Vol. XLI No. 7

ECONOMIC EDUCATION BULLETIN

Published by

AMERICAN INSTITUTE *for* ECONOMIC RESEARCH

July 2001

Great Barrington, Massachusetts 01230

A Climate of Opinion: The Kyoto Protocols and Atmospheric Science

In recent decades, just as the threats to human survival posed by a nuclear confrontation between the superpowers have receded, fears over human-induced environmental calamity have grown markedly. In 1992, for example, the world's major nations met in a United Nations Earth Summit in Rio de Janeiro, Brazil, to declare that greenhouse gases, in particular the gaseous effluents of human activities, were threatening the balance of Nature and adding the potential for catastrophic, world-wide warming that could surpass nuclear war in its destructiveness. In that meeting, attending nations agreed to reduce greenhouse gas emissions to 1990 levels by the year 2000. That non-binding "Rio Treaty" received much media coverage but lacked any effective means of enforcement.

The major nations again met in 1997 in Kyoto, Japan, to sign a legally binding and internationally enforceable agreement negotiated by the Clinton administration on human emissions. The resulting Kyoto Agreement, which world environmentalists had hoped would gain the status of a formal U.S. Treaty, failed ratification by the U.S. Senate in a subsequent 95-to-0 straw-poll vote. As of mid 2001 not one major country has ratified it.

The "Greenhouse Effect"

It is well established that the earth's atmosphere (see box on next page) moderates the extreme temperatures prevailing in unprotected celestial environments—for example, on the moon, where the lunar surface exposed to sunlight can reach hundreds of degrees Fahrenheit while its dark side can fall to hundreds of degrees below zero. Moreover, the atmosphere greatly attenuates the sun's harsh ultraviolet rays, ionizing particles, and X-radiations just as it lets in enough of the sun's radiated spectra to keep the oceans liquid and to foster diverse life forms. In view of the complex and crucial relationship of the atmosphere to all earthbound life, inquiry into possibly adverse atmospheric consequences of human enterprise seems entirely reasonable—and prudent.

However, it is precisely such inquiry that might be, and has been, exploited for political gain. It is no surprise that the results of any number of "expert" analyses into a given problem sometimes (perhaps often) have reflected the preferences of interested parties rather than disinterested science. The current global warming controversy would seem to be a classic illustration of this circumstance—and one that has been confounded by the genuine limitations imposed by fragmentary and imperfect data, technological obstacles to accurate measurement, and an imperfect understanding even of the most fundamental factors influencing climate change.

The Issues

Is a global disaster attributable to a human-induced warming just around the corner? Or is the world simply entering another, perhaps brief[1] and largely natural period of benign warmth?

The main assertion of those who propose immediate measures to alleviate the presumed potentially disastrous consequences of global warming is that rich na-

---

[1] Ohio State Research News, www.osu.edu/researchnews/archive/nowarm.htm:

"Global warming is a natural geological process that could begin to reverse itself within 10 to 20 years, predicts an Ohio State University researcher." Professor of Energy Conservation Robert Essenhigh says that "the rising global temperatures … are naturally increasing the levels of carbon dioxide, not the other way around … [and] compared to man-made sources' emission of about 5 to 6 billion tons per year, the natural sources would then account for more than 95 percent of all atmospheric carbon dioxide."

What Is the Atmosphere?

By volume the earth's atmosphere is 79.1% nitrogen, 20.9% oxygen, 0.036% carbon dioxide, and traces of other gases such as methane. The atmosphere is layered. The troposphere reaches up some 5 miles at the poles and up some 11 miles at the equator, and contains 85% of atmospheric mass. The stratosphere reaches up to 31 miles, the mesosphere reaches up over 50 miles, and the ionosphere, the last layer, blends weakly far out into space. The layers exchange gases poorly.

Oxygen, which reacts easily with many earth minerals and compounds, is constantly replaced by the earth's diverse plant life, which uses sunlight to strip carbon from atmospheric carbon dioxide and release oxygen to the air. The very low partial pressure of carbon dioxide limits plant growth. Increasing levels of atmospheric carbon dioxide speeds plant growth by what is known as the CO2 fertilizing effect.

