

FOIA MARKER

This is not a textual record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

Collection/Record Group: Clinton Presidential Records
Subgroup/Office of Origin: Council of Economic Advisers
Series/Staff Member: Jeffrey Frankel
Subseries:

OA/ID Number: 13721
FolderID:

Folder Title:
Panel Discussion bef ACCF [American Council for Capital Formation] Climate Change Policy Forum, Wed, 9/23/98, 9am, Natl. Press Club, 529 14th

Stack:	Row:	Section:	Shelf:	Position:
S	20	4	10	1

The Kyoto Treaty: Economic and Environmental Consequences

Jeffrey Frankel

Member, President's Council of Economic Advisers

comments for presentation at

Climate Change Policy:

Practical Strategies to Promote Economic Growth and Environmental Quality

forum sponsored by American Council for Capital Formation
The National Press Club, Sept. 23, 1998

I will make some general comments about the Administration position on the Kyoto Agreement, before commenting on Rich Richels' excellent paper.

The Administration Economic Analysis

The key bottom line of the economic analysis that we released in July was as follows, in qualitative terms: *Given key elements of the Agreement and of Administration policy (including tradeable permits and other flexibility features), the U.S. economic impacts are likely to be modest.*

Those key features are of several sorts. The Administration insisted that the design of the agreement be market-based, flexible, and global. The flexibility comes in three categories:

- "When" flexibility
 - 1st-period reductions less drastic than some countries wanted
 - targets phrased as multi-year averages
 - banking
- "What" flexibility
 - 6 gases included, not just carbon dioxide
 - sinks
- "Where" flexibility
 - international trading in emission permits
 - CDM

Finally, we require a global solution, to address a global problem.

- Without meaningful LDC participation, the President will not submit the Treaty for Senate ratification

Economic analysis of climate change policy is difficult for many reasons, which again fall into three categories.

- It is impossible to put a single monetary number on the benefits of averting Global Climate Change. It is difficult enough to put numbers on the economic costs of a 2-to-6

degree F increase in temperature or a 6-inch to 3-foot rise in sea level, which is what the IPCC scientists are forecasting for the next 100 years. But that difficulty pales next to the uncertainties surrounding the appropriate discount rate, danger of catastrophic climate events, and appropriate risk aversion.

- Some terms of the international agreement are still uncertain.
- Econometric models are subject to inevitable limitations. Some models are good at some things, other at others. No one model does it all. The estimates of each are subject to wide bands of uncertainty,

Despite these difficulties, we used some estimates based on Battelle Labs' SGM, which is well-designed to handle international trading. The most important quantitative findings, supporting the qualitative finding that I led with, were as follows.

- Full and successful implementation of Annex I trading would reduce costs by one-half, relative to a situation where each country had to satisfy its commitment domestically.
- Full and successful implementation of global trading (including developing countries) would reduce costs by 80-87%.
- Global trading would reduce resource costs by an estimated \$7-\$12 b/yr in 2010, which is 0.1 % GDP in 2010. This is a cost that I would describe as, if anything, less than modest.
- The effect on the price of carbon is estimated at \$14-\$23/ton.
 - Δ price of natural gas = 3-5 %
 - Δ price of fuel oil = 5-9 %
 - Δ price of gasoline = 4-6¢ / gal.
 - Δ price of electricity = 3-4 %
- Effect on the energy bill of the average household is estimated at \$70-\$110

The SGM model, along with the MERGE model of Manne and Richels and many other models, participates in the Stanford-based Energy-Modeling Forum. The most recent compilation by the EMF of the results of these models shows the SGM, the model that we used, in the middle of the pack of estimates of the costs of Kyoto, when standardizing on the policy experiment under consideration.

In one respect, our estimates are optimistic: we cannot be sure of getting full developing-country participation in the near future. But in other respects they are conservative. They omit some factors that would reduce the net costs of the agreement:

- The Administration proposal for Federal electricity restructuring, which we consider part of our energy-and-environment policy, would save approximately \$20 billion in costs -- potentially enough to offset the increase in the household energy bill.

- Allowance for sinks, such as land forestation, would potentially reduce the need for emission reductions substantially.
- The President's proposal to allocate \$6.3 billion over the next five years in Research and Development and tax breaks to develop and disseminate carbon-saving technologies could further reduce costs if it were enacted and if some of the technological payoff were to come in the next ten years. To be conservative, we assumed that it did not.
- Ancillary non-climate benefits, such as the health benefits of reduced air pollution could reduce net costs by an estimated one-quarter.
- Of course, the most important factor that has been left out of the above assessment is the benefit of mitigating climate change itself. (A full cost-benefit analysis would include mitigation in the benefits column. The only reason we have not done so, explained repeatedly above, is the difficulty in coming up with a number to capture the monetary benefits.) But nobody should lose sight of our ultimate objective -- keeping our planet the hospitable home that we enjoy today.

The Manne-Richels paper

Alan Manne and Rich Richels have done some of the most important and pioneering work in the economic modeling of climate change policy. They have been at the frontier, being the first, for example, to address the theoretically optimal time-path of GHG emissions over the coming century to get to a given environmental goal in terms of concentrations in the atmosphere. In their latest paper they have included analysis of some of the policy questions that are most topical in the ongoing negotiations.

In particular, of the various questions still to be settled in international negotiations, the two most important both receive useful analysis here. The first is what would be the likely effect of the caps on trading that have been proposed by European countries; the second is the importance of participation by developing countries. That first question, regarding trading caps, is shaping up to be probably the most contentious at the upcoming Buenos Aires negotiations. The second issue may be the most contentious thereafter.

I already have explained that the ability to buy and sell emission permits is critical to our view of the Kyoto Protocol. It allows us to achieve the same environmental goal at lower economic costs. The Manne-Richels estimates using their MERGE model are in this regard very similar to ours: trading among the "Annex I" countries reduces costs by more than half.

Unfortunately, not all countries share the American enthusiasm for trading. Some countries, particularly the EU, are not completely convinced of the case in favor of trading. They insist that trading should be only supplemental, by which I fear they mean that the United States must accomplish most of its reductions (relative to the Business as Usual path) through domestic reductions, rather than purchases. Some Europeans may be driven by a primitive distrust of

trading in general, analogous to those who believe that everybody should grow his or her own food. Others are in effect protesting the allocation of emission rights at Kyoto, believing the US and FSU allocations to be too generous. This is what it must mean to complain that the US needs to make more of a domestic sacrifice, or that Russia shouldn't be allowed to sell hot air. (It is not always easy to distinguish that belief from a -- logically quite distinct -- failure to understand that for any given allocation of emission rights, trading lowers the cost of the same environmental outcome. One of the great feats of Kyoto is that the Annex I countries were able to agree on the allocation of property rights, in a context where many of us had thought the political obstacles might be insuperable.)

In any case, some Europeans want to place quantitative limits on how much countries can buy. Such limits would operate as import quotas do for trade in agricultural commodities and other goods. They have the same drawbacks: they would artificially raise the price of emissions in the buying country, they would introduce an extra degree of complication, government bureaucracy, and rent-seeking into the marketplace, and they would generally impede efficiency. The US has said that it will not agree to trading limitations at Buenos Aires.

We have estimated that such limits could raise the cost of compliance substantially for the United States, and even more so for Europeans and others. A 50% limit rule could raise the price of carbon by an estimated 157 %. **[HOW MUCH DOES THIS RAISE COSTS?]** These estimates are based on an application of the SGM model of Battelle Labs [and they assume the regime we aspire to: participation and trading among key developing countries in addition to Annex I].

Manne and Richels consider a related experiment, what would happen if a limit were imposed on purchases equal to 1/3 of countries' commitments. Estimated costs are 2 ½ to 3 times higher than under full and unconstrained trading.

Even if we succeed in overcoming European objections to trading at Buenos Aires, a second -- even more daunting -- hurdle awaits us: convincing the developing countries to participate in the effort in a more meaningful way than they have in the past.

US Senators say we need developing country participation because otherwise we will lose competitiveness. I agree that we need the developing countries, but I would phrase the reasons differently. Any major structural change in the economy (like an increase in the price of energy) is likely to result in the expansion of some sectors and the contraction of others. The Manne-Richels paper reports likely negative effects -- "loss in competitiveness" -- in energy-intensive manufactures. But, as the paper mentions, other sectors will gain competitiveness. It is not clear that the overall effect will be negative. I am not aware of a study that has been able to address that question.¹

¹ It is even less clear that the US trade deficit will get larger, which is what some people apparently have in mind by "competitiveness." Indeed, if we are buying emissions from abroad, elementary application of the transfer problem framework says that our trade balance in goods and services should improve.

The reasons we need the LDCs are, rather:

- they are the fastest-growing emitters (so “fairness” demands their inclusion),
- without participation by the developing countries problems of free-riding and leakage would render an agreement ineffective at its environmental goals,
- their participation is needed to reduce economic costs to US compliance [by as much as 80% in our estimates, somewhat less in Manne-Richels], and
- the Senate will not ratify a treaty without them.

Manne and Richels offer estimates of the magnitude of leakage -- that is, the possibility that reductions in emissions in the industrialized countries under the agreement would be partly offset by increases in emissions in non-participating developing countries. They look at two sources of leakage: first the effect that lower demand for petroleum products in the industrialized countries would have, via a decline in world prices, on demand in non-participating countries; and second the effect of a contraction in output of energy-intensive sectors in industrialized countries and an expansion in non-participating countries. Conclusion: “[N]either of the two trade alternatives leads to a dramatic increase in carbon emissions outside Annex I. Apparently there is an international leakage problem, but it appears to be of manageable dimensions.” This is a useful result (though I think that we need to refine and extend estimates of leakage).

EPRI

W: JY
JA
SP
QF

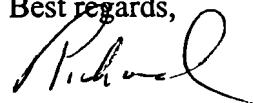
August 20, 1998

Dr. Jeffrey Frankel
Council of Economic Advisers
Old Executive Office Building
Washington, DC 20502

Dear Jeff:

Alan Manne and I thought you might be interested in the enclosed draft "The Kyoto Protocol: A Cost-Effective Strategy for Meeting Environmental Objectives?". The paper results from our involvement in the ongoing Energy Modeling Forum-16 study on the impacts of proposals for dealing with the threat of global climate change. Any comments or suggestions would be most welcomed.

Best regards,



Richard Richels
Director, Global Climate Change Research

MERGE

sinks

Kyoto forever

p9 Limits on purchaser (=13)
w/ rents accruing to buyer
(monopoly power) or seller

19-13 Leakage with trade in
→ Energy-intensive sector goods.
Est. leakage here still low.
But in US, J+Eur, production/consumption
in EIS fall some.

now included in model

But how about trade
in non-EIS goods.
Need both
to evaluate "competitiveness"

Kyoto not cost-effective
to attain conventions goal

The Kyoto Protocol: A Cost-Effective Strategy for Meeting Environmental Objectives?

Alan S. Manne, Stanford University

Richard G. Richels, EPRI

July 27, 1998

This research results from our involvement in Stanford University's Energy Modeling Forum 16 Study. The authors are indebted to James Deaker and Robert Parkin for their research assistance. We have benefited from discussions with Jae Edmonds, Henry Jacoby, David Montgomery, William Nordhaus, Stephen Peck, Thomas Rutherford, and John Weyant. Funding was provided by EPRI. The results presented here are solely those of the individual authors.

1. Introduction

The Kyoto Protocol represents a milestone in climate policy.¹ For the first time, negotiators have attempted to lay out emission reduction targets for the early part of the 21st century. The goal is for Annex 1 (developed countries plus economies in transition) to reduce their aggregate anthropogenic carbon dioxide equivalent emissions by at least 5 percent below 1990 levels in the commitment period 2008 to 2012. The Protocol, however, has yet to enter into force. To do so will require ratification by 55 countries representing 55 percent of total Annex 1 CO₂ emissions in 1990.

As each country considers ratification, important questions will arise. High up on the US list is the issue of economic costs. The Senate, for example, has stated that "any Protocol should be accompanied by a detailed financial analysis of impacts on the economy."² Not surprisingly, US negotiators had hardly returned from Kyoto before the first hearings were scheduled on Capitol Hill. Although the issue of costs is but one of many important considerations, policy makers are keenly interested in the economic implications of ratification.

This paper is intended to help clarify our understanding of compliance costs. The focus is on three questions, which we believe to be of particular relevance: What are the near-term costs of implementation? How significant are the so-called "flexibility provisions"? And, perhaps most importantly, is the Protocol cost-effective in the context of the long-term goals of the Framework Convention?³

Unfortunately, the answers to these questions will not come easily. It has always been difficult to calculate the economic costs of implementing climate policy. Kyoto has done little to simplify matters. Indeed, it raises at least as many questions as it resolves. These questions fall into two categories: those related to the near-term implementation of the Protocol and those related to the evolution of climate policy over the longer term.

The Protocol is unclear on a number of topics. These include the rules governing emission trading, joint implementation (JI), the Clean Development Mechanism (CDM), and the treatment of carbon sinks. In addition, there is a weak knowledge base regarding the costs of sink enhancement and of controlling several of the relevant trace gases. Until these issues are clarified, analyses will be highly speculative.

Calculating the costs of Kyoto is also complicated by the issue of "what happens next?" Energy sector investments are typically long-lived. Today's investment decisions are not only influenced by what happens during the next decade, but also by what happens thereafter. In order to estimate the costs of implementing emission cuts in the first commitment period, assumptions are required concerning the longer-term requirements. Unfortunately, the international negotiation process offers little guidance on this issue. This further complicates the process of analysis.

We do not wish to suggest that economic analysis is premature at the present time. Uncertainty is rarely an excuse for paralysis. It does mean, however, that we must be

careful to highlight the tentative nature of the projections and focus, to the extent possible, on the insights for decision making. Here, sensitivity analysis can be particularly useful. For example, in the case of several of the flexibility provisions (emission trading, joint implementation and the Clean Development Mechanism), we explore a variety of scenarios regarding constraints on the purchase of carbon emission rights. While the exact magnitude of the benefits will continue to be debated, the insights, nevertheless, appear to be quite robust.

We also examine the Protocol in the context of the longer-term goal of the Framework Convention, i.e., the stabilization of greenhouse gas concentrations in the earth's atmosphere. A particular concentration goal can be reached through a variety of emission pathways. Considerable effort has been devoted to trying to understand the characteristics of cost-effective pathways.⁴ It is interesting to examine Kyoto in the context of this work. The price tag for moving forward may be formidable. Consistent with the Framework Convention, it is essential that "policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible costs."⁵

2. The model

This analysis is based on MERGE (a model for evaluating the regional and global effects of greenhouse gas reduction policies).^{6,7} MERGE is an intertemporal market equilibrium model. It combines a bottom-up representation of the energy supply sector together with a top-down perspective on the remainder of the economy. Savings and investment decisions are modeled as though each of the regions maximizes the discounted utility of its consumption subject to an intertemporal wealth constraint. Each region's wealth includes not only capital, labor and exhaustible resources, but also its negotiated international share in carbon emission rights.

For the present version of the model, known as MERGE 3.0, we have adopted 10-year time intervals through 2050 and 25-year intervals through 2100. Geographically, the world is divided into nine geopolitical regions: 1) the USA, 2) OECD (Western Europe), 3) Japan, 4) CANZ (Canada, Australia and New Zealand), 5) EEFSU (Eastern Europe and the Former Soviet Union), 6) China, 7) India, 8) MOPEC (Mexico and OPEC) and, 9) ROW (the rest of world). Note that the OECD (regions 1 through 4) together with EEFSU constitute Annex 1 of the Framework Convention.

Particularly relevant for the present analyses, MERGE provides a general equilibrium formulation of the global economy. We model the possibility of international trade in carbon emission rights. This is sometimes known as "where" flexibility. It would allow regions with high marginal abatement costs to purchase emission rights from regions with low marginal abatement costs. In addition, MERGE can be used to examine the related issue of "when" flexibility - intertemporal transfers of carbon emission rights.

We also model international trade in oil, natural gas, and energy-intensive basic materials. We are therefore able to examine issues related to "carbon leakage". Such leakage can occur through a variety of pathways. For example, Annex 1 emission

reductions will result in lower oil demand, which in turn will lead to a decline in the international price of oil. As a result, non-Annex 1 countries may increase their oil imports and emit more than they would otherwise.

The present version of the model includes the notion of endogenous technical diffusion. Specifically, in the electric sector, the near-term adoption of high-cost carbon-free technologies leads to accelerated future introduction of lower cost versions. The model also includes both price-induced and non-price conservation. For most regions and time periods, the AEEI (autonomous energy efficiency improvement) rate is taken to be 40% of the rate of GDP growth. By 2100, this leads to regional energy-GDP ratios that are much closer to each other than they were in 1990.

In calibrating MERGE for the present analysis, several supply- and demand-side parameters were adjusted so that the global emissions baseline would approximate the Intergovernmental Panel on Climate Change (IPCC) central case “no policy” scenario (IS92a).⁸ Figure 2.1 shows carbon emissions for each region in the reference case scenario. For more on the model and its key assumptions, see our website:

<http://www-leland.stanford.edu/group/MERGE/>

3. Treatment of sinks and non-CO₂ greenhouse gases

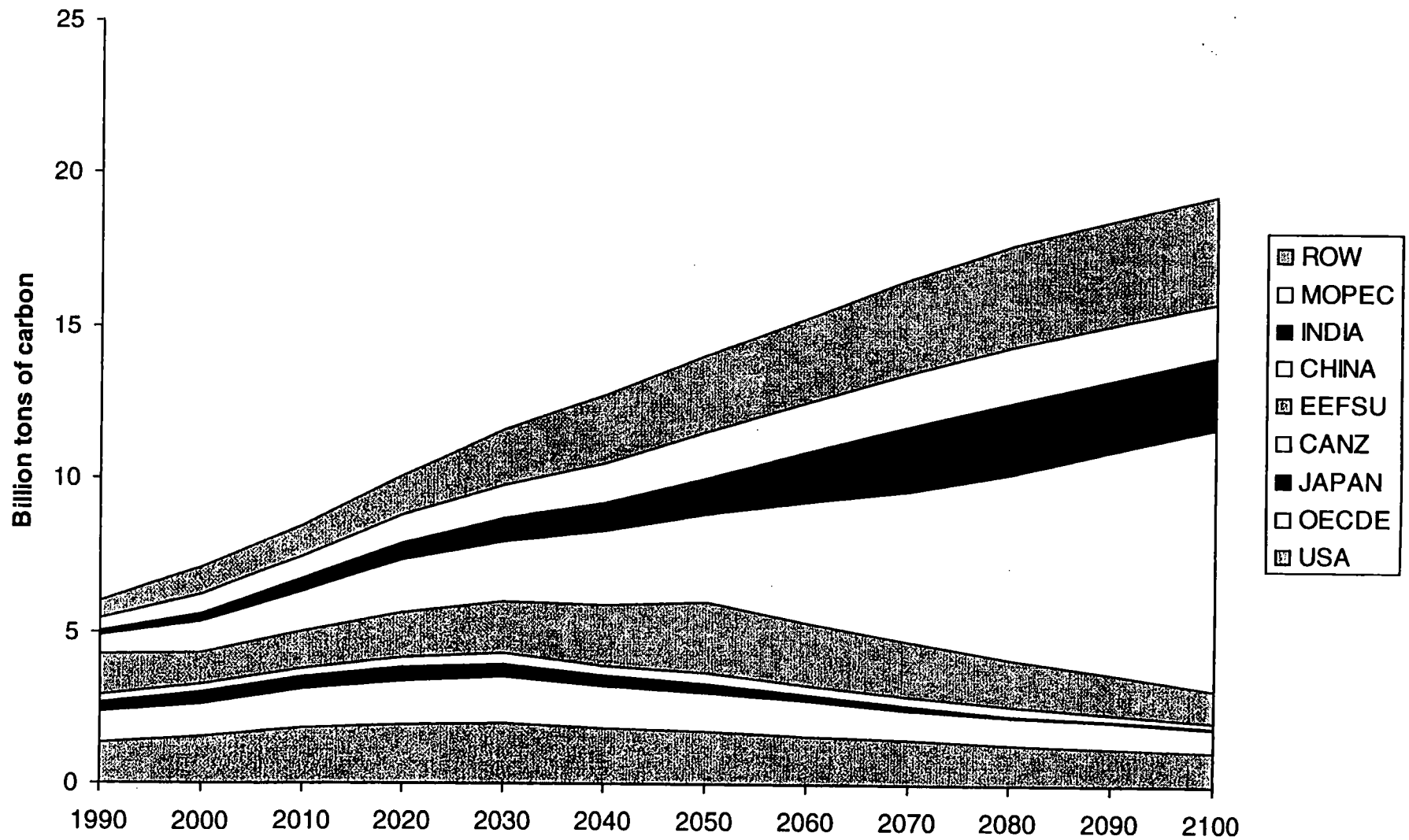
Few issues have engendered as much confusion as that of carbon sinks. Key questions include their definition, the extent to which they are included in the Protocol, the amount currently being sequestered, their time profile, and the costs of sink enhancement.

