it is now. If it is 2.6 percent lower because of climate change, it will be 4.9 times higher than today's GDP instead of 5 times higher. This difference would likely be imperceptible given uncertainty about future growth and future climate.

Nordhaus's reasoning legitimizes a cool-headed approach to climate concerns. In response, a line of research has developed arguing that warmer temperatures will reduce not just the level but *the growth rate* of GDP. If warming caused growth to slow, the effects over many years could be very large. The authors I

2. For calls to suppress or prosecute climate skepticism, see Whitehouse (2015); Senate Democrats' Special Committee on the Climate Crisis (**link**), which states that one of its "duties" is to "prioritize oversight and investigation of the efforts of special interests to foster climate denial;" and President Obama (2022), speaking about disinformation on social media and saying "regulation has to be part of the answer." Senator Whitehouse chaired the committee before which I testified, but he and his Democratic Party colleagues declined to ask me any questions.

critiqued all conducted analyses to estimate the association between year-to-year fluctuations of average temperatures in countries or U.S. states, and the annual rate of growth of GDP in those countries and states. The associations they found were large, with estimates of the reduction of per-capita GDP in the year 2100 resulting from warming ranging from 23 percent of world GDP (Burke et al. 2015) to 91 percent of GDP for already warm countries (Kiley 2024).

If temperatures significantly influence GDP growth rates, then climate change is a critical problem for the world. If they do not, then climate change may be a relatively trivial issue. If I am right, and there is no credible evidence that rising temperatures reduce the rate of economic growth, then the case for costly policies that supposedly reduce greenhouse gas emissions would be considerably weakened.

Summary of critiques

In my five papers that critique articles estimating the association between temperature and economic growth, I found basic errors that invalidate the critiqued papers' results.

The first paper I critiqued, by Riccardo Colacito, Bridget Hoffman, and Toan Phan (2018), was originally published by the Federal Reserve Bank of Richmond, and later in the *Journal of Money, Credit and Banking* (2019). The study is confined to the United States and uses annual average state GDP growth. It claims to show that higher temperatures decrease the rate of economic growth in the United States by approximately one third. The authors regressed annual average state GDP growth on seasonal temperatures and obtained regression coefficients for spring, summer, fall, and winter. But instead of testing whether the sum of the coefficients was statistically different from zero, which is the key result, they ignored winter and spring because these coefficients were statistically insignificant, and added the two statistically significant coefficients together to see if the total effect was positive or negative. They did not test whether the sum of summer and fall (which had opposite signs) or the sum of all four was statistically significant. I performed the test and found that neither sum was statistically significant. Testing individual coefficients for significance and concluding that their sum is significant without explicitly testing whether the sum itself is significant is a deeply flawed approach.

The "robustness checks" in the paper involved changing the months that were included in seasons. Instead, I looked at individual months and found that none showed statistically significant effects, and the monthly coefficients did not follow a logical pattern fitting the paper's hypothesis. I also found that when California is omitted from the sample, the sign of the effect of temperature on

economic growth is reversed. California has such a diverse climate that an annual average temperature for the state is essentially meaningless. All states are given equal weight in the analysis, so the effect of the exclusion of California is not due to the size or economic importance of the state. If the sign of a key result of a piece of research reverses because of the exclusion of one of fifty observations, that suggests that the research is not robust.

Another Federal Reserve paper, by Michael Kiley (2021), used data from 124 countries to claim that high temperatures decrease the rate of economic growth when growth is already low. I showed that his primary result, which was that the effect of temperature is greater when growth is low, was not statistically significant. I also showed that a few influential observations were driving his results, and that simulated data with no relationship between temperature and growth can generate his results. In other words, random data with certain characteristics unrelated to any relationship between temperature and growth can produce Kiley's results. Kiley did not respond to my critique, but he did publish a slightly revised version of his paper in *Economic Inquiry* (Kiley 2024) with a scatterplot resembling the one in my paper, and he also added a section on outlier observations. This section concluded that "outliers are not unduly influencing the results in this analysis" (Kiley 2024, 1144).

I responded to Kiley's revised paper, showing that his new "robustness checks" are faulty, including his analysis of outliers. I also showed that a more sophisticated bootstrap method eliminates the statistical significance of his results. Kiley's results are likely spurious, resulting from a combination of outlier observations, heteroskedasticity, and correlations of time with both GDP growth and temperature, and autocorrelation of growth and temperature. Spurious results due to data characteristics like these were described by Clive Granger (1974). I also created additional simulated data to illustrate how Kiley's estimation method could produce spurious results.

Using a database of political upheavals, I also found that removing countries with wars, revolutions, coups and genocides eliminated Kiley's results. Removing Greenland, a country with a very unusual climate and tiny economy, actually reverses the sign of Kiley's main result.