Water vapor, the dominant greenhouse gas, abounds in the troposphere and is best seen as precipitation and clouds, which play a large and important role in both large- and small-scale climate variability. Fortunately, natural greenhouse gases such as water vapor keep the earth's temperature some 59°F warmer than it otherwise would be. Much effort is being made to see if human additions to greenhouse gases have discernable effect on that average temperature and if so, are the additions on balance harmful or beneficial.

tions employ unsustainable technologies that have inflicted or are about to inflict irreparable harm upon the Earth and its inhabitants. The principal evidence is that the temperature of the earth's surface and lower atmosphere has warmed—some say alarmingly—over the past 20 years or so. Many scientists, politicians, pundits, public officials and private citizens say that the detected warming owes in some significant way to human activities. They postulate further that, if allowed to continue, such warming will precipitate much environmental harm as glaciers melt, sea levels rise, storms increase, crops and species fail, and death and disease lay waste major population centers.

On the other hand, others—including many prominent scientists—cite contrary data that show no discernable trend toward global warming. They suggest rather that, among other factors, pertinent data indicate periods of warming preceding the acceleration of human greenhouse effluents. In short, they say that concerns about human-induced global warming are overblown, that even if the earth does warm the consequences will be largely beneficial, and that over the long run the atmosphere probably is headed for a cooling period.

Our ongoing review of these issues has raised several areas of concern. To begin, the science often is anecdotal and subjective. Among the advocates of climate control, contrary data often have been ignored: long-term climate records have been disregarded, and temperature data have seemingly been "mined" to produce a desired result. There has been wide disagreement among climate scientists, unexplained and wide differences among many changeable computer model predictions, and a disregard for the potential economic costs of proposed remedies. In our view, a useful approach to inquiry into any problems requires objectivity, direct observation, and careful measurement. In the world climate debate, strict adherence to scientific methods would seem crucial to the development of warranted assertions that are the basis of informed action.[2]

The Science

Climate is a word for regional weather variability. The earth has many climates, and life has lasted through severe global climate variability. Climate scientists readily agree that the earth has been warming for thousands of years following the peak of the last major glacial age. The warming has not been smooth and may or may not continue. (During the late 1970s, some scientists warned of a seemingly imminent cooling.)[3] Within the last 2,000 years, humans have survived two protracted temperature extremes. In the first, known as the Medieval Climate Optimum, much warmer tem-

[2] An exemplary paper is "Environmental Effects of Increased Atmospheric Carbon Dioxide," Arthur B. Robinson, et al, Oregon Institute of Science and Medicine, 2251 Dick George Rd., Cave Junction, OR 97523 (info@oism.org). The paper also was published recently in the *Wall Street Journal* and elsewhere, and has had a wide distribution among interested parties.

[3] Paul Ehrlich, author of *The Population Bomb* (1968), said that the "population of the U.S. will shrink to about 22.5 million before 1999, because of famine and global warm-

peratures fostered migrations to previously inhospitable lands such as Greenland (abandoned upon the return of cold temperatures). In the subsequent Little Ice Age, Europe's rivers and canals froze, crops failed, and life spans shortened by a decade. As retreating mountain glaciers testify, for the past 300 years world temperatures have been rebounding from that relatively cold period to a level still a bit below the average temperature for the past 3,000 years. The obvious cautionary point here is that naturally occurring global temperature variation has been much larger for far longer than that observed during the last industrialized century.

Climate scientists also agree that 98 percent of global greenhouse gas emissions have non-human sources (mostly water vapor) and that only some two percent of all greenhouse gases come from human sources. For comparison, the termite and ant family alone digest and compost plants, thereby reportedly releasing carbon dioxide at a rate double that of all human emissions.

Atmospheric carbon dioxide concentration has risen since 1900 from less than 300 parts per million by volume to more than 360 ppm. Some rise is to be expected following any global warming as the oceans also have warmed and degassed a bit of their massive quantity of dissolved carbon dioxide, much like a warming soda pop degasses. Moreover, the total of annual human carbon dioxide sources is but four or five percent of all such sources.[4] In other words, carbon dioxide increases seem destined for further increase even in the absence of humans on the planet.

Some 82 percent of the combined greenhouse-gas increase came after 1940, but 70 percent of this century's 1°F warming occurred before 1940, and higher temperatures widely reported for the 1980s and 1990s do not show up in either weather balloon measurements or satellite measurements or "proxy" temperature records.[5] Most importantly, they also do not show up in surface temperature measurements kept for regions with comprehensive, high-quality records such as in North America and Europe.[6] In other words, changes in surface and near-surface temperature and the atmosphere's scarce carbon dioxide appear to be out of sync. Increases in carbon dioxide *lagged* the onset of warming.[7]

The satellite temperature measurements are especially noteworthy because the trend of the monthly averages since 1979 continues to show a slight decrease. The discrepancy between this decrease and the increase indicated by land-based measurements may be the result of the "local heat-island effect," which names the well documented and uncontroversial effect of urbanization upon the long-term trend of urban temperature records. In essence, concrete and asphalt hold heat longer than grass and trees, and expanding cities and suburbs, rather than a general atmospheric warming, have contributed to many recorded land-based temperature increases.