The Protocol states that Annex 1 commitments can be met by “the net changes in greenhouse gas emissions from sources and removal by sinks resulting from direct human-induced land use change and forestry activities limited to afforestation, reforestation, and deforestation since 1990, measured as verifiable changes in stocks in each commitment period.”⁹ The confusion results from alternative interpretations regarding the treatment of soil carbon, an issue flagged for further study in the Protocol. Their inclusion may result in large increases in the international legal definition of sink potential.

The quality of the data is uneven. The supply curves for sink enhancement are particularly questionable. The degree of confidence concerning current and predicted future levels of carbon sequestration varies enormously across regions of the globe. Not surprisingly, information is most reliable (albeit still poor) for Annex 1 countries. Comparatively little effort has been made to collect such data elsewhere.

As placeholders, we have adopted the values shown in Table 1. To provide some perspective, in order for the US to reduce industrial carbon emissions by 7% below 1990 levels in 2010, it would have to reduce emissions by approximately 550 million tons below its reference trajectory. Sink enhancement would satisfy 9 percent of this

Figure 2.1 Regional Carbon Emissions -- reference case



obligation. For purposes of the present analysis, we assume that this sink enhancement is costless.

Table 1. Sink Enhancement (million metric tons of carbon annually)

USA	50
OECD	17
Japan	0
CANZ	50
EEFSU	34

CO₂ is by far the most important of the greenhouse gases. In addition, the Protocol includes five other trace gases (methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride). Given the scarcity of reliable emissions and cost data, the treatment of the non-CO₂ greenhouse gases is also problematic. For purposes of the present analysis, we assume that each gas is reduced proportionately. With this proportionality assumption, the inclusion of the non-CO₂ greenhouse gases does not affect the requirements for CO₂ reductions.

As with our treatment of sinks, we do not include the costs of abating the non-CO₂ greenhouse gases in our estimates of the costs of complying with the Protocol. Clearly, an important next step would be to develop supply curves for the cost of abating non-CO₂ greenhouse gases and for sink enhancement. Neither of these costs is included in the present version of MERGE.

4. "Kyoto Forever"

We begin with an examination of a "Kyoto Forever" scenario. This is a case in which the Kyoto constraints on Annex 1 countries are maintained throughout the 21st century. With regard to non-Annex 1 emissions, we assume they will continue to be bounded by their business-as-usual baseline (Figure 2.1). The latter constraint is imposed in order to prevent carbon leakage. Later on, we will explore the impact of relaxing this constraint.

Numerous studies have shown that global mitigation costs can be reduced substantially by allowing emission reductions to take place wherever it is cheapest to do so - regardless of geographical location.¹⁰ The Kyoto Protocol includes several provisions allowing for a limited amount of "where" flexibility. These include emission trading and joint implementation among Annex 1 countries. They also include provisions for a Clean Development Mechanism (CDM) that is intended to facilitate joint implementation between Annex 1 and non-Annex 1 countries.

As with the definition of sinks, the Protocol leaves many critical details unresolved. For example, it remains unclear whether there will be limits on the extent to which a country can rely upon the purchase of emission rights to satisfy its obligations. The Protocol states that "the Conference of the Parties shall define the relevant principles, modalities, rules and guidelines ..." ¹¹ Similar ambiguity surrounds the Clean Development

Mechanism. Again, the elaboration of “modalities and procedures” is left to a future meeting of the Conference of the Parties.¹²

In this section, we explore three scenarios: 1) no trading, 2) Annex 1 trading plus CDM, and 3) full global trading. These three options are representative of alternative implementations of the Kyoto Protocol. Each has its own advocates and opponents, but we do not consider them equally likely. In our opinion, there is little likelihood of enticing all major countries to participate in a global market in emission rights during the initial commitment period (2008-2012).

The full global trading scenario places an upper bound on the CDM’s potential to reduce GDP losses. In calculating the potential size of the contribution from a CDM, we therefore calculate this upper bound on the export of emission rights from non-Annex 1 regions. Because of the difficulties in implementation of the CDM, however, we assume that only 15% of the potential would be available for purchase through this mechanism. This is a highly subjective estimate. Given the complexities of the CDM, however, we are not inclined to assign a higher value

Figure 4.1 reports the incremental value of carbon emission rights to the US in 2010 and 2020. We focus first on 2010. In the most constrained scenario, the US must satisfy its emission reduction requirements within its own geographical boundaries. In this case, the value of emission rights approaches \$240 per ton. With Annex 1 trading plus CDM, the value drops to slightly less than \$100 per ton. As might be expected, the value of emission rights is lowest with full global trading. Here, it falls below \$70 per ton.

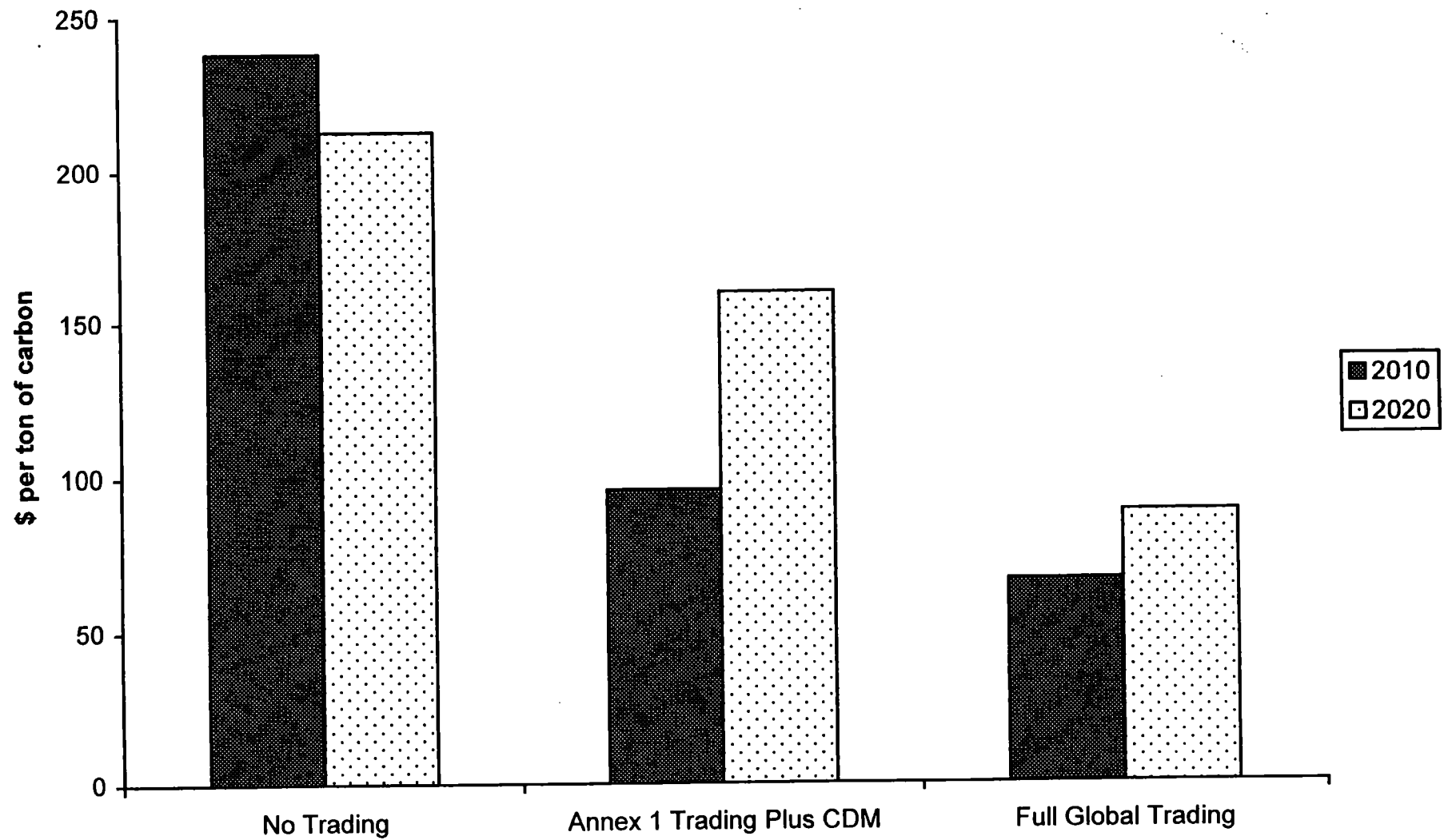
For the two scenarios in which trading is permitted, the value of emission rights increases in 2020. This is because EEFSU’s projected emissions lie below its negotiated constraint for 2010. It has been allocated more emission rights than it needs to satisfy its internal obligations. By 2020, however, EEFSU’s economic growth is expected to be such that it no longer enjoys an excess of emission rights. As a result, there is more competition for emission rights in the international marketplace, and there is an increase in their price.

Another way to view the costs of abatement is to show the GDP losses. Figure 4.2 contains those for the US. Losses are highest in the absence of trade. Here, they exceed \$80 billion dollars in 2010. This is approximately one percent of US GDP. To the extent that trade is introduced, losses decline. In the most optimistic scenario (full global trade), losses are approximately \$20 billion or one-quarter of one percent of GDP in 2010.

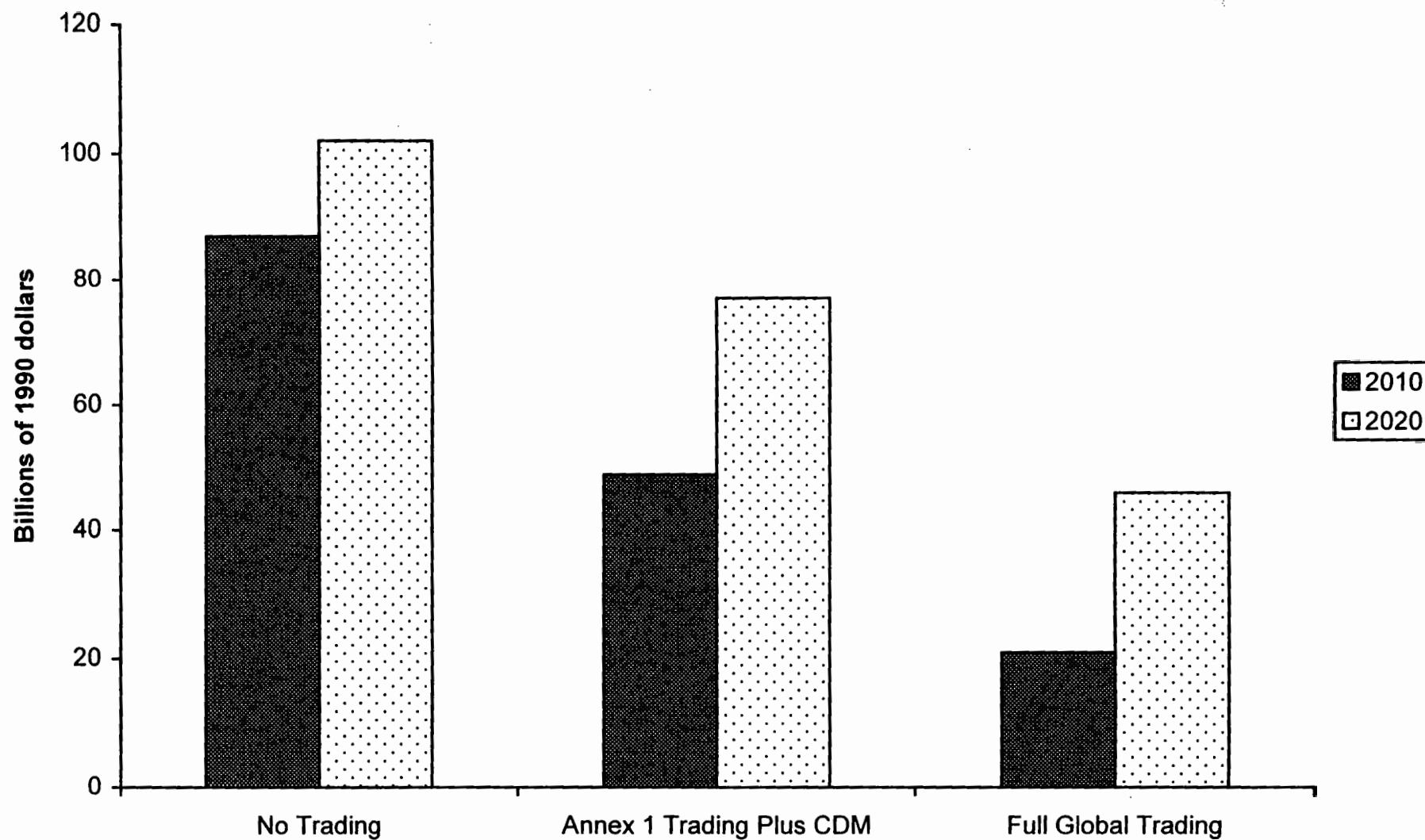
Of the three scenarios, “Annex 1 trading plus the CDM” is most consistent with the Protocol as it currently stands. However, the US Senate has stated that the US should not be a signatory to the Protocol if it does not mandate specific commitments for developing countries.¹³ If this were to result in full global emission trading, we move in the direction of the right-most bar of Figure 4.2.

There is, however, strong sentiment among many parties to the Framework Convention to substantially limit the extent to which Annex 1 countries can meet their obligation

Figure 4.1 Incremental Value of Carbon Emission Rights in US Under Kyoto Forever



**Figure 4.2 Annual US GDP Losses Under Kyoto Forever
(\$ billions)**



through the purchase of emission rights. Several influential developing countries have expressed strong opposition to the concept altogether. Figure 4.2 shows the costs of the no trading scenario. We now turn to the case where trading is permitted, but with limitations on the purchase of emission rights.

5. Limits on the purchase of carbon emission rights

Figure 5.1 shows our estimates of the percentage of the US emission reduction obligation that would be satisfied through the purchase of emission rights under base case assumptions. With full global trading (the least-cost of our three scenarios), trading is used to satisfy more than 50% of the US obligation. But suppose that limits are placed on the purchase of emission rights? For example, suppose that international negotiators agree that Annex 1 buyers can satisfy only one-third of their obligation through this means. What would be the impact on GDP losses?

Figure 5.2 compares three cases. All assume full global participation in an international market for carbon emission rights, but only the first assumes no limits on the amount a country can buy. The second and third case are based upon the one-third limitation. We further make the distinction between a buyers' market and a sellers' market. With the former, sellers of emission rights are price takers. Buyers exert sufficient market power to hold the international price to the marginal cost of abatement in the selling countries. However, since a country is only able to satisfy one-third of its obligation through the purchase of emission rights, it must eventually rely on its own domestic marginal abatement capabilities to meet its obligations. Hence, there is an important distinction between the international price and the domestic price. Conversely, with a sellers' market, buyers face but one price. Here, the rents accrue to the sellers.

Figure 5.3 shows the GDP losses associated with the three scenarios. Note that losses in 2010 are two and one-half to three times higher with the constraint on the purchase of carbon emission rights. That is, the benefits from "where" flexibility are greatly diminished. The message is clear. Developing country participation in the market for carbon emission rights is a necessary, but by no means a sufficient condition for reaping the full benefits of "where" flexibility. To achieve a cost-effective solution, buyers must also be unconstrained in the manner in which they fulfill their obligation.

Also note that the distribution of the rents makes a difference to GDP losses. US losses are 25% higher in 2020 when market power resides with the sellers. The analysis provides an additional message for Annex 1 buyers. If at a given point in time, low-cost sellers are concentrated among a few countries (e.g., EEFSU), they may have considerable potential for extracting monopoly rents.