An early and influential paper, by Melissa Dell, Benjamin Jones, and Benjamin Olken (2012), published in *American Economic Journal: Macroeconomics*, claimed that higher temperatures have reduced growth in poor countries. I found that a slight and eminently proper change to their method of classifying countries as rich or poor eliminated their results. Dell et al. (2012) classified a country as poor for the entire sample if that country was below the median of country income per capita at the beginning of their sample period, 1961. But South Korea, for example, was poor in 1961 and rich by the 1980s. I tried classifying countries as

poor in years they were poor and rich in years they were rich, and the results of Dell et al. (2012) were eliminated. Another one of their curious methodological choices—about the inclusion of complex fixed effects—also significantly affects their results. One set of their fixed effects variables was dummy variables indicating the year of the observation multiplied by a dummy variable indicating whether a country was poor. But on average, growth in poor countries improved over the sample period at the same time that the author's data showed average temperatures in these countries increasing. This correlation worked against their hypothesis. Including the fixed effect variables offset this correlation, boosting the statistical significance of temperature. Dell et al. (2012) provide no justification for the inclusion of these variables, and report that dropping them has little effect on their results. Close examination of their online appendix, however, reveals hints that including these variables had a large effect on the estimates, and my analysis confirms that this is the case.[3]

Dell et al. (2012), like Kiley (2021) and an article by Marshall Burke, Solomon Hsiang, and Edward Miguel (2015), give equal weight to all countries. Small-GDP, unusual countries, such as Greenland, can significantly affect the results, even though many of their very high and very low rates of growth are unlikely to have been caused by temperature. For example, a genocide occurred in Rwanda in 1994, resulting in a 63 percent decline in per capita GDP that single year. Temperatures were warm that year, but not until *after* the genocide had occurred. Because Dell et al. (2012) used annual, and not monthly, temperature and growth, the observation of Rwanda in 1994 appears to confirm that high temperatures damage growth and helps to trick the model into concluding that there is a relationship between growth and temperature. Dell et al. (2012) also claimed that high temperatures lead to political upheaval, but these results crumbled upon close examination.

I included additional countries and more recent data into the sample, which weakened Dell et al.'s results. An alternative source of data over a longer time period did not support their hypothesis that high temperatures reduce economic growth.

3. Footnote 21 in Dell et al. (2012) simply says that dropping the controls "produces similar estimated temperature effects." Table A20 in the online appendix shows estimates and standard errors of the temperature effect with and without the controls for a subset of the data, both with double asterisks indicating "significant at 5%." A quick calculation shows that the t-statistic falls from 2.41 to 2.01 when the controls are removed. No mention is made in Dell et al. (2012) of this reduction in statistical significance. Using the entire dataset, I find that removing the controls eliminates the statistical significance of temperature at the 5% level. Calculations using results from Table A30 in their online appendix shows that using satellite temperature data, the t-statistic on temperature using the full dataset is only 1.54, and dropping the controls reduces it to 1.03. These results are not discussed in the paper, other than to say "Numerous additional analyses are presented in the online Appendix" and "We find broadly consistent results across a wide range of alternative specifications" (Dell et al. 2012, 78, 68).

Perhaps the most influential paper claiming that warmer temperatures will reduce economic growth was published in *Nature* (Burke et al. 2015). Using annual temperature and economic growth data from 166 countries, the authors estimate an optimal temperature that maximizes growth. They then estimate how much, in terms of percentage annual growth, deviations from the optimum cost each country. From these results they calculate the cost of the warming that is predicted by the IPCC and conclude that warming will reduce the world's year-2100 GDP per capita by 23 percent.

I found multiple problems with Burke et al. (2015). Weighting countries by size and growth volatility significantly diminished their results, meaning that small and unusual countries appear to have influenced Burke's results. The results were also diminished by adjusting for temporal and spatial autocorrelation of growth. The results are also heavily influenced by a few outlier observations. When adjustments are made for all of these factors, the results disappear.

In addition, any effect of temperature on growth is reversed in the following year, and any effect (if it exists at all) shows signs of being mitigated over time. There are also warning signs of unreliability in their bootstrap estimates, which the authors ignore.[4]

It should not be surprising that small temperature changes have no impact on economic growth. Many warm places, such as Florida and Singapore, have grown rapidly in recent years, while many cooler places have not. In recent years, for example, the rate of growth in Florida and Arizona has exceeded that of Michigan and Maine. If the data had been properly interpreted, the studies I critiqued would have confirmed the unsurprising truth that small changes in temperatures have no measurable effect on economic growth. But the studies were improperly done, allowing the authors to claim that the effect of temperature on growth is huge.[5]

Why no responses?

Econ Journal Watch's Comments section, in which my pieces appeared, always

4. Burke et al. (2015) reports the point estimate of the effect of temperature on growth (23 percent) and the median of the bootstrap estimates (21 percent) but not the mean of the bootstrap estimates, which I find to be 11 percent, less than half of the point estimate. I find that the bootstrap estimates have a fat tail to the right, indicating a 5 percent probability of global GDP in the year 2100 being 66 percent higher because of warming temperatures. They also indicate a 0.1 percent chance that global GDP will be four times higher because of warming temperatures. These results are not reported in Burke et al. (2015).

