Econ 325 In-Class Work: Ozone Depletion, Global Warming and the Economy

Ozone:
The earth’s upper atmosphere is surrounded by a thin shield of naturally occurring chemical known as ozone. This ozone layer serves a beneficial role by screening out the sun’s harmful ultraviolet rays, expose to which can threaten the health of humans and wildlife, and reduce agricultural productivity.

Ozone Depletion:
A chemical reaction which converts ozone (O\textsubscript{1} and O\textsubscript{3}) into Oxygen (O\textsubscript{2}) when ozone, ice crystals, and certain inert catalysts are present in the atmosphere. A 1985 study revealed the presence of a hole in the ozone layer over Antarctica. The hole is approximately the size of the United States.

Inert catalyst which contributes to ozone depletion:
• Chlorofluorocarbons (CFCs) - used in air conditioning and refrigeration units (released when such units are ruptured during misuse or disposal), and as propellants in spray cans. CFC’s are long-lived stock pollutants, which means they cannot be naturally absorbed by the environment, and as a result accumulate over time. CFC’s releases into the atmosphere today from the disposal of a refrigerator will continue to break down the ozone layer for up to 100 years.

The Montreal Protocol:
In 1987 most countries of the world signed a treaty called the “Montreal Protocol” and agreed to reduce the production of CFC’s to offset the depletion of the ozone layer. The treaty called for a ten-year, 50 percent reduction in CFC production, with 1986 production as the baseline. The treaty was revised in 1990 to establish a $260 million fund to finance the adjustment to substitutes for CFC’s in developing countries, and to completely phase-out CFC production by the year 2000. In 1992 the treaty was strengthened to call for a complete ban on the production of CFC’s by 1996, and the compensation fund was strengthened to $500 million. CFC production is still allowed to service existing equipment.

→ Explain with words and a graph why CFC’s were banned completely rather than reduced to some optimal level.

→ Do you see a free-rider problem associated with the Montreal Protocol?

→ List the factors that contributed to the success of the Montreal Protocol and its subsequent amendments:
Global warming:
An acceleration of the “greenhouse effect” due to the release of greenhouse gases into the atmosphere.

→ What is the “greenhouse effect”?

→ Is the greenhouse effect a problem?

→ What are the greenhouse gases, and where they come from?

Projections for future climate change:

• *Alteration of rainfall patterns* -- 3-10 °F warming of the earth’s surface will likely lead to changes in patterns of precipitation and evaporation.
  → Hotter and drier weather in mid-continental regions.

• *Melting of polar ice caps* -- Sea level will rise.
  → Flooding of coastal and low-lying areas.

→ What economic sectors are most likely to be affected by global climate change?

→ Why will the potential economic impacts of global climate change be more extreme for developing countries of the world?
3 categories of policy responses to global climate change:

1. **Amelioration**: Adapt to the effects of climate change as they occur
   → What are some example of ameliorative activities for climate change?

2. **Mitigation**: Reduce the degree of climate change by offsetting the effects of greenhouse gas buildup.
   → What are some example of mitigation activities for climate change?

3. **Abatement**: Prevent the buildup of greenhouse gases before they can affect global climate.
   → What are some example of abatement activities for climate change?

→ Will a market economy achieve the efficient level of emissions reduction on its own? Explain.

→ Who will incur the costs of greenhouse gas emissions reduction?

→ To whom will the benefits of greenhouse gas emissions reduction accrue?
Reducing emissions through regulation:

1. Technology-based regulation (command and control): Government mandates the adoption of particular types of pollution abatement technology.

2. Incentive-based regulation: Taxes, subsidies, and tradable permits which operate through the market mechanism.
   
   National level:
   - “Carbon tax” -- tax carbon-based fuels in proportion to the amount of atmospheric CO₂ that is released when they are burned.
   - Investment subsidy -- provide monetary incentives for companies to develop carbon-free energy sources.

   International level:
   - Marketable permit system -- divide global emissions target across countries of the world according to population size, and assign a salable quota for that amount of emissions (each person in the world is therefore permitted to make an equal contribution to global warming).

“The Rio Summit” May, 1992 Rio de Janeiro, Brazil

→ This “Earth Summit” produced an international agreement on global climate change called the “Convention on Climate Change”. Most industrialized countries of the world signed a pledge to stabilize emissions of greenhouse gases at 1990 levels by the year 2000.

“The Kyoto Summit” December, 1997 Kyoto, Japan

→ This second summit on climate change resulted in a new international treaty to protect the global environment. Representatives of 160 nations attended. The 39 developed nations agreed to cut emissions on six global pollutants (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). Differential limits were set across the nations. The EU, Japan, and the US agreed to cutback emissions of 8, 6 and 7 percent below 1990 levels by 2012. The Russian Federation, Ukraine, and New Zealand will cut emissions to 1990 levels by 2012. Australia and Iceland will cut emissions to 8 and 10 percent above 1990 levels.

** Industrial nations are divided into two “bubbles”, with pollution rights tradable within each bubble.
** Emissions credits will be granted for forest preservation and planting.
** US senate has not agreed to this treaty because it does not require “meaningful participation” by developing countries such as China and India, which are major polluters.

Buenos Aires (Argentina) Climate Change Meeting November, 1998. The 160 nations, were to work out agreements regarding mechanisms for implementing the requirements of the Kyoto Protocol. The US Congressional delegation to the conference declared the Protocol "dead on arrival." The US Senate’s 1997 Byrd-Hagel resolution (passed 95-0), bans any protocol that does not include emission restrictions for developing countries "within the same compliance period" as the US. The Kyoto Protocol lacks this feature. Therefore the Senate will not ratify the treaty. Without ratification of the treaty, the UN parties cannot amend it. (reference: Competitive Enterprise Institute, "May Cooler Heads Prevail" November 10, 1998).

Question:
The problems of global warming and ozone depletion are similar because they both will require international cooperation to be resolved. Another similarity is that both problems are well-defined: the chemical compounds which contribute to each problem are known. In light of the success of the Montreal Protocol, and given the information above, do you see any reason why the goals of the Kyoto Protocol to resolve the global warming problem cannot be as “easily” attained?