6. The issue of carbon leakage

The Kyoto Protocol refers specifically to the period centered about 2010. During this period, the onus for emission reductions falls on Annex 1. No specific obligations are imposed on countries outside Annex 1, and there is the possibility of "leakage". That is,

Figure 5.1 Percent of US Obligation Satisfied Through the Purchase of Emission Rights

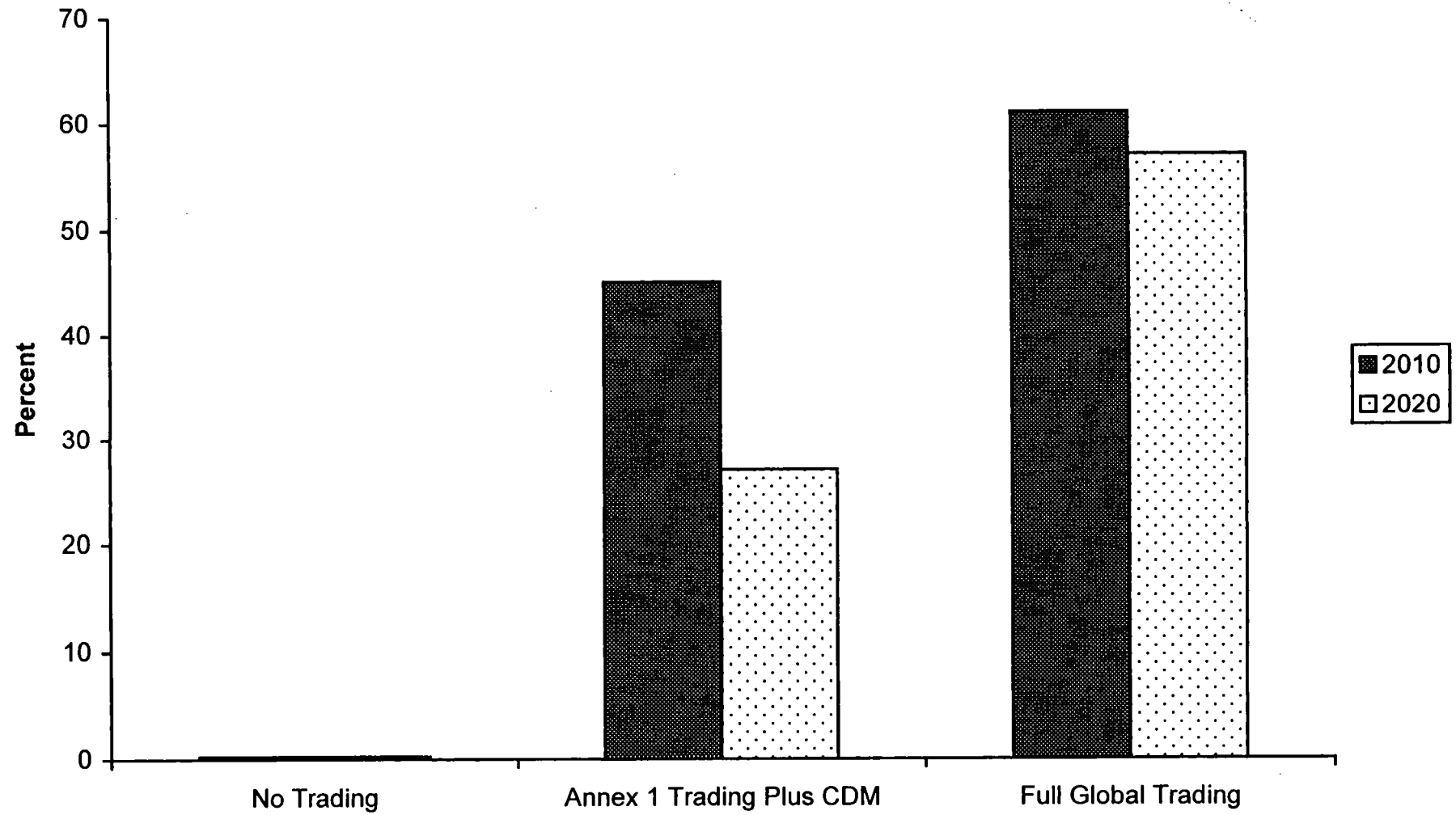


Figure 5.2 Incremental Value of Carbon Emission Rights With and Without Limits on the Purchase of Emission Rights -- Kyoto Forever

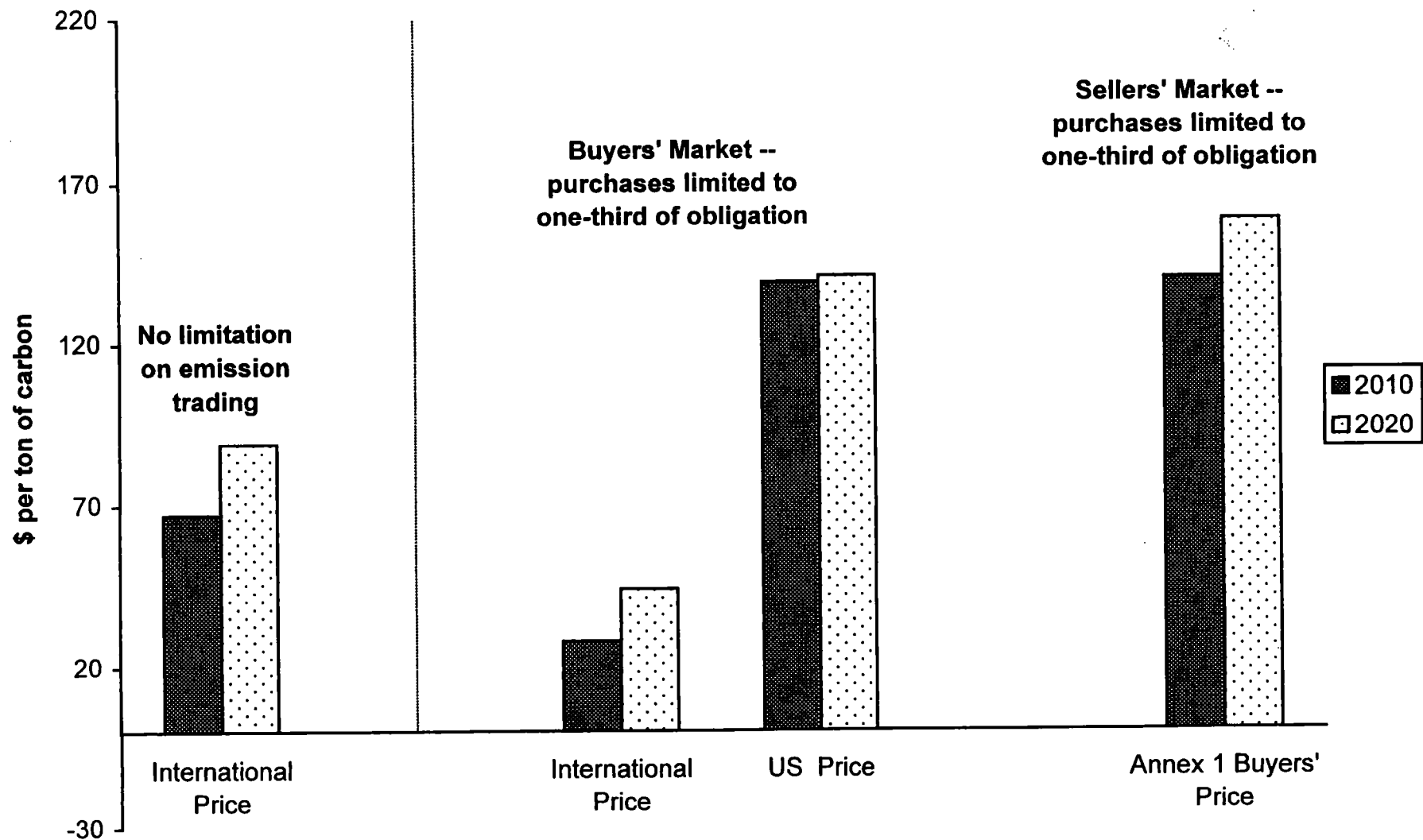
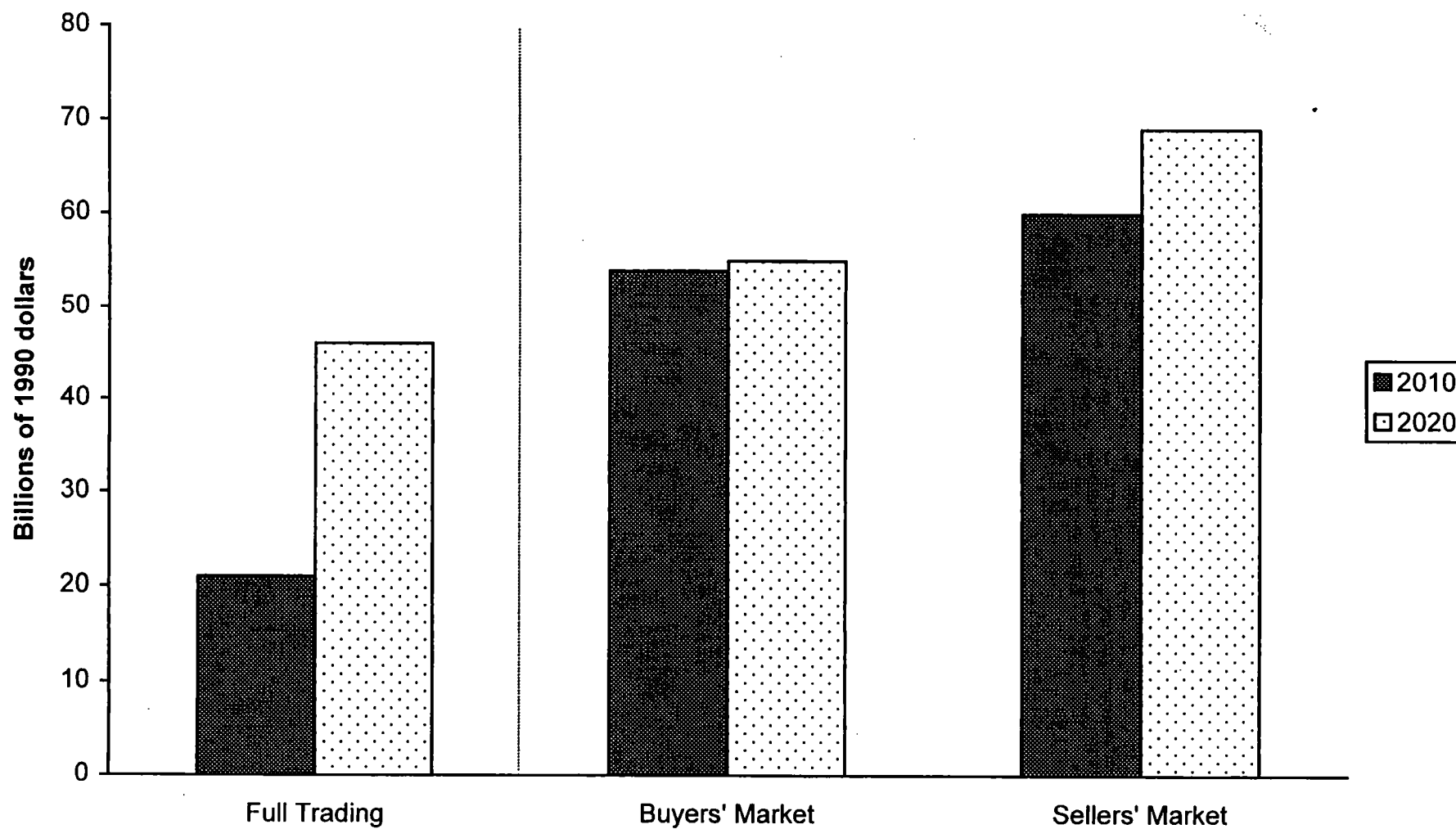


Figure 5.3 Annual US GDP Losses with Full Trading - Annex 1 May Satisfy Only One-Third of Obligation Through the Purchase of Emission Rights -- Kyoto Forever



the reductions in Annex 1 might be partially offset by increased emissions from China, India, Brazil and other countries that do *not* belong to Annex 1.

In this section, we examine the potential for leakage through international fuel markets and through the migration of energy-intensive industries. We therefore drop the assumption that non-Annex 1 countries are constrained to their reference case emissions. Two variants on the reference scenario are reported. In the first, the only trade impact of the Protocol consists of limiting the ability of the Annex 1 countries to import oil and gas. There is a lower international price of these goods, and there is a modest increase in price-induced demands by non-Annex 1 countries. However, there is no international trade in carbon emission rights, and there is no international migration of production within the energy-intensive sectors (EIS).

The second alternative is the same as the first, except that we now permit EIS trade. For a description of how the model has been modified to account for international trade in the energy-intensive sectors, see Appendix A. Figure 6.1 summarizes the overall results. According to this figure, neither of the two trade alternatives leads to a dramatic increase in carbon emissions outside Annex 1. Apparently there is an international leakage problem, but it appears to be of manageable dimensions.

Figure 6.2 suggests a somewhat different interpretation. Here we report the EIS trade scenario, and we compare the impact upon production-consumption ratios in each region. Under the reference case, these ratios are close to unity (the horizontal line) in most regions. The bars in Figure 6.2 show that the Protocol could lead to serious competitive problems for EIS producers in the USA, Japan and OECD Europe. The Protocol would lead to significant reductions in their output and employment, and there would be offsetting increases in regions with low energy costs. One can easily anticipate calls for protection against “unfair competition”. In its present form, the Protocol could lead to acrimonious conflicts between those who advocate free international trade and those who advocate a low-carbon global environment.

7. Evaluating Kyoto in the context of the longer-term goal

The objective of the Framework Convention is “the stabilization of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system.”¹⁴ The drafters of the Protocol focused exclusively on the initial steps to be taken by Annex 1 countries. Little attention was paid to the ultimate goal. We now examine the Protocol in the context of a long-term stabilization objective.

From Figure 2.1 it is clear that the “Kyoto Forever” scenario will fail to stabilize global emissions and concentrations. A particular concentration target can be achieved through a variety of emission pathways. In this section, we explore three pathways for stabilizing concentrations at 550ppmv (twice preindustrial levels) by 2100. We stress, however, that the issue of what constitutes “dangerous interference” has yet to be determined. Indeed, it is likely to be the subject of intense scientific and political debate for decades to come. Hence, our choice of a target is meant to be purely illustrative.

**Figure 6.1 Carbon Emissions Outside Annex 1 --
Alternative Leakage Scenarios**

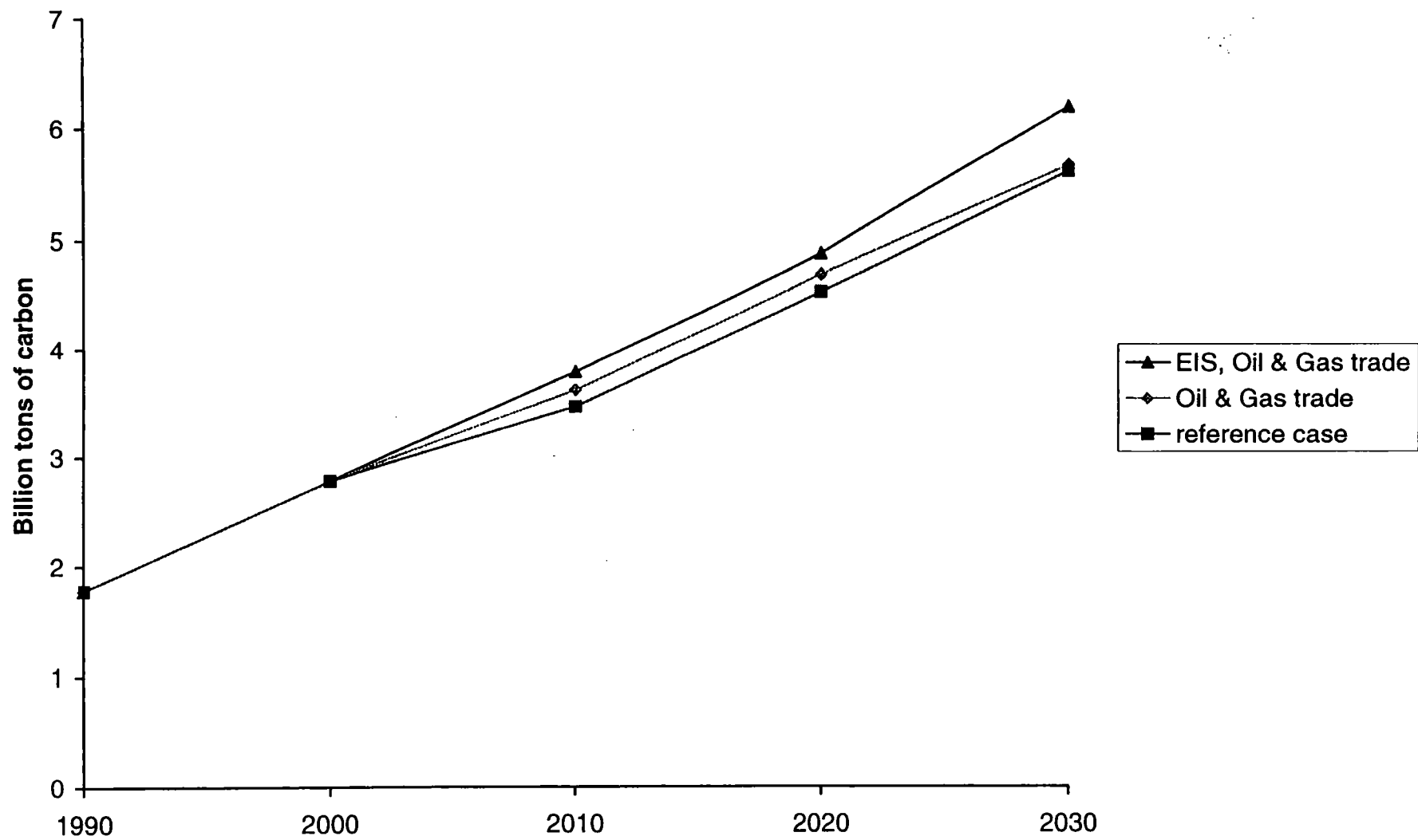
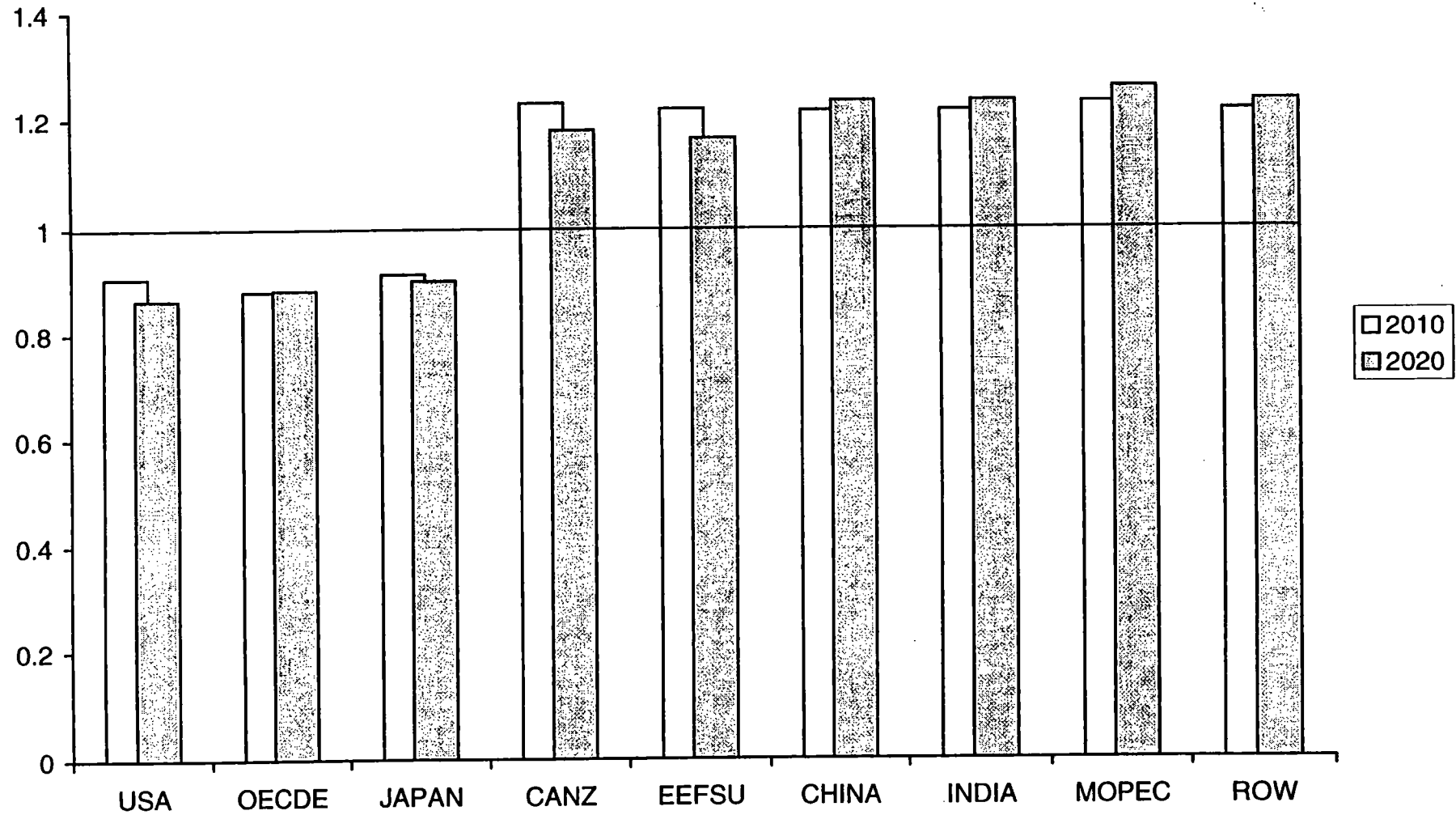


Figure 6.2 Ratios of Domestic EIS Supplies to Demands -- Kyoto with Leakage



Our three pathways are intended to illustrate the benefits of “when” flexibility. They are titled: 1) “Kyoto followed by arbitrary reductions”; 2) “Kyoto followed by least-cost”; and, 3) “least-cost”. As their names imply, the first two are designed to be consistent with the Protocol during the first commitment period. The third assumes a clean slate in the choice of emissions pathway throughout the 21st century.