5. Of course, no analysis can rule out the existence of "tipping points," where temperature increases beyond some unknown threshold might cause catastrophe. But it seems unwise to base policy on non-falsifiable hypotheses.

invites commented-on authors to reply, and often they do. It is often unclear who gets the better of these exchanges. The authors whom I commented on have all had ample time to reply, but none have done so. Perhaps the imbalance in academic stature between the commented-on authors and myself convinced them that there was no need to reply, but my critiques were widely distributed and publicized, potentially damaging their reputations. If my critiques are mistaken and the errors I claim to point out are not errors at all, then the authors would have a strong incentive to reply.

Assuming, then, that I have found real errors in these papers, it is possible that they are the result of honest mistakes. Data are messy, and computer code can be very complex. A small error in thousands of lines of code or an incorrectly merged dataset can cause large errors in final results. In this case, the authors would also have an incentive to reply, as Carmen Reinhart and Kenneth Rogoff (2013) did in response to a critique by Thomas Herndon, Michael Ash and Robert Pollin (2013). Reinhart and Rogoff accepted that they had made a coding error identified in Herndon et al. (2013), but denied their accusation that some data points had been selectively omitted. If the errors I identified were real but honest, it would seem that the authors I critiqued would want to acknowledge them and argue that the errors were honest, and not an attempt to falsify results.

It is also possible that the commented-on authors know that my critiques are valid, but believe that answering them will only give the critiques more attention, so they believe that it is best for their reputations to simply ignore them. If so, their approach is not that of honest scholarship.

Honest mistakes tend to be random in size and direction. It is unlikely that honest mistakes would all lead to the same conclusion, which is that higher temperatures reduce GDP growth by large amounts. Not only have I critiqued many different papers, but for each paper, I identify errors that nearly all make the authors' results appear to be stronger.

We are forced by this pattern of errors to consider the possibility that some of the body of research I have critiqued is less than honest. It appears to be the result of bias—implicit collaboration of authors, reviewers and editors to promote socially and politically acceptable ideas leading to conformity and suppression of alternative ideas. Additional evidence of bias in academia can be found in surveys of literature on the effect of climate change on the economy. Two recent surveys (Bilal and Stock 2025; Breckenfelder et al. 2023) discuss hundreds of papers, including the papers I critiqued, but neither of them cite my critiques. In the 2020s, it is impossible that the authors of survey pieces like these would have been unaware of my work. The authors also knew that my critiques have not been answered. The irresponsibility of failing to provide a balanced review of the literature in these articles can only be explained by ideological bias.

If the academic establishment is biased in this way, what would it mean? First, it would mean that many prominent economists cannot be trusted to produce reliable scientific results. Second, it would mean that academic journals, referees, and universities participate in endeavors that mislead the public and policymakers. Third, it would mean that much of the media is gullible at best, since they have, with the exception of the editorial section of the *Wall Street Journal*, amplified the original papers and ignored my critiques.

Imagine that academic authors confect results. Why would they do so? Even someone with strong credentials might wish to make them even stronger, and publishing another paper helps to burnish one's reputation and career. Another possibility is seeking moral approbation or validation. Yet another possibility is that an author believes in an agenda and seeks to serve it, even to the point of confecting false research in support of it.

But in our case, why would authors be so intent on promoting the agenda of climate alarmism? There would have to be some evidence that has convinced the authors of the reality of catastrophic climate change. Why, on this hypothesis, would they not focus on the evidence that actually instilled their beliefs, instead of confecting and promoting false evidence? Perhaps they are unable to validate the evidence that caused their belief but believe it anyway. If so, then their beliefs are not scientific.

Scholars of religion and politics have noted the tension between true faith and desire for material gain and that both may be simultaneously present in the minds of some leaders (Weber 1919; Festinger 1957; Armstrong 2009). The belief that anthropogenic climate change will cause calamity might be both a belief and a racket benefiting elite members of society. We might liken the situation to the 15th-century Catholic Church: universities play the role of the church, governments are the new church-allied monarchs, and politically favored private enterprises profit in a manner similar to medieval bankers, architects, and builders. In the next century came the Reformation. We might also liken the situation to the 20th-century Soviet Union, in which academia, scientific research, and media constituted a class of nomenklatura or were under their thumb.

The authors of the papers I critiqued are welcome to respond. If they do, I look forward to engaging with them to test our conflicting ideas. If they do not, I hope readers will take their non-response as evidence of the unreliability of some areas of academic research. A topic for future discussion is whether climate change research is unique, or whether other areas of academic research are also scientifically unreliable and function as apologetics for indefensible beliefs.

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