Interestingly, the U.S. surface temperature record for the last 20 years or so shows no statistically significant warming trend, a record that agrees with the balloon and satellite records. Only recently noted is that the widely reported *global* temperature increase may be attributable in part to sloppy measurement outside of North America and Western Europe. For example, according to Accu-Weather, the world's leading commercial forecaster, "Global air temperatures as measured by land-based weather stations show an increase of about 0.45 degree Celsius [0.81 degree Fahrenheit] over the past century. This may be no more than normal climatic variation [and] several biases in the data may be responsible for some of this increase."

So why has the Earth's temperature warmed at all this century? There appear to be several possible causes. To pick one, scientists increasingly find that the sun's output, once thought to be "constant," is not. Indeed, solar research shows that highly energetic changes in ultraviolet, visible, and infrared light influence the earth's atmosphere in ways more involved than previously thought. The sun's powerfully squeezing magnetic flux only recently was discovered to be the appar-

---

ing."

In 1970, he wrote in fear of global cooling, "Should the south polar region get colder, the Antarctic ice cap might slump into the Antarctic Ocean … It might produce a global tidal wave the could wipe out a substantial portion of mankind, and the sea level could rise 60 to 100 feet, worldwide."

From "Interesting Quotes," J. Gordon Edwards, Department of Biology, San Jose State University, San Jose, CA 95192.

[4] *Climate Change 1995: The Science of Climate Change*, (Cambridge Univ. Press) 1996, p. 77.

[5] Christy, J.R. (1997) "The Use of Satellites in Global Warming Forecasts," George C. Marshall Institute.

[6] See, for example, "The Surface Record: Global Mean Temperature and how it is determined at surface level," www.greeningearthsociety.org/Articles/2000/surface1/htm.

[7] See *Science*, 12 March 1999, p. 1712, for more on the lag of carbon dioxide buildup: "High-resolution records from Antarctic ice cores show that carbon dioxide concentrations increased … 600 ± 400 years *after* the warming of the last three deglaciation." (Our emphasis.)

ent driving force behind the extremely high temperature of the sun's corona.[8]

Also, the sun's changes in output and its well documented sunspot activity closely correlate with the Medieval Optimum and Little Ice Age temperature extremes as well as some of the suspected recent global temperature increases. In short, and in addition to the earth's periodic orbital changes and precession, the sun increasingly is considered to be a significant factor in natural temperature fluctuations ranging from decadal to millennial periods.

How do humans alter the earth's temperature record? In many ways, some with unintended humor: "In the former Union of Soviet Socialist Republics (encompassing one-sixth of the land surface of the planet), falsification of data of all kinds was a way of life, especially during the Stalin, Khrushchev and Brezhnev eras when statistics were routinely altered to avoid problems with the planning bureaucracy. Thus the accuracy of Soviet historical data is dependent on whether local officials found it necessary, for economic reasons, to overstate or understate their recorded temperatures. Anomalies in fuel allocations for transport, industry and heating under the rigid Communist 5-year plans amounts to a powerful incentive for falsifying temperature data in some Soviet communities."[9] Increasingly likely is that some of the recent warming is attributable to such corruption of temperature records.

If, as is increasingly thought possible, the land-based global temperature record increase of the past 22 years even in part is an artifact of the combination of good and bad temperature record keeping, the models become suspect. Also, if the recent 20-year record is wrong, what of the pre-1979 data? No small part of the global temperature record has been inferred from proxies for actual temperature measurement. The farther back in time one goes, the more unreliable are the data.