For the first scenario, we assume that Annex 1 countries reduce emissions through 2030 at the same rate as the OECD during the first decade of the 21st century (2% per year). During this period, non Annex-1 countries are permitted to emit up to their reference case levels. By 2020, emissions in the developing nations are larger than those in Annex I. We then choose a pathway to stabilization which represents a relatively smooth transition to the target. As for the post-2030 burden-sharing scheme, we assume that between 2030 and 2050 all regions move to equal per capita emission rights (based on their 1990 population). Equal per capita emission rights have been proposed as one approach to international fairness, but there are others that might also serve to separate the issue of equity from that of economic efficiency.

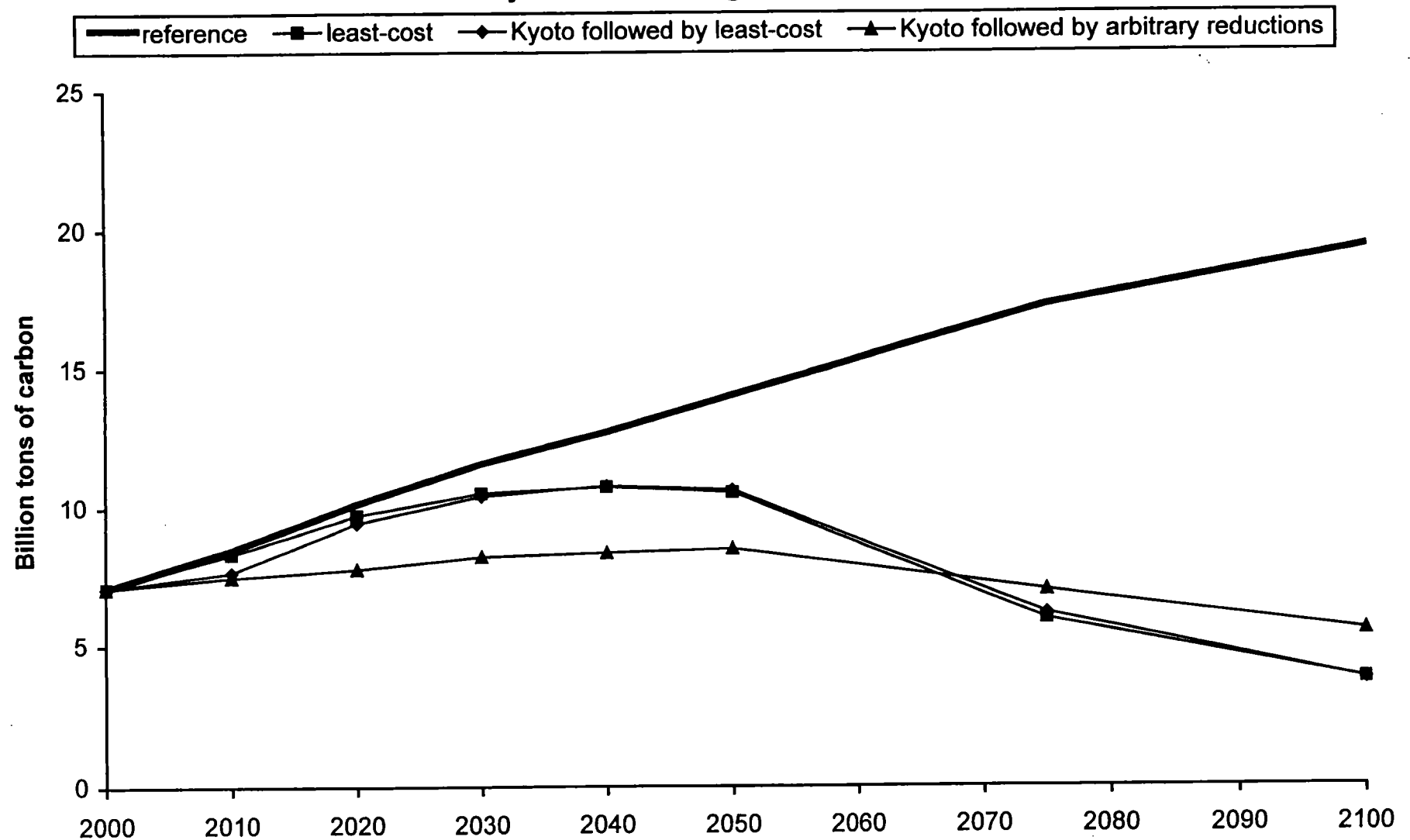
With “Kyoto followed by least-cost”, the Protocol is adopted for the initial commitment period. Thereafter, the most cost-effective pathway is followed for stabilizing concentrations at 550ppmv. With “least-cost”, the most cost-effective pathway for stabilizing concentrations at 550ppmv is followed from the outset. The latter two scenarios adopt the same proportionate burden-sharing scheme as the first.

All three scenarios assume Annex 1 trading plus the CDM. However, they differ as to the timing of developing country involvement in the international market for carbon emission rights. By definition, least-cost assumes that emission reductions will be made where it is cheapest to do so, regardless of the geographical location. Hence, in the least-cost scenario, we assume global emission trading from the outset. In the case of “Kyoto followed by least-cost”, we assume that global emission trading is delayed until after the first commitment period. With “Kyoto followed by arbitrary reductions”, global emission trading does not begin until 2030, the year that developing countries agree to lower their emissions below business-as-usual.

Global carbon emissions. Figure 7.1 shows global carbon emissions for the reference case and the three stabilization scenarios. Following a least-cost strategy from the outset results in an emissions pathway that tracks the reference path through 2010 and then departs at an increasing rate thereafter. There are several reasons why a gradual transition to a less carbon-intensive economy is preferable to one involving sharper near-term reductions.

Concentrations at a given point in time are determined more by cumulative, rather than year-by-year, emissions. Indeed, a concentration target defines an approximate carbon budget, i.e., an amount of carbon that can be emitted between now and the date at which the target is to be reached. At issue is the optimal allocation of the budget. Reasons for relying more heavily on the budget in the early years include: 1) providing more time for the economic turnover of existing plant and equipment, 2) providing more time to

Figure 7.1 Global Carbon Emissions -- Reference Case and Three Alternative Emission Pathways for Stabilizing Concentrations at 550ppmv



develop low-cost substitutes to carbon-intensive technologies, 3) providing more time to remove carbon from the atmosphere via the carbon cycle, and 4) the effect of time discounting on mitigation costs.¹⁵

We next turn to the two scenarios where we adopt the Protocol for the first commitment period. Notice that the two emission pathways behave quite differently post-2010. “Kyoto followed by least-cost” follows the least-cost pathway once the Protocol’s constraints are relaxed. “Kyoto followed by arbitrary reductions”, on the other hand, bears no resemblance to the least-cost pathway. What is striking about Figure 7.1 is that with a 550ppmv target, the Protocol is inconsistent with the most cost-effective mitigation pathway, i.e. “least-cost”. Indeed, it appears that the ultimate target would have to be considerably lower than 550ppmv for the Protocol to be justified in terms of cost-effectiveness.

Near-term losses. It is instructive to look at the incremental value of emission rights for the three stabilization scenarios (Figure 7.2). With the least-cost path, the value is relatively low in the early years (\$11 per ton of carbon in 2010), and it rises gradually over time. With “Kyoto followed by least-cost”, the value is \$130 per ton in 2010 and then tracks the least-cost path thereafter. In the case labeled “Kyoto followed by arbitrary reductions”, the incremental value of emission rights starts at about \$160 per ton and it remains high.

Figure 7.3 shows US GDP losses in 2010 and 2020 under the three stabilization scenarios. Notice that GDP losses in 2010 differ for the two scenarios involving the initial adoption of the Protocol. Because of the long-lived nature of energy investments, investors are concerned both with what happens in the initial commitment period and what happens thereafter. In the case of the more rapid transition away from the baseline (“Kyoto followed by arbitrary reductions”), investors will be forced to invest more heavily in high-cost substitutes in the early years. With “Kyoto followed by least-cost”, they will have more flexibility.

It is striking by how much GDP losses can be lowered under the “least-cost” scenario. This strategy involves a more gradual transition away from the baseline in the early years. It relieves much of the pressure for premature retirement of existing plant and equipment and for dependence on high-cost substitutes (both on the supply- and demand-sides of the energy sector). Relative to the reference case, the US also receives some benefits as an oil importer. Recall that a carbon constraint decreases the overall demand for oil and lowers its price on the international market.

Global losses. Finally, it is instructive to examine losses from a global perspective (Figure 7.4). For purposes of the present comparison, we focus on the present value of consumption losses over the 21st century discounted to 1990 at 5 percent. The relative magnitude of the cumulative losses for the three stabilization scenarios comes as no surprise given the previous discussion. “Kyoto followed by arbitrary reductions” is by far the most expensive of the three paths. “Kyoto followed by least-cost” is a considerable

Figure 7.2 Incremental Value of Carbon Emission Rights under Three Alternative Emission Pathways for Stabilizing Concentrations at 550ppmv -- Global Trading

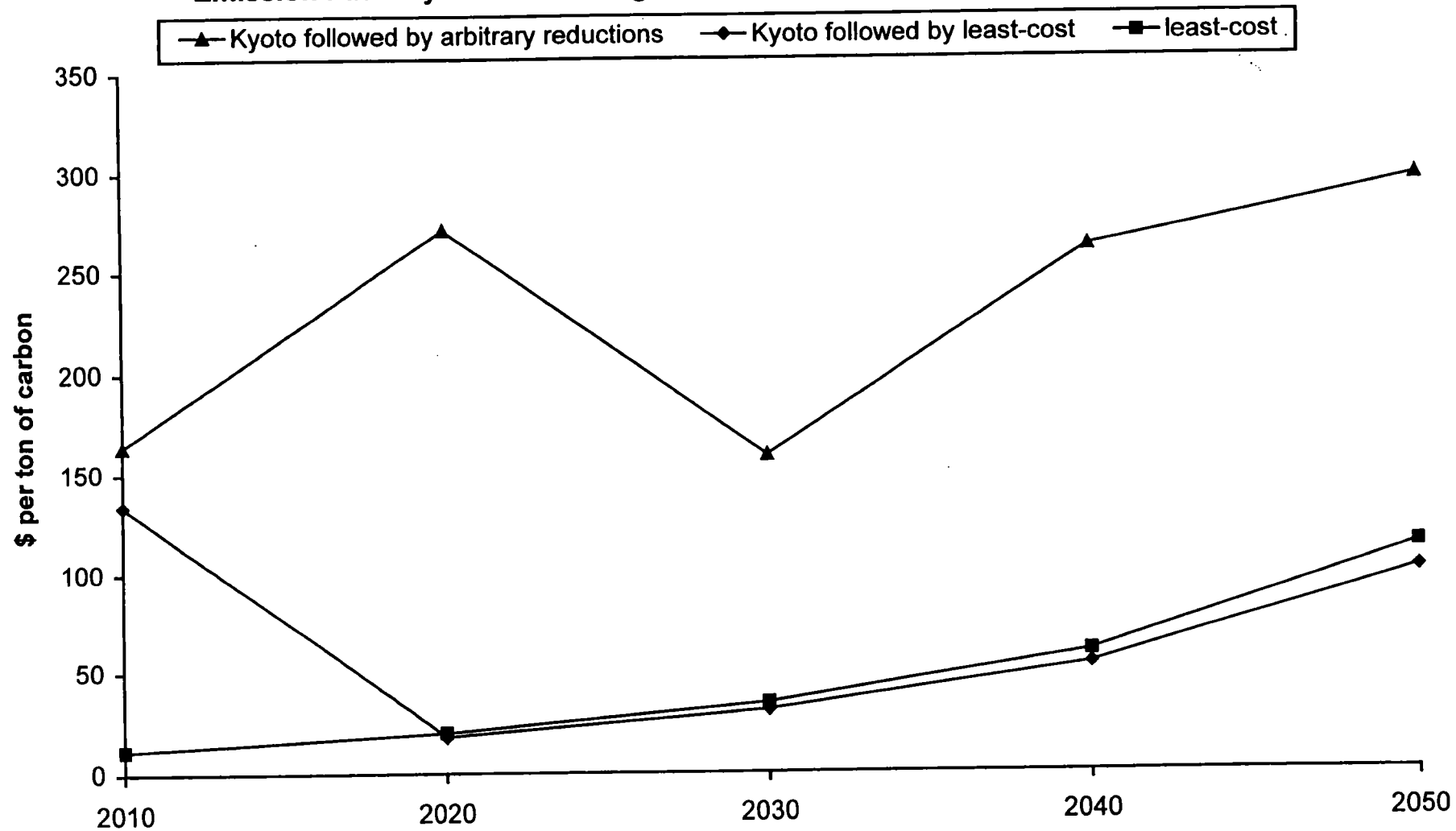
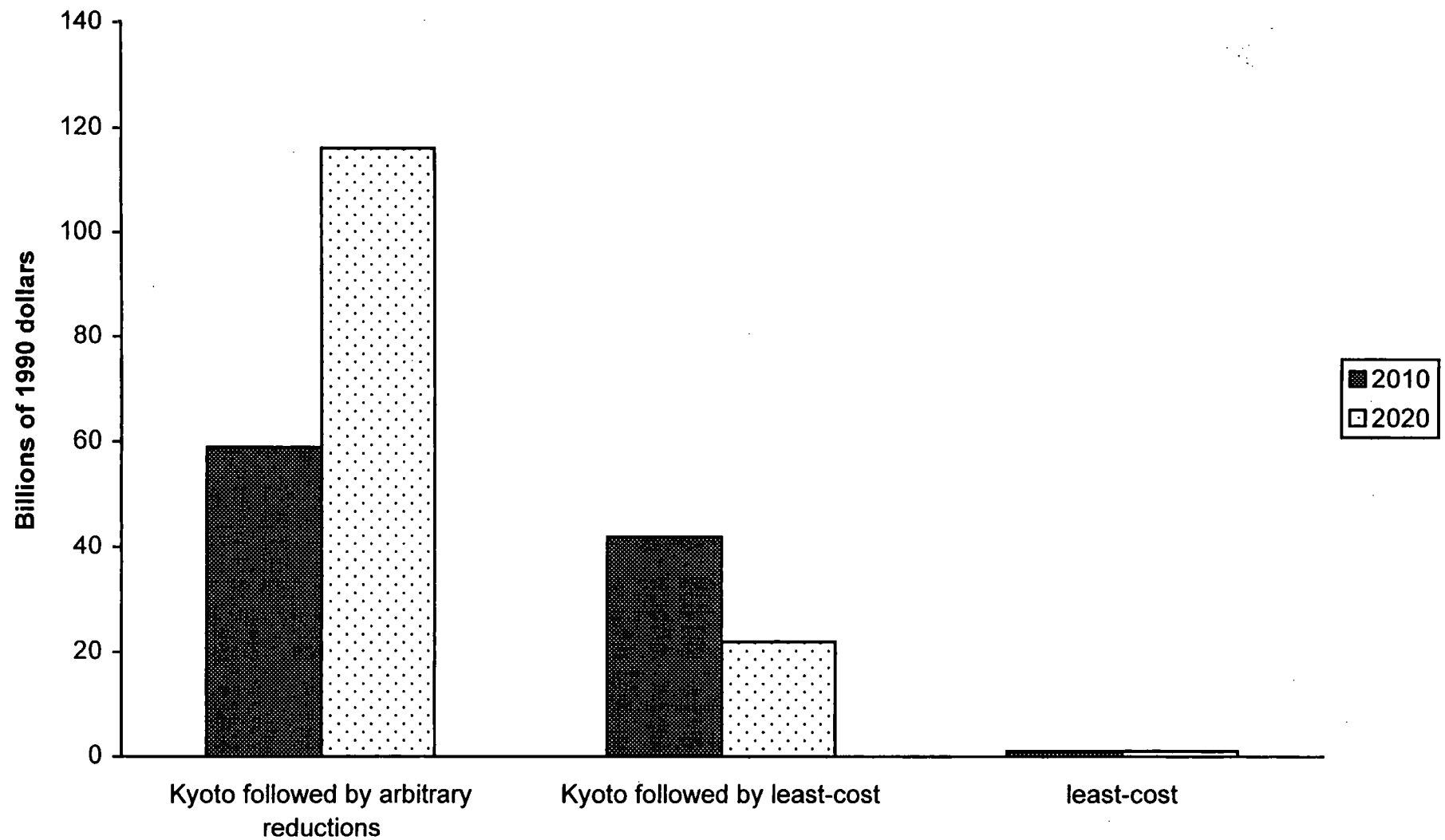
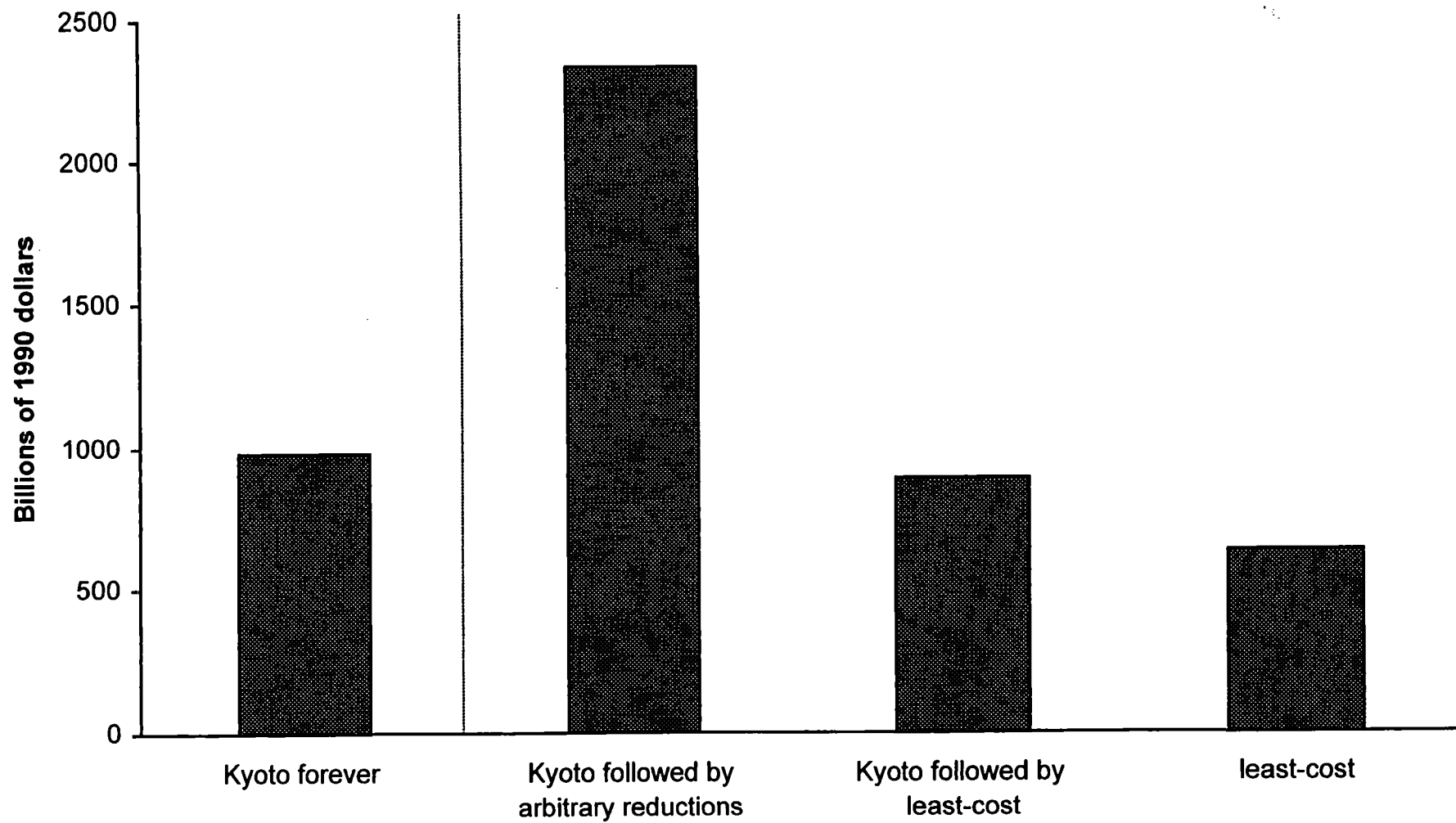


Figure 7.3 US GDP Losses Under Alternative 550ppmv Stabilization Scenarios



**Figure 7.4 Global Consumption Losses through 2100 Discounted to 1990 at 5% --
Kyoto Forever vs. Three Scenarios for Stabilizing Concentrations at 550ppmv**



improvement, but is still 40% more expensive than embarking on the most cost-effective mitigation pathway from the outset.

What is ^{??}surprising is that “Kyoto Forever” turns out to be more expensive than “Kyoto followed by least cost” or “least cost”. “Kyoto Forever” results in sharper global emission reductions during the early decades of the 21st century. It does not, however, succeed in stabilizing emissions, much less concentrations. By contrast, the other scenarios all lead to stabilization at 550ppmv. In other words, “Kyoto Forever” ends up costing more, and it buys less long-term protection.

8. Further comments

Some suggest that models such as MERGE tend to *overestimate* the costs of mitigation. They argue that, when prospects for technical progress are incorporated, the costs of a carbon constraint, even a sharp near-term constraint, will be minimal. We, too, are optimistic about the outlook for technical innovation. Indeed, such innovation is embedded both in our reference case and in the policy scenarios. The disagreement is over the rate at which such progress will occur. We do not believe that economically competitive substitutes will become available at such a rate as to trivialize the costs of a Kyoto-like Protocol.

A more valid concern may be that we are *underestimating* the costs of a carbon constraint. There are several reasons why this may be the case. To begin with, optimization models assume that decision makers have perfect foresight. That is, they assume that investors are fully informed about the nature of future constraints, and act accordingly. Given the present state of uncertainty, this is highly unlikely. Models such as MERGE also tend to ignore short-term macro shocks. For example, the higher energy prices brought about by a carbon constraint are likely to be inflationary. If this leads to higher interest rates, investment may be dampened. The result would be a slowdown in economic growth.

In addition, we assume that policies will be efficient. That is, market mechanisms will be chosen over “command and control” approaches to accomplishing environmental objectives. Whereas, in recent years, there has been an increasing trend toward market mechanisms, the approach to be taken with climate policy is by no means assured. Moreover, even if such a commitment were made, we have no assurances that the requisite international institutions will be available when needed.

Although it is easy to quibble over the numbers, the real value of analyses lies more in insights than in numerical values. And, indeed we believe that the current exercise has yielded several insights that may be of value to those charged with interpreting the current proposal. Here, we summarize what we have learned:

- First, it is extremely unlikely that a “Kyoto Forever” scenario will stabilize emissions -- much less concentrations. Non-Annex 1 emissions are quickly overtaking those of the OECD and the economies in transition. Hence, meeting the stabilization goal of

the Framework Convention will eventually require the participation of developing countries.

- International cooperation through trade in emission rights is essential if we are to reduce mitigation costs. The magnitude of the savings will depend on several factors. These include the number of countries participating in the trading market, the shape of each country's marginal abatement cost curve, and the extent to which buyers can satisfy their obligation through the purchase of emission rights.
- With regard to the latter, limitations on the purchase of emission rights may be especially costly. In the example explored here, limiting purchases to one-third of a country's obligation increased GDP losses by a factor of at least two and one-half in the year 2010. If proponents of such limitations are successful, they may seriously reduce the benefits from "where" flexibility.
- The issue of monopoly power in markets for emission rights may turn out to be important. This is most likely to occur if trading is limited to Annex 1 and the majority of inexpensive emission rights are concentrated in a small number of countries. If these countries were successful in organizing a sellers' cartel, they might be able to extract sizable rents.
- The near-term costs of the Protocol will depend on expectations regarding the future. Energy investments are typically long-lived. Today's investment decisions are not only influenced by what happens during the next decade, but also by what happens thereafter. Hence, analyses which focus solely on 2010 may be underestimating the costs of Kyoto.
- Finally, and perhaps most importantly, unless the concentration target for CO₂ is well below 550ppmv, the Protocol appears to be inconsistent with a cost-effective long-term strategy for stabilizing CO₂ concentrations. Rather than requiring sharp near-term reductions, it appears that a more sensible strategy would be to make the transition at the point of capital stock turnover. This would eliminate the need for premature retirement of existing plant and equipment and would provide the time that is needed to develop low-cost, low-carbon substitutes.

References

- ¹ Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", Third Session Kyoto, 1-10 December.
- ² 105th Congress, 1st Session (1997), S. Res. 98.
- ³ Intergovernmental Negotiating Committee for A Framework Convention on Climate Change (1992). Fifth Session, Second Part, New York, 30 April-9 May.
- ⁴ IPCC (1997). "Stabilization of Atmospheric Greenhouse Gases: Physical, Biological and Socio-Economic Implications", Technical Paper III.
- ⁵ Intergovernmental Negotiating Committee for A Framework Convention on Climate Change (1992), op. cit.
- ⁶ Manne, A., Mendelsohn, R., and Richels, R. (1995). "MERGE: a model for evaluating regional and global effects of GHG reduction policies", *Energy Policy*, 3 (1).
- ⁷ Manne, A., and Richels, R. (1995). "The Greenhouse Debate: economic efficiency, burden sharing and hedging strategies", *The Energy Journal*, 16 (4).
- ⁸ IPCC (1994). *Climate Change 1994*, Cambridge University Press.
- ⁹ Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", op. cit.
- ¹⁰ Richels, R., Edmonds, J., Gruenspecht, H., and Wigley, T. (1996). "The Berlin Mandate: The Design of Cost Effective Mitigation Strategies", EMF-14, Working Paper 3, Stanford University, Stanford, CA.
- ¹¹ Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", op. cit.
- ¹² Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", op. cit.
- ¹³ 105th Congress, 1st Session (1997), S. Res. 98.
- ¹⁴ Intergovernmental Negotiating Committee for A Framework Convention on Climate Change (1992), op. cit.
- ¹⁵ Wigley, T., Richels, R., and Edmonds, J. (1996). "Economic and Environmental Choices in the Stabilization of Atmospheric CO₂ Concentrations", *Nature*, Vol. 379, 18 January.

Appendix A. Modeling international trade in the energy-intensive sectors

MERGE 3.0 has recently been modified to include the possibility of trade in EIS (energy-intensive sectors). EIS is an aggregate including ferrous and non-ferrous metals, chemicals, nonmetallic minerals, paper, pulp and print. This aggregate does not include the energy-intensive industry of petroleum refining. The model may be run either with or without EIS trade.

The new feature is introduced in a way that preserves the basic simplifying characteristics of the ETA-MACRO submodel. That is, energy, capital and labor are substitutes that enter into an aggregate production function. They produce a numeraire good which may be used for consumption, investment and interindustry payments for energy costs.

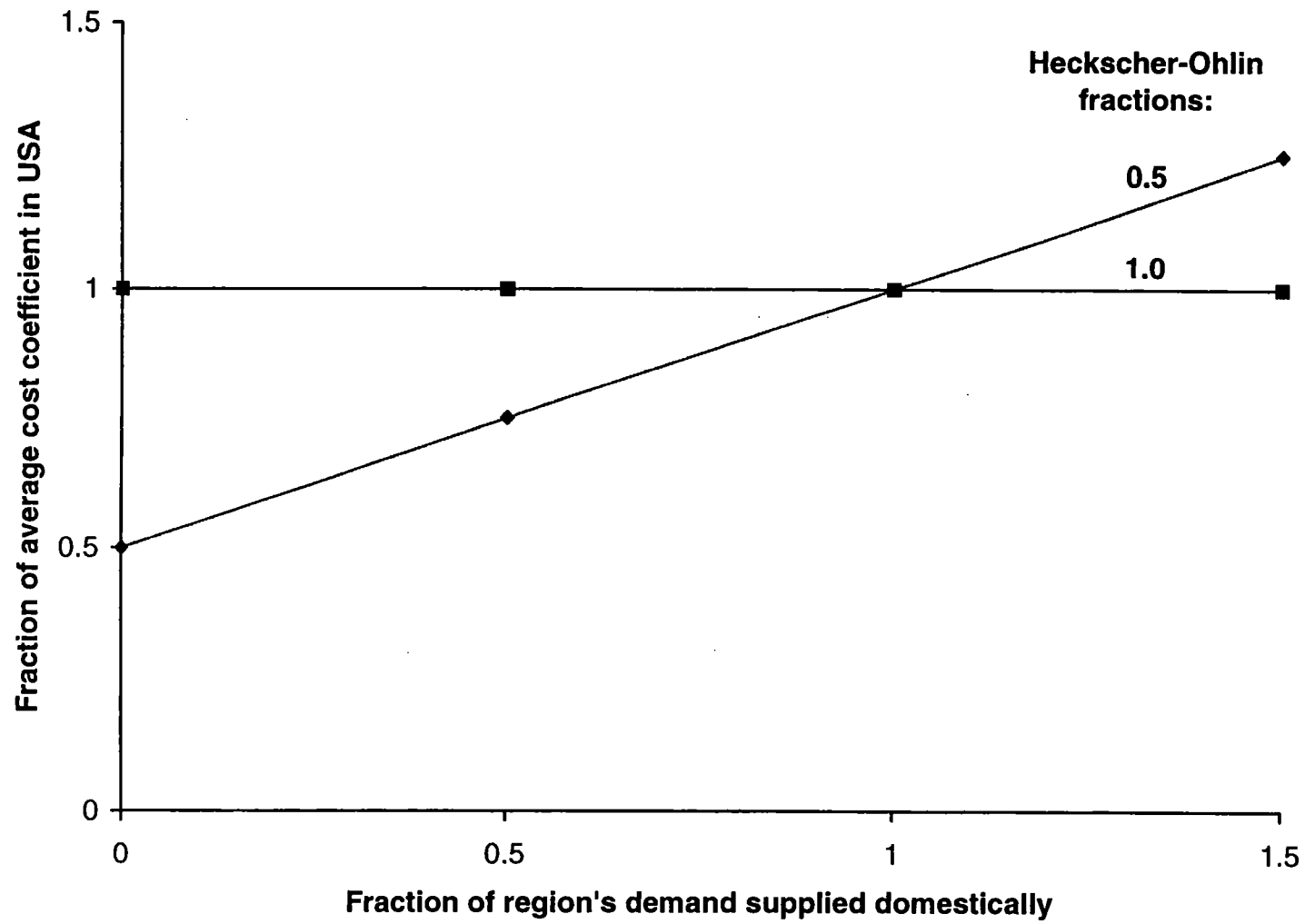
It is assumed that trade will continue to represent a relatively small amount of each region's total internal demand for EIS. The GTAP (General Trade Analysis Program, 1992) data base is employed to estimate each region's EIS demands. In all other respects, the model is the same as MERGE 3.0.

For projecting the impact of the Kyoto protocol, each region is taken to be self-sufficient at base year energy prices. Changes in the location of production are attributed primarily to changes in the cost of energy. At base year prices in the USA, 85% of the cost of EIS consisted of non-energy inputs (labor, shipping, capital, iron ore, etc.), and 15% of the cost consisted of energy inputs (half electric and half non-electric). Under these conditions, a doubling of energy prices would imply only a 15% increase in the cost of EIS. This is why it is assumed that the demand for EIS is inelastic with respect to the price of energy. For projecting future demands, the income elasticity is taken to be 0.5.

For modeling purposes, we have supposed that the marginal supplies of EIS in all regions are determined by the same international technology that prevails in the USA. Each region has the same energy-EIS production ratio. For non-energy inputs, each supply curve is linear. Its positive slope serves the same purpose as an Armington elasticity describing substitution between foreign and domestic goods. This is the way in which we avoid penny-switching as a characteristic solution mode.

The slope of the non-energy supply curve is described as a Heckscher-Ohlin fraction. If this fraction is unity, EIS is viewed as a perfectly homogeneous commodity. Small changes in energy costs will then lead to large changes in the international location of production. If this fraction is less than unity, the supply function is less elastic, and the changes in location will be less dramatic. (See Figure A.1.)

**Figure A.1 EIS Supply Curves --
Marginal Cost of Non-Energy Inputs to EIS**



ACCF

AMERICAN COUNCIL FOR CAPITAL FORMATION

FAX TRANSMISSION COVER SHEET

DATE: 8/14/98

TO: Hon. Jeffrey Frankel

FROM: ☐ Mark Bloomfield
☐ Marl Lee Dunn
☒ Margo Thorning
☐ Ernestine Johnson
☐ Angela Wilkes

FAX PHONE #: 395-6958

PAGES (including cover): 2

Contact Doreen at (202) 293-5811 if there is any problem.

NOTE:

Attached is an updated agenda
for our Sept. 23 Conference.

Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality

September 23, 1998 • The National Press Club • 13th floor, 14th and F Streets, N.W. • Washington, D.C.

7:15-7:45 a.m. **REGISTRATION**

7:45 a.m. **WELCOME**

Mark Bloomfield
President
ACCF Center for Policy Research

7:45-9:00 a.m. **BREAKFAST ADDRESS:
A CONGRESSIONAL PERSPECTIVE**

Speaker: Hon. E James Sensenbrenner, Jr. (R-WI)
Chairman
House Science Committee

9:00-10:00 a.m. **THE KYOTO TREATY: ECONOMIC AND
ENVIRONMENTAL CONSEQUENCES**

Paper: Richard Richels
Director, Department of Energy
Analysis and Planning
Electric Power Research Institute

Respondents: Jeffrey Frankel
Member
Council of Economic Advisers
Richard Schmalensee
Gordon Y Billard Professor of
Economics and Management
Massachusetts Institute of Technology

10:00-11:00 a.m. **THE ROLE OF ENERGY IN
THE U.S. ECONOMY**

Paper: John Moroney
Texas A&M University

Respondents: Joyce Brinner
Principal
Standard & Poor's DRI
Michael Buckner
Director of Research
United Mine Workers of America

11:00 a.m.-noon **REMOVING THE OBSTACLES FOR LONG-
TERM TECHNOLOGICAL INNOVATION TO
REDUCE CO₂ EMISSIONS**

Paper: Jae Edmonds
Technical Leader of
Economic Programs
Pacific Northwest
National Laboratory

Respondents: Alan S. Manne

Professor Emeritus,
Operations Research
Stanford University
Thomas Marx
Director of Economic Studies
General Motors Corp.

Noon-1:45 p.m. **LUNCHEON ADDRESS:
AN URBAN PERSPECTIVE ON
CLIMATE MITIGATION POLICY**

Speaker: Arthur Fletcher
Chairman
National Black Chamber
of Commerce

1:45-2:45 p.m. **TRADABLE PERMITS FOR CO₂ EMISSIONS:
OBSTACLES TO A FUNCTIONAL
INTERNATIONAL SYSTEM**

Paper: A. Denny Ellerman
Executive Director, MIT Center for Energy
and Environmental Policy Research

Respondents: David Harrison, Jr.
Vice President and Director of
Environmental Practice
National Economic
Research Associates
W. David Montgomery
Vice President
Charles River Associates, Inc.

2:45-3:45 p.m. **TECHNOLOGICAL DEVELOPMENT AND
CO₂ REDUCTION IN ENERGY USE:
OUTLOOK FOR NEAR-TERM PROGRESS**

Paper: Henry Jacoby
Massachusetts Institute of Technology

Respondents: Eric Peterson*
Director, Office of Budget, Planning,
and Customer Service
U.S. Department of Energy
Ronald Sutherland
Senior Economist
American Petroleum Institute

*invited

A public policy forum sponsored by the ACCF Center for Policy Research

MARGO THORNING

September 11, 1998

TO: Dr. Frankel

Attached is Richard Richels' paper that he will be presenting to your panel, "The Kyoto Treaty: Economic and Environmental Consequences," at our September 23 forum.

Please call if you have any questions.

THE KYOTO PROTOCOL: A COST-EFFECTIVE STRATEGY FOR MEETING ENVIRONMENTAL OBJECTIVES?

PAPER

ALAN S. MANNE
PROFESSOR EMERITUS, OPERATIONS RESEARCH
STANFORD UNIVERSITY

AND

RICHARD G. RICHEL
DIRECTOR, GLOBAL CLIMATE CHANGE RESEARCH
ELECTRIC POWER RESEARCH INSTITUTE

DRAFT

DO NOT CITE OR QUOTE WITHOUT PERMISSION

PREPARED FOR
**CLIMATE CHANGE POLICY: PRACTICAL STRATEGIES TO PROMOTE
ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY**
A SYMPOSIUM SPONSORED BY THE
AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH
NATIONAL PRESS CLUB
WASHINGTON, D.C.
SEPTEMBER 23, 1998

AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH

1750 K Street, N.W., Suite 400, Washington, D.C. 20006-2302 • 202/293-5811 • 202/785-8165 FAX • info@accf.org E-MAIL • Web site: [<http://www.accf.org>](http://www.accf.org)

Sonesta Hotels & Resorts

Richards ¹⁵⁰⁰
model

Why \$70 > \$23

check EMF range
ask Joe A why
make overhead
of EMF 444

✓
DRAFT

The Kyoto Protocol: A Cost-Effective Strategy for Meeting Environmental Objectives?

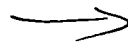
has sinks (excl 50) = 97,
not committing
(6 gases just issuing
proportional)
p6 cost

Alan S. Manne, Stanford University

Richard G. Richels, EPRI

p9 limits

their by
1 atm.



p13 leakage

13-16 1-T paths

to concentrating deal.
least cost, Kyoto.

July 27, 1998

This research results from our involvement in Stanford University's Energy Modeling Forum 16 Study. The authors are indebted to James Deaker and Robert Parkin for their research assistance. We have benefited from discussions with Jae Edmonds, Henry Jacoby, David Montgomery, William Nordhaus, Stephen Peck, Thomas Rutherford, and John Weyant. Funding was provided by EPRI. The results presented here are solely those of the individual authors.

1. Introduction

The Kyoto Protocol represents a milestone in climate policy.¹ For the first time, negotiators have attempted to lay out emission reduction targets for the early part of the 21st century. The goal is for Annex 1 (developed countries plus economies in transition) to reduce their aggregate anthropogenic carbon dioxide equivalent emissions by at least 5 percent below 1990 levels in the commitment period 2008 to 2012. The Protocol, however, has yet to enter into force. To do so will require ratification by 55 countries representing 55 percent of total Annex 1 CO₂ emissions in 1990.

As each country considers ratification, important questions will arise. High up on the US list is the issue of economic costs. The Senate, for example, has stated that "any Protocol should be accompanied by a detailed financial analysis of impacts on the economy."² Not surprisingly, US negotiators had hardly returned from Kyoto before the first hearings were scheduled on Capitol Hill. Although the issue of costs is but one of many important considerations, policy makers are keenly interested in the economic implications of ratification.

This paper is intended to help clarify our understanding of compliance costs. The focus is on three questions, which we believe to be of particular relevance: What are the near-term costs of implementation? How significant are the so-called "flexibility provisions"? And, perhaps most importantly, is the Protocol cost-effective in the context of the long-term goals of the Framework Convention?³

Unfortunately, the answers to these questions will not come easily. It has always been difficult to calculate the economic costs of implementing climate policy. Kyoto has done little to simplify matters. Indeed, it raises at least as many questions as it resolves. These questions fall into two categories: those related to the near-term implementation of the Protocol and those related to the evolution of climate policy over the longer term.