Models

The global warming hypothesis is based on the notion that increased greenhouse gases foster a small temperature increase that other factors then amplify. However, this notion is supported primarily by poor reasoning. For example, the once popularized "Butterfly Effect" presumes that the least butterfly's wing stroke can perturb the atmosphere sufficiently to turn a coincident eddy into a hurricane. But, in addition to the absence of any direct measurement of such a causation, a strongly positive reinforcement mechanism for small perturbations surely long ago would have clipped most insect wings. Rather, the atmosphere can absorb even a nuclear blast or series of horrendous volcanic eruptions without precipitating the mother of all hurricanes. Indeed, the two most turbulent atmospheric forces are the earth's spin and the sun's shine. All the butterflies on the planet cannot stop or start the wind, and models amplifying micro puffs of air into major problems are fanciful speculation at best.

Back in 1980, the media were quick to repeat the doomsday scenario of the "Global 2000 Report to the President," a federal study employing special-interests that has failed the test of time. The report falsely predicted that 500 million persons would starve in Asia between 1980 and 2025. Its palpably failed economic model predicted that by the year 2000 more people would mean less income per person everywhere, and that by the turn of the century we would run out of raw materials and enter an age of bleak scarcity. It concluded with the recommendation for "further cooperation among nations … to strengthen international mechanisms for protecting and utilizing the global commons, the oceans and atmosphere." The report's modeling failed every empirical scientific test, but few among the popular media seem to be keeping score. Instead of raising a cautionary red flag over models and modelers, another suspect modeling process very much like Global 2000 finds world political acclaim in the Kyoto accord and in the United Nation's IPCC Grand Circulation Model, another global warming model.

A recent report in *Science* (Vol. 293, pp. 199-201) contains refreshingly plain comment about problems with present models: "In a warming climate, clouds will morph to reflect more or less solar energy back into space—but no one is sure which it will be or how much warming or cooling that process will add." Also, "aerosols can modify clouds themselves so that they cool more, but the magnitude of this indirect effect is *so uncertain that it might be large enough to counteract most of the greenhouse warming to date* (our emphasis)."

The article further recognizes the need to directly measure data. Many lay persons concerned about global warming do not realize that a great deal of the data fed into present computer modeling is deduced, not measured in the field. Researchers know about this considerable problem and are requesting the means to dramatically improve "the collection of global climate data

---

[8] *Scientific American*, June 2001.

[9] From "The Surface Record" above.

used to verify the models. 'A sustained network of global observations is required if we're going to believe what's coming out of the models,' says climate modeler Jeffery Kielh of the National Center for Atmospheric Research. 'We don't have that, and what we do have is deteriorating.'" Moreover, "'A climate observing system really has always been lacking,' says atmospheric chemist Ralph Cicerone of the University of California, Irvine, … 'We're limping by with observations from platforms that were never designed for climate studies.'"

An example of how the models do not agree with actual measurements is contained in a brief article on the Internet site of the Center for the Study of Carbon Dioxide and Global Change (www.co2science.org). The models all predict that warming will be greater at the poles. However, despite a claimed pronounced and accelerating warming for the past two decades, "Antarctic temperature data obtained from 21 surface stations and from infrared satellites operating from 1979 to 1998 … revealed that the 20-year temperature trend over Antarctica from the satellite data was a cooling of 0.042°C per year, while the 20-year temperature trend derived from the station data was a cooling of 0.008°C per year." The article also notes that the "net trend in the mean Antarctic ice edge over the last 18 years has been an equator-ward expansion of 0.011 degrees of latitude per year." Such measured field evidence does not support the many models or those who claim that significant melting of polar ice caps is about to occur.

Another example of model uncertainty is contained in *The Waters—A Report on Sea Levels*, by John L. Daly, Science Advisor to the Greening Earth Society.[10] That global temperatures have increased significantly since the Little Ice Age is widely accepted among climate scientists. The modelers and the United Nation's Intergovernmental Panel on Climate Change (IPCC) predict that as oceans warm, they expand. When combined with polar ice sheet and glacier melt, the oceans should rise virtually in step with global warming. Many tide gauges around the world have been in continuous operation for centuries. As one might expect, many show varying amounts of ocean level rise over those centuries. However, several durable studies suggest that a warmer ocean will vaporize more water, which will find its way to the poles and increase, not decrease, polar and glacial ice mass. Also, increased rainfall in previously arid regions will raise water tables and fill more soil and sand pore spaces. The net effect *lowers* the ocean level.

Other factors influence ocean levels. Sea floors are not stable; the earth's mantle is plastic and the continental plates move about the planet. Mantle hot plumes cause island chains to bulge upward, and subducting ocean floor pushes some continental margins upward and others down. Northern lands, once pressed down by heavy glaciers, are rebounding. Sea level gauges reflect all of these processes, producing disparate records of sea level rise *and* fall.