The Protocol is unclear on a number of topics. These include the rules governing emission trading, joint implementation (JI), the Clean Development Mechanism (CDM), and the treatment of carbon sinks. In addition, there is a weak knowledge base regarding the costs of sink enhancement and of controlling several of the relevant trace gases. Until these issues are clarified, analyses will be highly speculative.

Calculating the costs of Kyoto is also complicated by the issue of "what happens next?" Energy sector investments are typically long-lived. Today's investment decisions are not only influenced by what happens during the next decade, but also by what happens thereafter. In order to estimate the costs of implementing emission cuts in the first commitment period, assumptions are required concerning the longer-term requirements. Unfortunately, the international negotiation process offers little guidance on this issue. This further complicates the process of analysis.

We do not wish to suggest that economic analysis is premature at the present time. Uncertainty is rarely an excuse for paralysis. It does mean, however, that we must be

careful to highlight the tentative nature of the projections and focus, to the extent possible, on the insights for decision making. Here, sensitivity analysis can be particularly useful. For example, in the case of several of the flexibility provisions (emission trading, joint implementation and the Clean Development Mechanism), we explore a variety of scenarios regarding constraints on the purchase of carbon emission rights. While the exact magnitude of the benefits will continue to be debated, the insights, nevertheless, appear to be quite robust.

We also examine the Protocol in the context of the longer-term goal of the Framework Convention, i.e., the stabilization of greenhouse gas concentrations in the earth's atmosphere. A particular concentration goal can be reached through a variety of emission pathways. Considerable effort has been devoted to trying to understand the characteristics of cost-effective pathways.⁴ It is interesting to examine Kyoto in the context of this work. The price tag for moving forward may be formidable. Consistent with the Framework Convention, it is essential that "policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible costs."⁵

2. The model

This analysis is based on MERGE (a model for evaluating the regional and global effects of greenhouse gas reduction policies).^{6,7} MERGE is an intertemporal market equilibrium model. It combines a bottom-up representation of the energy supply sector together with a top-down perspective on the remainder of the economy. Savings and investment decisions are modeled as though each of the regions maximizes the discounted utility of its consumption subject to an intertemporal wealth constraint. Each region's wealth includes not only capital, labor and exhaustible resources, but also its negotiated international share in carbon emission rights.

For the present version of the model, known as MERGE 3.0, we have adopted 10-year time intervals through 2050 and 25-year intervals through 2100. Geographically, the world is divided into nine geopolitical regions: 1) the USA, 2) OECD (Western Europe), 3) Japan, 4) CANZ (Canada, Australia and New Zealand), 5) EEFSU (Eastern Europe and the Former Soviet Union), 6) China, 7) India, 8) MOPEC (Mexico and OPEC) and, 9) ROW (the rest of world). Note that the OECD (regions 1 through 4) together with EEFSU constitute Annex 1 of the Framework Convention.

Particularly relevant for the present analyses, MERGE provides a general equilibrium formulation of the global economy. We model the possibility of international trade in carbon emission rights. This is sometimes known as "where" flexibility. It would allow regions with high marginal abatement costs to purchase emission rights from regions with low marginal abatement costs. In addition, MERGE can be used to examine the related issue of "when" flexibility - intertemporal transfers of carbon emission rights.

We also model international trade in oil, natural gas, and energy-intensive basic materials. We are therefore able to examine issues related to "carbon leakage". Such leakage can occur through a variety of pathways. For example, Annex 1 emission

reductions will result in lower oil demand, which in turn will lead to a decline in the international price of oil. As a result, non-Annex 1 countries may increase their oil imports and emit more than they would otherwise.

The present version of the model includes the notion of endogenous technical diffusion. Specifically, in the electric sector, the near-term adoption of high-cost carbon-free technologies leads to accelerated future introduction of lower cost versions. The model also includes both price-induced and non-price conservation. For most regions and time periods, the AEEI (autonomous energy efficiency improvement) rate is taken to be 40% of the rate of GDP growth. By 2100, this leads to regional energy-GDP ratios that are much closer to each other than they were in 1990.

In calibrating MERGE for the present analysis, several supply- and demand-side parameters were adjusted so that the global emissions baseline would approximate the Intergovernmental Panel on Climate Change (IPCC) central case "no policy" scenario (IS92a).⁸ Figure 2.1 shows carbon emissions for each region in the reference case scenario. For more on the model and its key assumptions, see our website:

<http://www-leland.stanford.edu/group/MERGE/>

3. Treatment of sinks and non-CO2 greenhouse gases

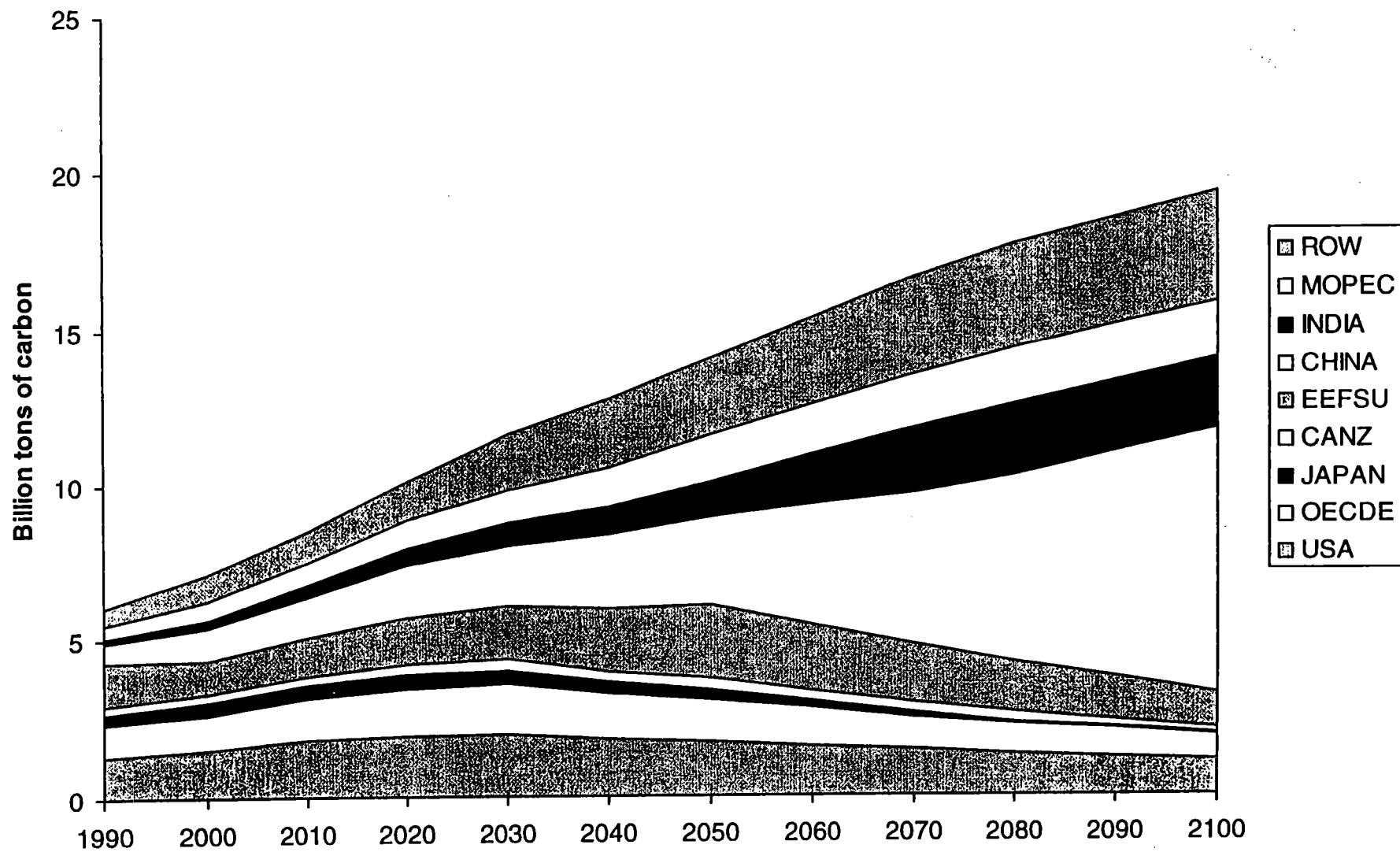
Few issues have engendered as much confusion as that of carbon sinks. Key questions include their definition, the extent to which they are included in the Protocol, the amount currently being sequestered, their time profile, and the costs of sink enhancement.

The Protocol states that Annex 1 commitments can be met by "the net changes in greenhouse gas emissions from sources and removal by sinks resulting from direct human-induced land use change and forestry activities limited to afforestation, reforestation, and deforestation since 1990, measured as verifiable changes in stocks in each commitment period."⁹ The confusion results from alternative interpretations regarding the treatment of soil carbon, an issue flagged for further study in the Protocol. Their inclusion may result in large increases in the international legal definition of sink potential.

The quality of the data is uneven. The supply curves for sink enhancement are particularly questionable. The degree of confidence concerning current and predicted future levels of carbon sequestration varies enormously across regions of the globe. Not surprisingly, information is most reliable (albeit still poor) for Annex 1 countries. Comparatively little effort has been made to collect such data elsewhere.

As placeholders, we have adopted the values shown in Table 1. To provide some perspective, in order for the US to reduce industrial carbon emissions by 7% below 1990 levels in 2010, it would have to reduce emissions by approximately 550 million tons below its reference trajectory. Sink enhancement would satisfy 9 percent of this

Figure 2.1 Regional Carbon Emissions -- reference case



obligation. For purposes of the present analysis, we assume that this sink enhancement is costless.

Table 1. Sink Enhancement (million metric tons of carbon annually)

USA	50
OECD	17
Japan	0
CANZ	50
EEFSU	34

CO₂ is by far the most important of the greenhouse gases. In addition, the Protocol includes five other trace gases (methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride). Given the scarcity of reliable emissions and cost data, the treatment of the non-CO₂ greenhouse gases is also problematic. For purposes of the present analysis, we assume that each gas is reduced proportionately. With this proportionality assumption, the inclusion of the non-CO₂ greenhouse gases does not affect the requirements for CO₂ reductions.

As with our treatment of sinks, we do not include the costs of abating the non-CO₂ greenhouse gases in our estimates of the costs of complying with the Protocol. Clearly, an important next step would be to develop supply curves for the cost of abating non-CO₂ greenhouse gases and for sink enhancement. Neither of these costs is included in the present version of MERGE.

4. "Kyoto Forever"

We begin with an examination of a "Kyoto Forever" scenario. This is a case in which the Kyoto constraints on Annex 1 countries are maintained throughout the 21st century. With regard to non-Annex 1 emissions, we assume they will continue to be bounded by their business-as-usual baseline (Figure 2.1). The latter constraint is imposed in order to prevent carbon leakage. Later on, we will explore the impact of relaxing this constraint.

Numerous studies have shown that global mitigation costs can be reduced substantially by allowing emission reductions to take place wherever it is cheapest to do so - regardless of geographical location.¹⁰ The Kyoto Protocol includes several provisions allowing for a limited amount of "where" flexibility. These include emission trading and joint implementation among Annex 1 countries. They also include provisions for a Clean Development Mechanism (CDM) that is intended to facilitate joint implementation between Annex 1 and non-Annex 1 countries.

As with the definition of sinks, the Protocol leaves many critical details unresolved. For example, it remains unclear whether there will be limits on the extent to which a country can rely upon the purchase of emission rights to satisfy its obligations. The Protocol states that "the Conference of the Parties shall define the relevant principles, modalities, rules and guidelines ..."¹¹ Similar ambiguity surrounds the Clean Development

Mechanism. Again, the elaboration of "modalities and procedures" is left to a future meeting of the Conference of the Parties.¹²

In this section, we explore three scenarios: 1) no trading, 2) Annex 1 trading plus CDM, and 3) full global trading. These three options are representative of alternative implementations of the Kyoto Protocol. Each has its own advocates and opponents, but we do not consider them equally likely. In our opinion, there is little likelihood of enticing all major countries to participate in a global market in emission rights during the initial commitment period (2008-2012).

The full global trading scenario places an upper bound on the CDM's potential to reduce GDP losses. In calculating the potential size of the contribution from a CDM, we therefore calculate this upper bound on the export of emission rights from non-Annex 1 regions. Because of the difficulties in implementation of the CDM, however, we assume that only 15% of the potential would be available for purchase through this mechanism. This is a highly subjective estimate. Given the complexities of the CDM, however, we are not inclined to assign a higher value

Figure 4.1 reports the incremental value of carbon emission rights to the US in 2010 and 2020. We focus first on 2010. In the most constrained scenario, the US must satisfy its emission reduction requirements within its own geographical boundaries. In this case, the value of emission rights approaches \$240 per ton. With Annex 1 trading plus CDM, the value drops to slightly less than \$100 per ton. As might be expected, the value of emission rights is lowest with full global trading. Here, it falls below \$70 per ton.

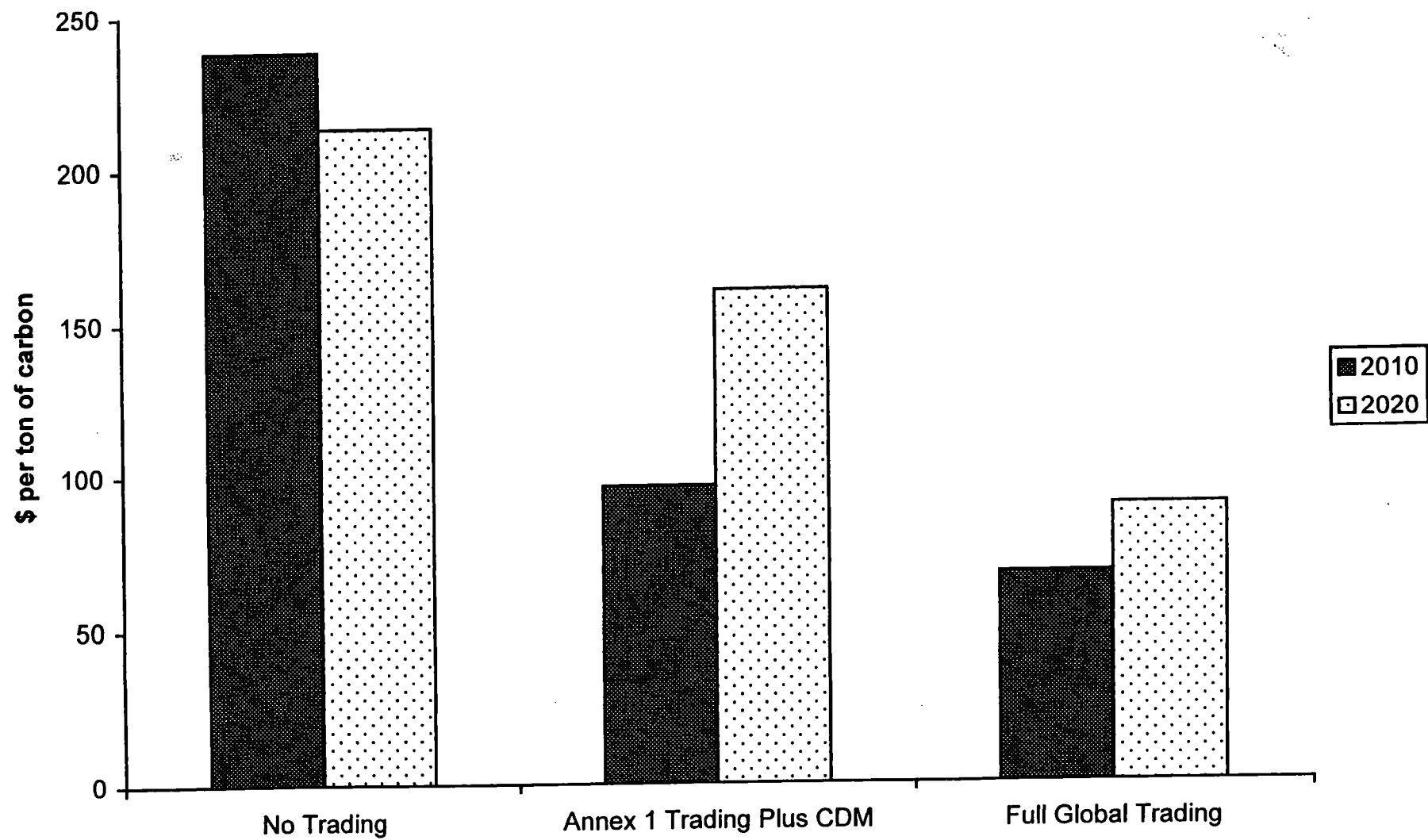
For the two scenarios in which trading is permitted, the value of emission rights increases in 2020. This is because EEFSU's projected emissions lie below its negotiated constraint for 2010. It has been allocated more emission rights than it needs to satisfy its internal obligations. By 2020, however, EEFSU's economic growth is expected to be such that it no longer enjoys an excess of emission rights. As a result, there is more competition for emission rights in the international marketplace, and there is an increase in their price.

Another way to view the costs of abatement is to show the GDP losses. Figure 4.2 contains those for the US. Losses are highest in the absence of trade. Here, they exceed \$80 billion dollars in 2010. This is approximately one percent of US GDP. To the extent that trade is introduced, losses decline. In the most optimistic scenario (full global trade), losses are approximately \$20 billion or one-quarter of one percent of GDP in 2010.

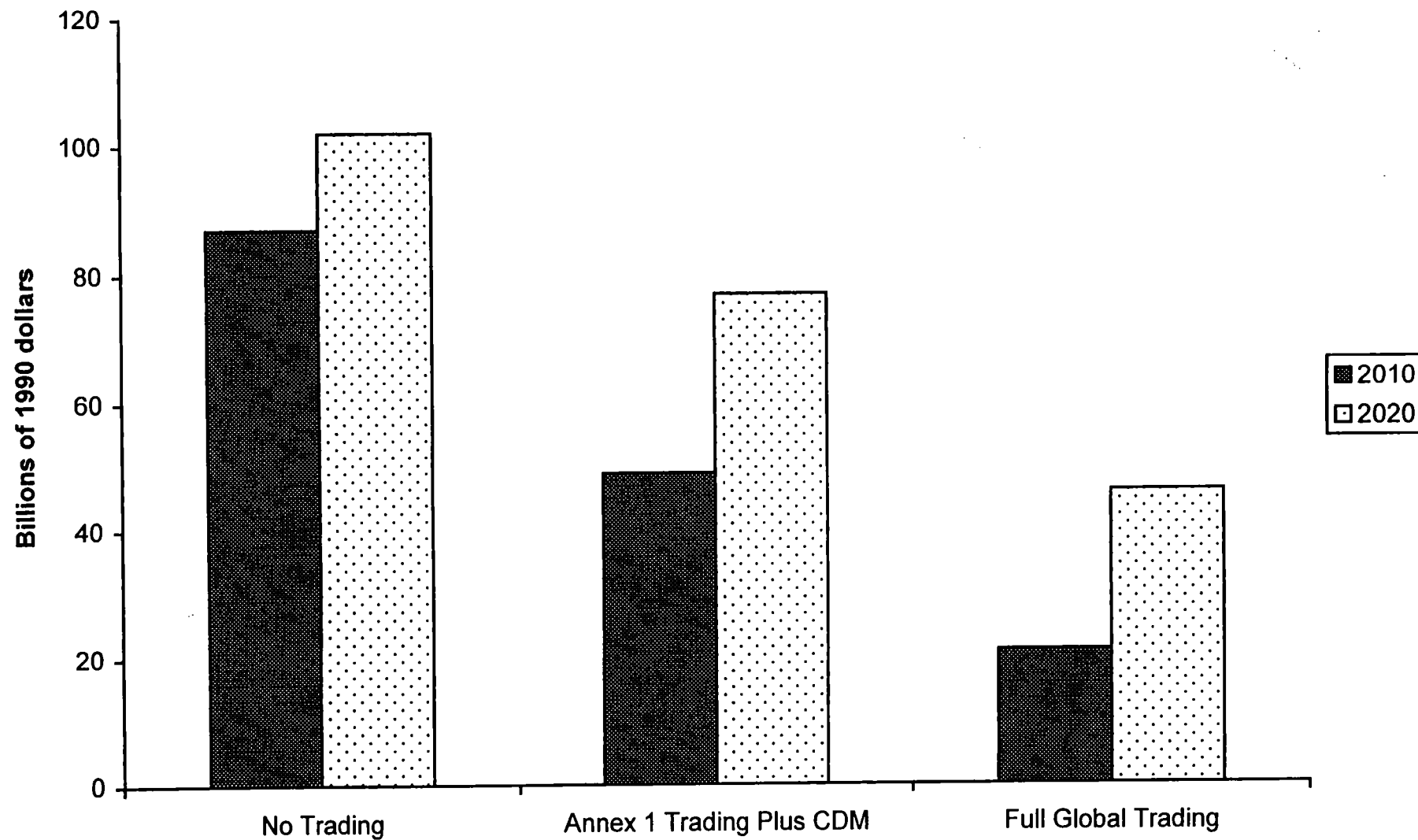
Of the three scenarios, "Annex 1 trading plus the CDM" is most consistent with the Protocol as it currently stands. However, the US Senate has stated that the US should not be a signatory to the Protocol if it does not mandate specific commitments for developing countries.¹³ If this were to result in full global emission trading, we move in the direction of the right-most bar of Figure 4.2.

There is, however, strong sentiment among many parties to the Framework Convention to substantially limit the extent to which Annex 1 countries can meet their obligation

Figure 4.1 Incremental Value of Carbon Emission Rights in US Under Kyoto Forever



**Figure 4.2 Annual US GDP Losses Under Kyoto Forever
(\$ billions)**



through the purchase of emission rights. Several influential developing countries have expressed strong opposition to the concept altogether. Figure 4.2 shows the costs of the no trading scenario. We now turn to the case where trading is permitted, but with limitations on the purchase of emission rights.

5. Limits on the purchase of carbon emission rights

Figure 5.1 shows our estimates of the percentage of the US emission reduction obligation that would be satisfied through the purchase of emission rights under base case assumptions. With full global trading (the least-cost of our three scenarios), trading is used to satisfy more than 50% of the US obligation. But suppose that limits are placed on the purchase of emission rights? For example, suppose that international negotiators agree that Annex 1 buyers can satisfy only one-third of their obligation through this means. What would be the impact on GDP losses?

If limit
purchase
to 1/3,

Figure 5.2 compares three cases. All assume full global participation in an international market for carbon emission rights, but only the first assumes no limits on the amount a country can buy. The second and third case are based upon the one-third limitation. We further make the distinction between a buyers' market and a sellers' market. With the former, sellers of emission rights are price takers. Buyers exert sufficient market power to hold the international price to the marginal cost of abatement in the selling countries. However, since a country is only able to satisfy one-third of its obligation through the purchase of emission rights, it must eventually rely on its own domestic marginal abatement capabilities to meet its obligations. Hence, there is an important distinction between the international price and the domestic price. Conversely, with a sellers' market, buyers face but one price. Here, the rents accrue to the sellers.

then

$P \approx 140$

Figure 5.3 shows the GDP losses associated with the three scenarios. Note that losses in 2010 are two and one-half to three times higher with the constraint on the purchase of carbon emission rights. That is, the benefits from "where" flexibility are greatly diminished. The message is clear. Developing country participation in the market for carbon emission rights is a necessary, but by no means a sufficient condition for reaping the full benefits of "where" flexibility. To achieve a cost-effective solution, buyers must also be unconstrained in the manner in which they fulfill their obligation.

losses
=

$2\frac{1}{2} - 3 \times$

unconstr.

Also note that the distribution of the rents makes a difference to GDP losses. US losses are 25% higher in 2020 when market power resides with the sellers. The analysis provides an additional message for Annex 1 buyers. If at a given point in time, low-cost sellers are concentrated among a few countries (e.g., EEFSU), they may have considerable potential for extracting monopoly rents.

6. The issue of carbon leakage

The Kyoto Protocol refers specifically to the period centered about 2010. During this period, the onus for emission reductions falls on Annex 1. No specific obligations are imposed on countries outside Annex 1, and there is the possibility of "leakage". That is,

Figure 5.1 Percent of US Obligation Satisfied Through the Purchase of Emission Rights

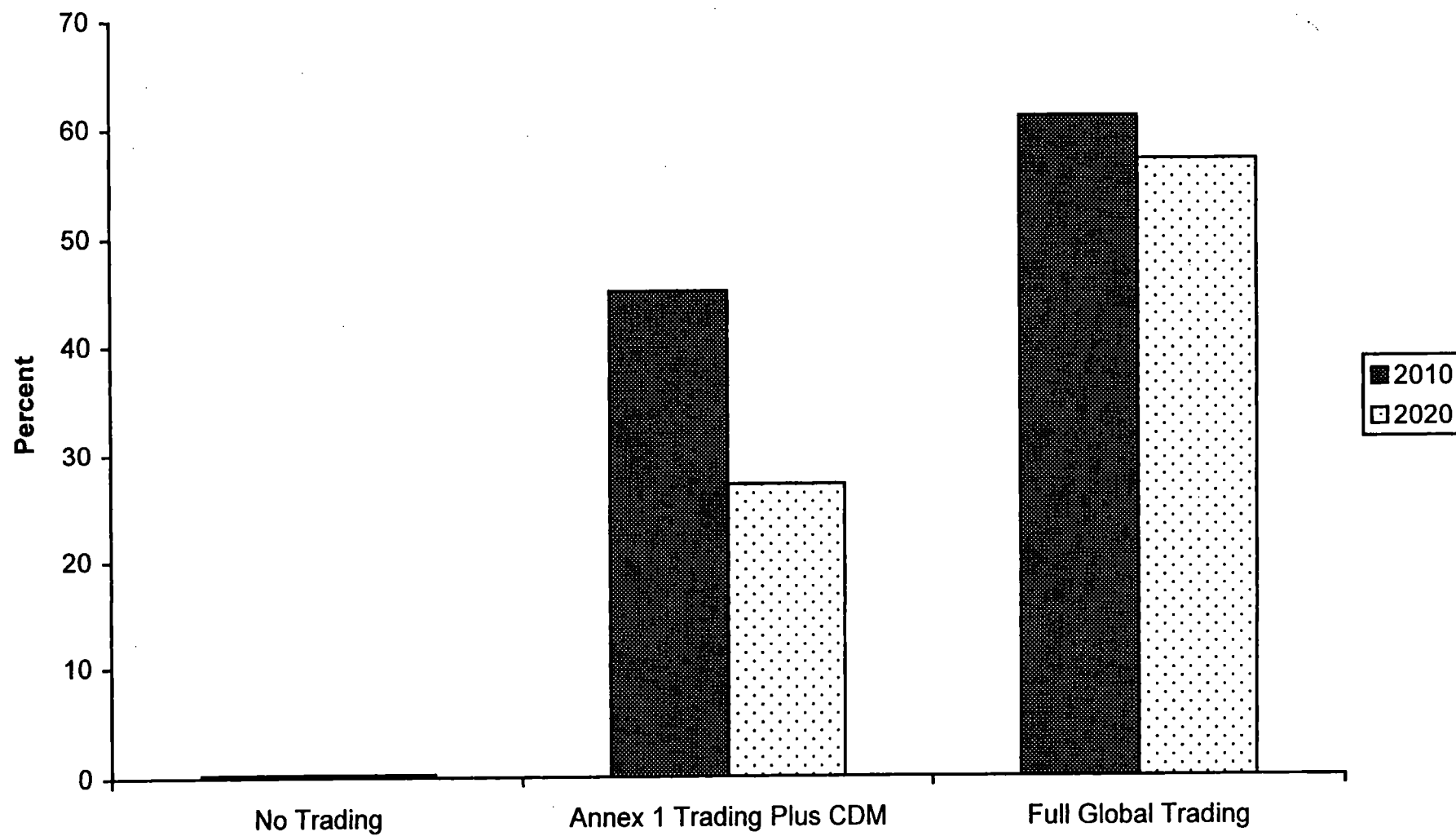


Figure 5.2 Incremental Value of Carbon Emission Rights With and Without Limits on the Purchase of Emission Rights -- Kyoto Forever

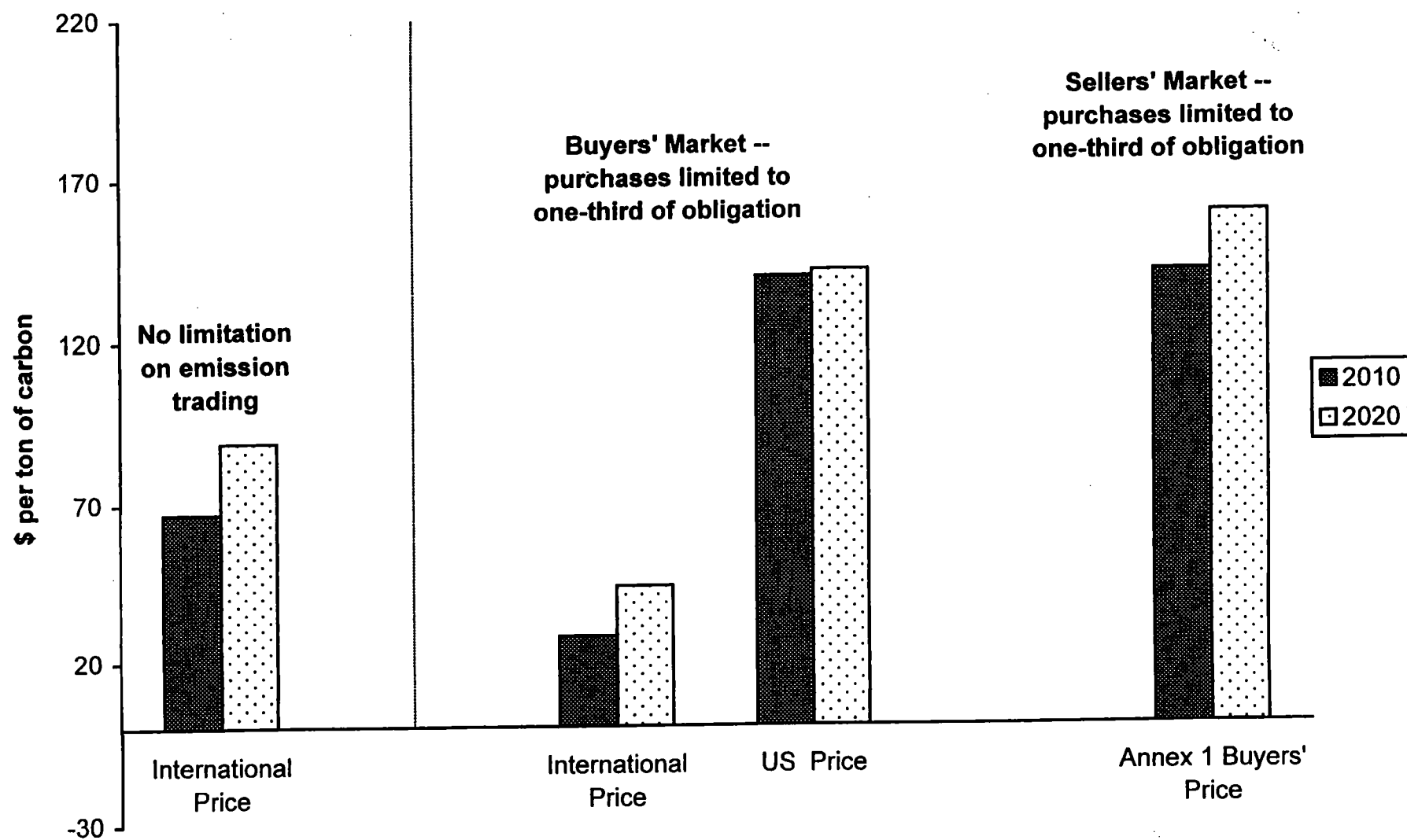
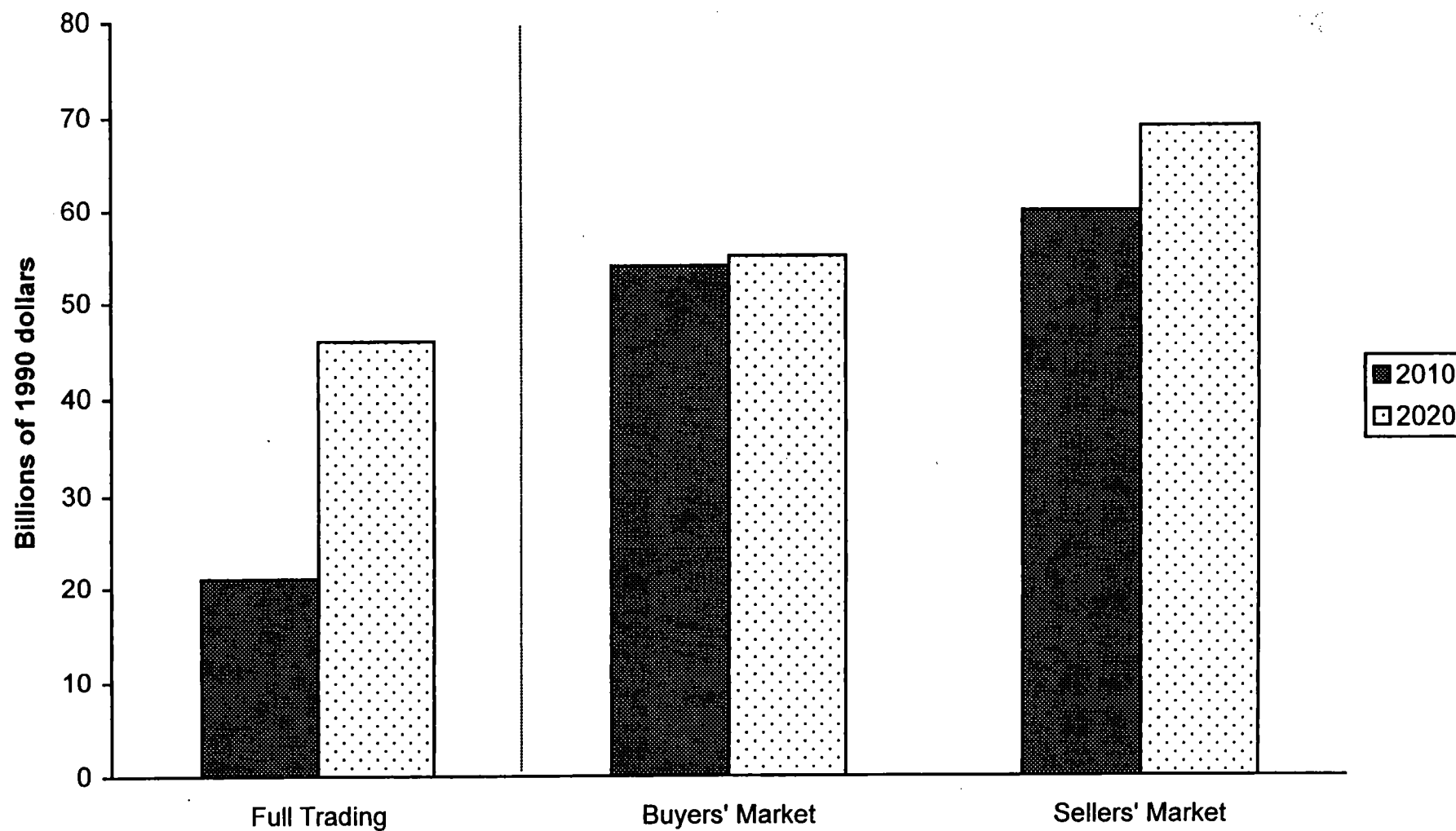


Figure 5.3 Annual US GDP Losses with Full Trading - Annex 1 May Satisfy Only One-Third of Obligation Through the Purchase of Emission Rights -- Kyoto Forever



the reductions in Annex 1 might be partially offset by increased emissions from China, India, Brazil and other countries that do *not* belong to Annex 1.

In this section, we examine the potential for leakage through international fuel markets and through the migration of energy-intensive industries. We therefore drop the assumption that non-Annex 1 countries are constrained to their reference case emissions. Two variants on the reference scenario are reported. In the first, the only trade impact of the Protocol consists of limiting the ability of the Annex 1 countries to import oil and gas. There is a lower international price of these goods, and there is a modest increase in price-induced demands by non-Annex 1 countries. However, there is no international trade in carbon emission rights, and there is no international migration of production within the energy-intensive sectors (EIS).

Leakage
via oil & gas

The second alternative is the same as the first, except that we now permit EIS trade. For a description of how the model has been modified to account for international trade in the energy-intensive sectors, see Appendix A. Figure 6.1 summarizes the overall results. According to this figure, neither of the two trade alternatives leads to a dramatic increase in carbon emissions outside Annex 1. Apparently there is an international leakage problem, but it appears to be of manageable dimensions.

not much

Figure 6.2 suggests a somewhat different interpretation. Here we report the EIS trade scenario, and we compare the impact upon production-consumption ratios in each region. Under the reference case, these ratios are close to unity (the horizontal line) in most regions. The bars in Figure 6.2 show that the Protocol could lead to serious competitive problems for EIS producers in the USA, Japan and OECD Europe. The Protocol would lead to significant reductions in their output and employment, and there would be offsetting increases in regions with low energy costs. One can easily anticipate calls for protection against "unfair competition". In its present form, the Protocol could lead to acrimonious conflicts between those who advocate free international trade and those who advocate a low-carbon global environment.

But energy-intensive sectors could move to LDCs
BUT

7. Evaluating Kyoto in the context of the longer-term goal

The objective of the Framework Convention is "the stabilization of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system."¹⁴ The drafters of the Protocol focused exclusively on the initial steps to be taken by Annex 1 countries. Little attention was paid to the ultimate goal. We now examine the Protocol in the context of a long-term stabilization objective.

From Figure 2.1 it is clear that the "Kyoto Forever" scenario will fail to stabilize global emissions and concentrations. A particular concentration target can be achieved through a variety of emission pathways. In this section, we explore three pathways for stabilizing concentrations at 550ppmv (twice preindustrial levels) by 2100. We stress, however, that the issue of what constitutes "dangerous interference" has yet to be determined. Indeed, it is likely to be the subject of intense scientific and political debate for decades to come. Hence, our choice of a target is meant to be purely illustrative.