Satellites provide more stable platforms for measuring sea level, as do surface areas relatively free from tectonic effects. Although satellites have been accurately measuring sea level for less than a decade and show a small increase of one-fifth of the rate claimed for the 21st century, one old sea level station invites review.

In July 1841, Britain's Captain James Clark Ross had a mean sea level mark engraved on a sea-side cliff at Port Arthur in southeastern Tasmania. Today that official mark is well above the mean sea level, even after considering tectonic and glacial rebound effects.

The atmospheric models also do not agree with the observed carbon dioxide rate of accumulation. Despite much furor over a postulated runaway accumulation and despite a 40-percent increase in emission rates over the past 20 years, the amount of carbon dioxide accumulating in the atmosphere has stayed the same or even declined slightly.[11] Moreover, the continental U.S. soils and vegetation take up as much as 40 percent of *world wide* fossil fuel emissions.

Major countries have their own climate models. Unfortunately, they disagree by nontrivial amounts. Also, as they have had to adjust their inputs to better agree with past and present realities, prior warming predictions have moderated. The disagreement among models remains so large, however, that the Massachusetts Institute of Technology undertook an assessment for the probability of likely outcomes. It settled on a modest temperature increase prediction as the most likely. One should keep in mind, however, that modern weather forecasting past three to five days remains hazardous. MIT's assignment of probability for climate warming over the next century, despite its objectivity, remains speculative—it is yet another imperfect estimate that has been derived from other imperfect results. The like-

[10] http::://www.greeningearthsociety.org/Articles/2000/sea.htm

[11] *Science*, 22 June 2001, pp. 2261-2263, Steven C. Wofsy, Department of Earth and Planetary Sciences, Harvard Univ.

When the Precautionary Principle Doesn't Apply

The precautionary principle has been invoked to justify a policy of aggressive greenhouse gas (GHG) emission controls that would go beyond "no regrets" actions to reduce global warming. However, this justification is based upon selectively applying the principle to the potential public health and environmental consequences of global warming but not to the adverse consequences of such a policy.

This report attempts to rectify this one-sided application of the precautionary principle. It finds that such a policy, despite its claim to be precautionary, would, in fact, be incautious in many areas because it has a high likelihood of increasing overall risks to public health and the environment. Specifically, GHG emission reduction requirements that go beyond secular improvements in technology and elimination of unjustified energy subsidies could retard economic development, leading to greater hunger, poorer health, and higher mortality, especially in developing countries. Moreover, higher oil and gas prices would reduce food availability and would also retard switching from solid fuels to more environmentally benign fuels for heating and cooking in households of the developing world. Indoor air pollution resulting from current heating and cooking practices in these nations is a major source of premature deaths.

A truly precautionary principle argues, instead, for focusing on solving current problems that may be aggravated by climate change, and on increasing society's adaptability and decreasing its vulnerability to environmental problems in general and climate change in particular. These could be achieved by bolstering the mutually-reinforcing forces of technological change, economic growth, and trade. Moreover, enhancing adaptability and reducing vulnerability will raise the thresholds at which greenhouse gas concentrations could become "dangerous."

—from "Applying the Precautionary Principle to Global Warming", by Indur M. Goklany, Center for the Study of American Business, November 2000.

lihood that various implausible results further massaged by computer programs constitute more than an untestable hypothesis about the future is remote.

Also, we find evidence for political suppression of scientific disagreement. A recent example was MIT Professor Richard S. Lindzen's charge that the IPCC was politically driven and had misrepresented the actual work of its contributing scientists, of which he was one. One of the world's foremost atmospheric scientists, Lindzen stated that the IPCC summary misrepresented the full report, used language that means different things to scientists and laymen, exploited public ignorance, and exaggerated both scientific certainty and the authority of undistinguished scientists. Further, Lindzen, the lead author of Chapter 7 of the IPCC's *Third Assessment Report*, revealed that he found his work so distorted that he asked to be delisted as an author, only to be refused. He also noted that many of the IPCC's scientists differ with the highly political summaries and conclusions.

One often reads that "most scientists agree" about the existence of human-caused global warming. Frederick Seitz, past President of the U.S. National Academy of Sciences and President Emeritus, Rockefeller University, expressed his disagreement in the following letter, which he invited other scientists to sign as a petition: "[The Kyoto] treaty, is, in our opinion, based upon flawed ideas. Research data on climate change do not show that human use of hydrocarbons is harmful. To the contrary, there is good evidence that increased atmospheric carbon dioxide is environmentally helpful.

"The proposed agreement would have very negative effects upon the technology of nations throughout the world, especially those that are currently attempting to lift from poverty and provide opportunities to the over 4 billion people in technologically underdeveloped countries.

"It is especially important for America to hear from its citizens who have the training necessary to evaluate the relevant data and offer sound advice."

To date, more than 19,000 scientists, engineers, and scientifically savvy citizens (some 17,000 with degrees in science, including more than 70 scientists with the National Academy of Sciences) have signed the petition.[12]

The Potential Costs of Kyoto

Accumulating evidence of a slow and perhaps largely natural and possibly beneficent global warming that in

[12] Petition Project, PO Box 1925, La Jolla, CA 92038-1925. See also http://www.oism.org/pproject/s33p41.htm.

all likelihood will persist despite any human efforts to the contrary suggests that a review of international attempts to mount emergency or precautionary efforts to prevent warming is in order. Adoption of the recommendations in the Kyoto protocols will cost some three to four percent of the $10.2 trillion U.S. Gross Domestic Product, according to estimates by the U.S. Department of Energy and others. And other developed countries will incur substantial expense. That $300 to $400 billion each year would be a very large insurance premium for a very small problem.

Various estimates of the costs show that proposed carbon taxes could double energy prices by 2010. Gasoline prices could rise some 53%, and electricity prices by 86%.[13] A Department of Energy draft report noted that, for example, the cost of producing steel could increase by more than two-and-half times and far exceed present industry profit margins. And the principle effect of carbon taxes on major economies would be to foster a massive flight of capital, industry, and labor to countries not covered by the Kyoto Protocol. Despite all efforts, carbon emissions might only be reduced to a 2.6 percent annual increase rather than a decline.

But perhaps the greatest cost of Kyoto would be the surrender of national sovereignty. A treaty that would effectively give other nations the power to impose taxes upon domestic productive enterprise would be contrary to the most fundamental precepts of American governance. On all counts, Kyoto's costs would seem to outweigh any of its possible benefits.

---

[13] http://www.eia.doe.gov/oiaf/Kyoto/kyotorpt.html

A MODEL Poem

What have you got, a theory?
Hypothesis? A strategy?
A peachy-keen analogy?
Rest your brain
With a quiet coddle,
Join the crowd and call it a MODEL!

Do you itch to tell your latest scheme,
Hunch, proposal, process, theme,
Idea that boosts your self-esteem,
And your brain can't sprint
But only waddle?
Join the crowd and call it a MODEL!

What's the word, a preparation?
Notion? Plan? Sketch? Creation?
Diagram? An explanation?
But if your brain can only
Crawl or toddle,
Join the crowd and just use MODEL!

Is "Design of an Experiment"
The essence of your mind's intent?
Words like those don't pay the rent!
Why strain your brain
For more than a twaddle?
Join the crowd and just use MODEL!

Protocol? System? Prototype?
The word that's got the mostest hype
To push a thought that's barely ripe?
Don't sweat your
Cliché-loaded noodle!
Join the crowd and just use MODEL!

O, Muse of Science! Muse of each
Kind of lucid, sparkling speech!
How far do you think
This prayer will reach?
Bless'd be the day
When even a clod'll
Use his brain instead of MODEL!

By permission of:
Irving Rothchild
Emeritus Professor of Reproductive Biology
Case Western Reserve University
Science, 11 August 2000, p. 871-872

"Opinions based upon theory, superstition, and ignorance are not very precious."
—*Mark Twain's Letters*, [1917 ed.], Vol. II

Economic Education Bulletin (ISSN 0424-2769) (USPS 167-360) is published once a month at Great Barrington, Massachusetts, by American Institute for Economic Research, a scientific and educational organization with no stockholders, chartered under Chapter 180 of the General Laws of Massachusetts. Periodical postage paid at Great Barrington, Massachusetts. Printed in the United States of America. Subscription: $25 per year. POSTMASTER: Send address changes to ***Economic Education Bulletin***, American Institute for Economic Research, Great Barrington, Massachusetts 01230.

ECONOMIC EDUCATION BULLETIN

AMERICAN INSTITUTE FOR ECONOMIC RESEARCH
Great Barrington, Massachusetts 01230

Periodical postage paid at
Great Barrington, Massachusetts