**Figure 6.1 Carbon Emissions Outside Annex 1 --
Alternative Leakage Scenarios**

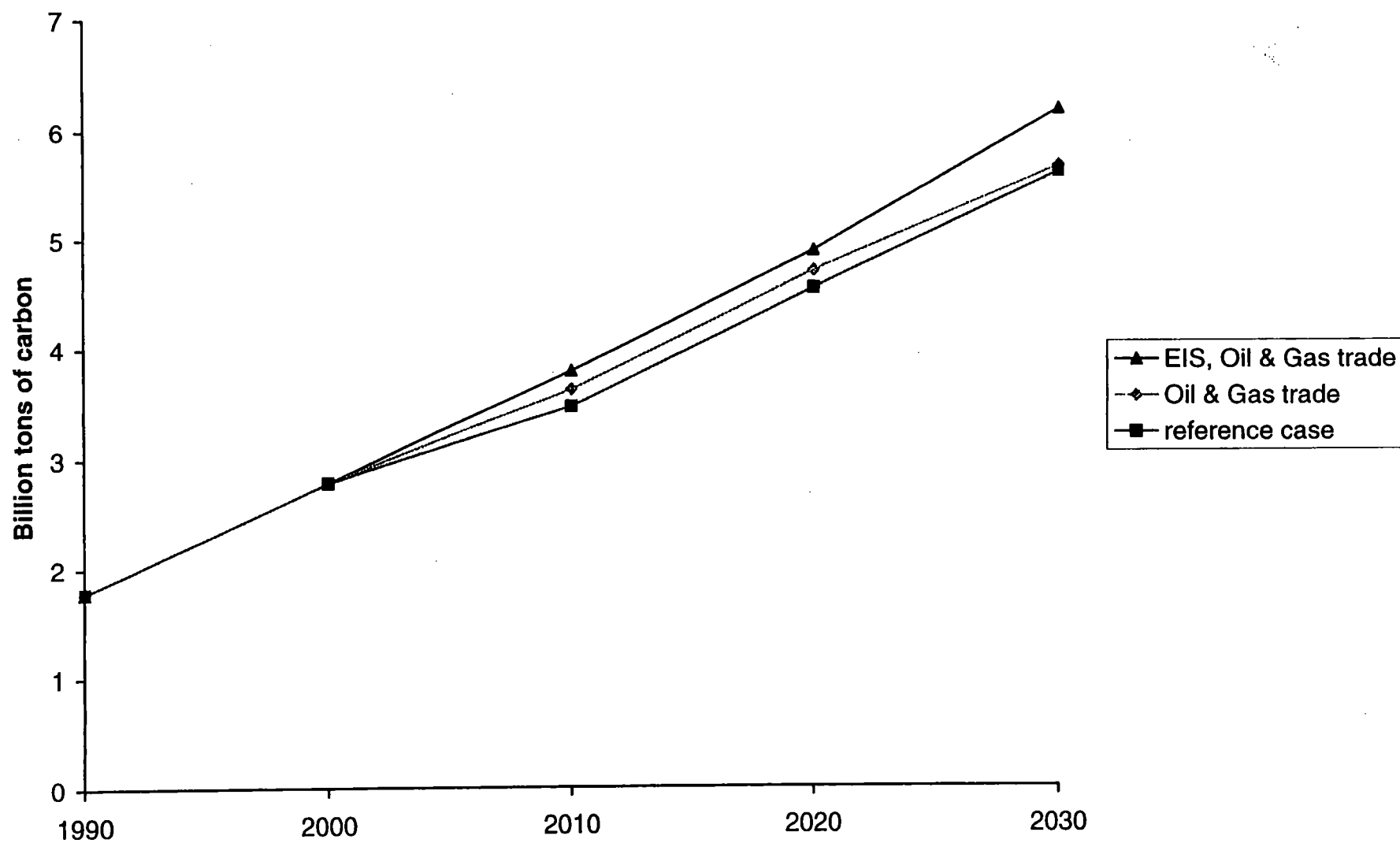
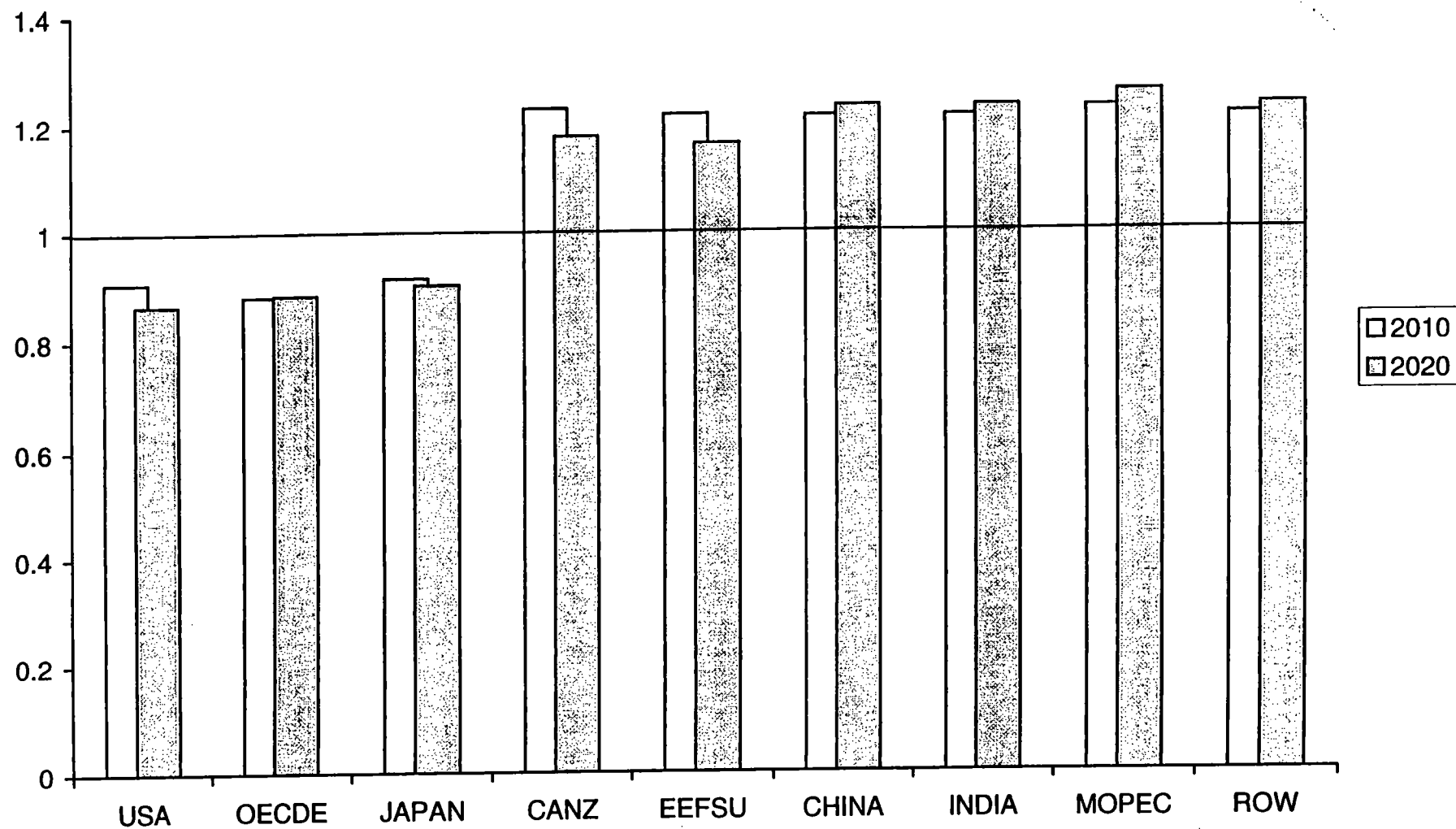


Figure 6.2 Ratios of Domestic EIS Supplies to Demands -- Kyoto with Leakage



Our three pathways are intended to illustrate the benefits of “when” flexibility. They are titled: 1) “Kyoto followed by arbitrary reductions”; 2) “Kyoto followed by least-cost”; and, 3) “least-cost”. As their names imply, the first two are designed to be consistent with the Protocol during the first commitment period. The third assumes a clean slate in the choice of emissions pathway throughout the 21st century.

For the first scenario, we assume that Annex 1 countries reduce emissions through 2030 at the same rate as the OECD during the first decade of the 21st century (2% per year). During this period, non Annex-1 countries are permitted to emit up to their reference case levels. By 2020, emissions in the developing nations are larger than those in Annex I. We then choose a pathway to stabilization which represents a relatively smooth transition to the target. As for the post-2030 burden-sharing scheme, we assume that between 2030 and 2050 all regions move to equal per capita emission rights (based on their 1990 population). Equal per capita emission rights have been proposed as one approach to international fairness, but there are others that might also serve to separate the issue of equity from that of economic efficiency.

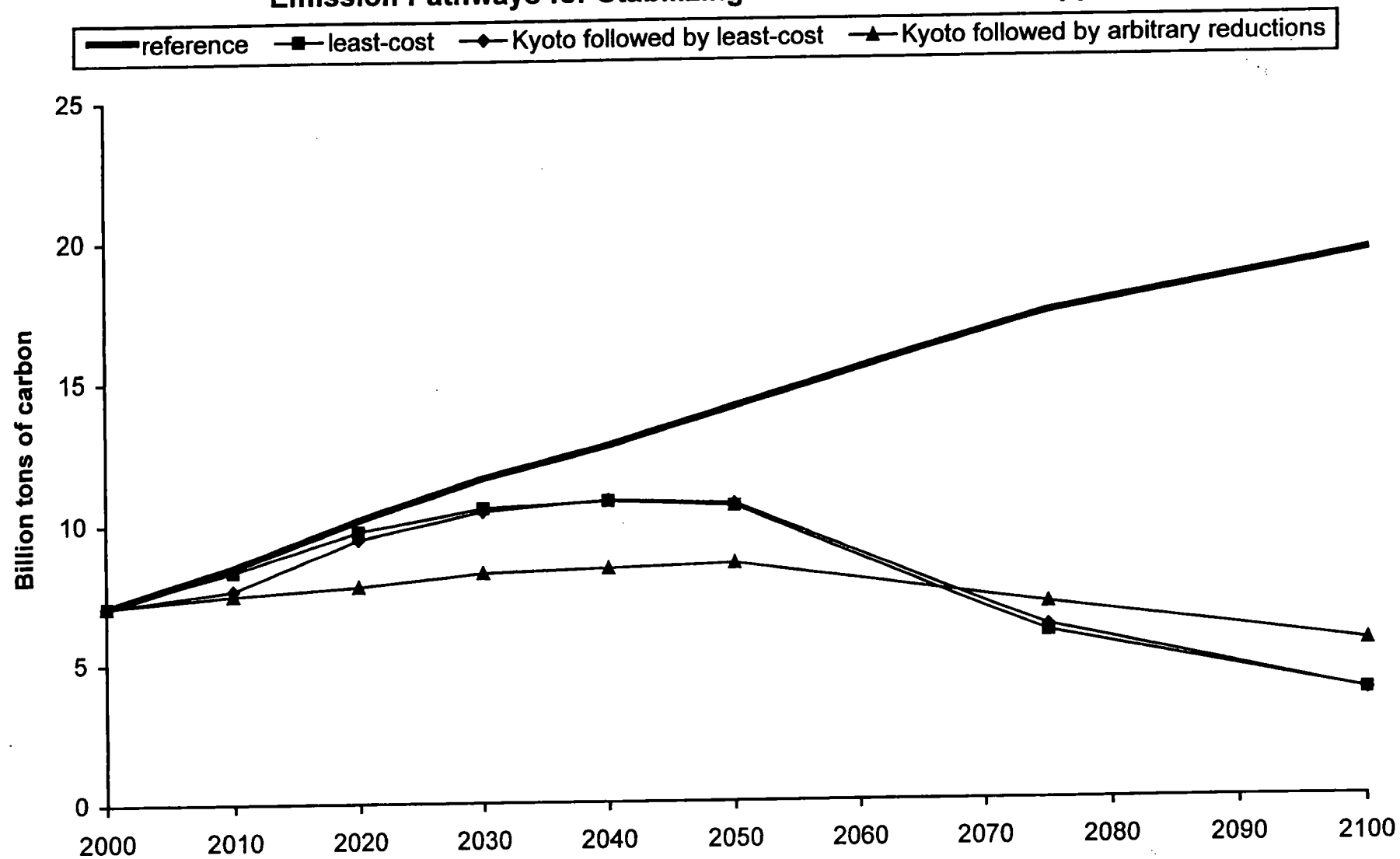
With “Kyoto followed by least-cost”, the Protocol is adopted for the initial commitment period. Thereafter, the most cost-effective pathway is followed for stabilizing concentrations at 550ppmv. With “least-cost”, the most cost-effective pathway for stabilizing concentrations at 550ppmv is followed from the outset. The latter two scenarios adopt the same proportionate burden-sharing scheme as the first.

All three scenarios assume Annex 1 trading plus the CDM. However, they differ as to the timing of developing country involvement in the international market for carbon emission rights. By definition, least-cost assumes that emission reductions will be made where it is cheapest to do so, regardless of the geographical location. Hence, in the least-cost scenario, we assume global emission trading from the outset. In the case of “Kyoto followed by least-cost”, we assume that global emission trading is delayed until after the first commitment period. With “Kyoto followed by arbitrary reductions”, global emission trading does not begin until 2030, the year that developing countries agree to lower their emissions below business-as-usual.

Global carbon emissions. Figure 7.1 shows global carbon emissions for the reference case and the three stabilization scenarios. Following a least-cost strategy from the outset results in an emissions pathway that tracks the reference path through 2010 and then departs at an increasing rate thereafter. There are several reasons why a gradual transition to a less carbon-intensive economy is preferable to one involving sharper near-term reductions.

Concentrations at a given point in time are determined more by cumulative, rather than year-by-year, emissions. Indeed, a concentration target defines an approximate carbon budget, i.e., an amount of carbon that can be emitted between now and the date at which the target is to be reached. At issue is the optimal allocation of the budget. Reasons for relying more heavily on the budget in the early years include: 1) providing more time for the economic turnover of existing plant and equipment, 2) providing more time to

Figure 7.1 Global Carbon Emissions -- Reference Case and Three Alternative Emission Pathways for Stabilizing Concentrations at 550ppmv



develop low-cost substitutes to carbon-intensive technologies, 3) providing more time to remove carbon from the atmosphere via the carbon cycle, and 4) the effect of time discounting on mitigation costs.¹⁵

We next turn to the two scenarios where we adopt the Protocol for the first commitment period. Notice that the two emission pathways behave quite differently post-2010. "Kyoto followed by least-cost" follows the least-cost pathway once the Protocol's constraints are relaxed. "Kyoto followed by arbitrary reductions", on the other hand, bears no resemblance to the least-cost pathway. What is striking about Figure 7.1 is that with a 550ppmv target, the Protocol is inconsistent with the most cost-effective mitigation pathway, i.e. "least-cost". Indeed, it appears that the ultimate target would have to be considerably lower than 550ppmv for the Protocol to be justified in terms of cost-effectiveness.

Near-term losses. It is instructive to look at the incremental value of emission rights for the three stabilization scenarios (Figure 7.2). With the least-cost path, the value is relatively low in the early years (\$11 per ton of carbon in 2010), and it rises gradually over time. With "Kyoto followed by least-cost", the value is \$130 per ton in 2010 and then tracks the least-cost path thereafter. In the case labeled "Kyoto followed by arbitrary reductions", the incremental value of emission rights starts at about \$160 per ton and it remains high.

Figure 7.3 shows US GDP losses in 2010 and 2020 under the three stabilization scenarios. Notice that GDP losses in 2010 differ for the two scenarios involving the initial adoption of the Protocol. Because of the long-lived nature of energy investments, investors are concerned both with what happens in the initial commitment period and what happens thereafter. In the case of the more rapid transition away from the baseline ("Kyoto followed by arbitrary reductions"), investors will be forced to invest more heavily in high-cost substitutes in the early years. With "Kyoto followed by least-cost", they will have more flexibility.

It is striking by how much GDP losses can be lowered under the "least-cost" scenario. This strategy involves a more gradual transition away from the baseline in the early years. It relieves much of the pressure for premature retirement of existing plant and equipment and for dependence on high-cost substitutes (both on the supply- and demand-sides of the energy sector). Relative to the reference case, the US also receives some benefits as an oil importer. Recall that a carbon constraint decreases the overall demand for oil and lowers its price on the international market.

Global losses. Finally, it is instructive to examine losses from a global perspective (Figure 7.4). For purposes of the present comparison, we focus on the present value of consumption losses over the 21st century discounted to 1990 at 5 percent. The relative magnitude of the cumulative losses for the three stabilization scenarios comes as no surprise given the previous discussion. "Kyoto followed by arbitrary reductions" is by far the most expensive of the three paths. "Kyoto followed by least-cost" is a considerable

Figure 7.2 Incremental Value of Carbon Emission Rights under Three Alternative Emission Pathways for Stabilizing Concentrations at 550ppmv -- Global Trading

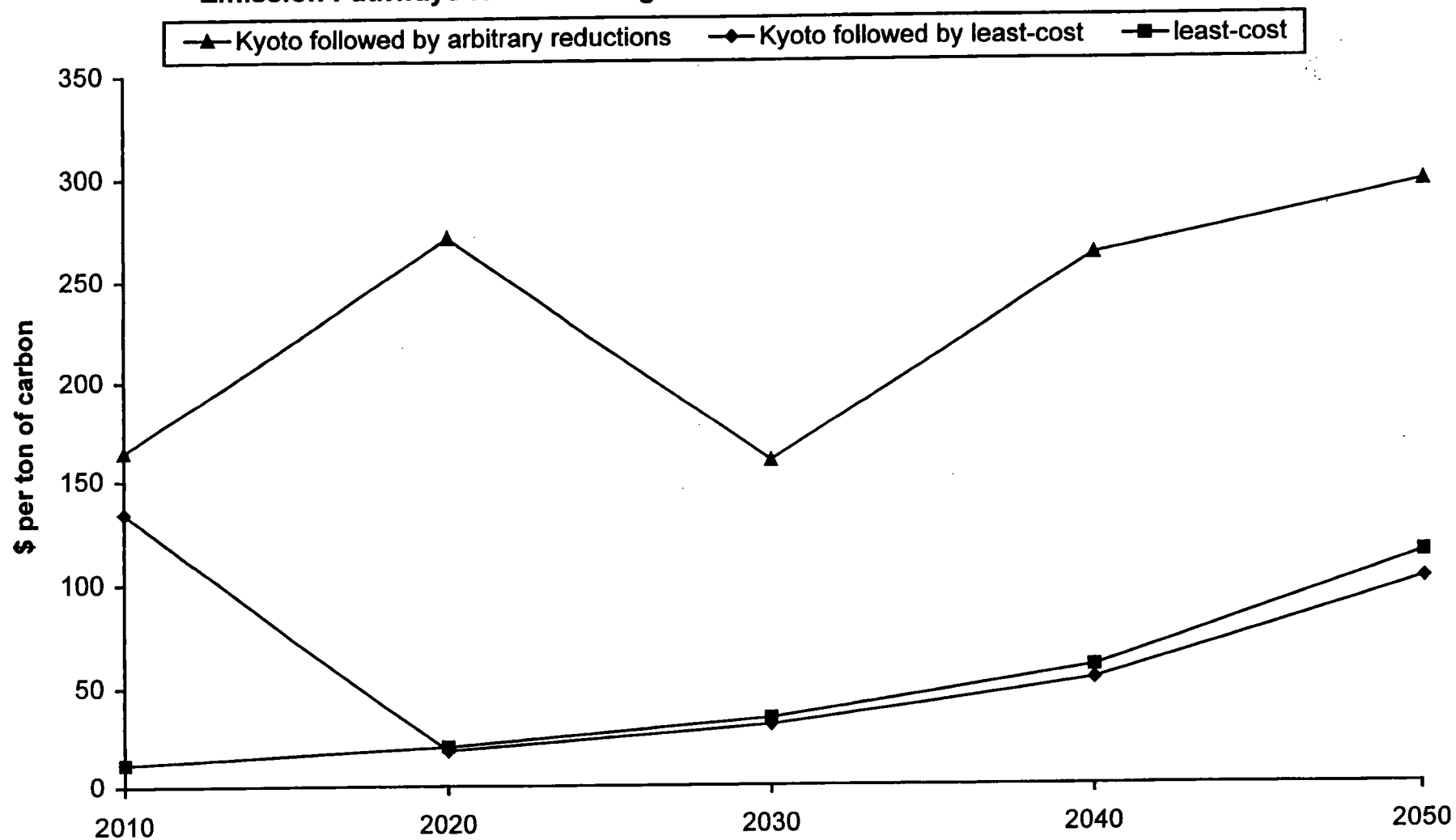
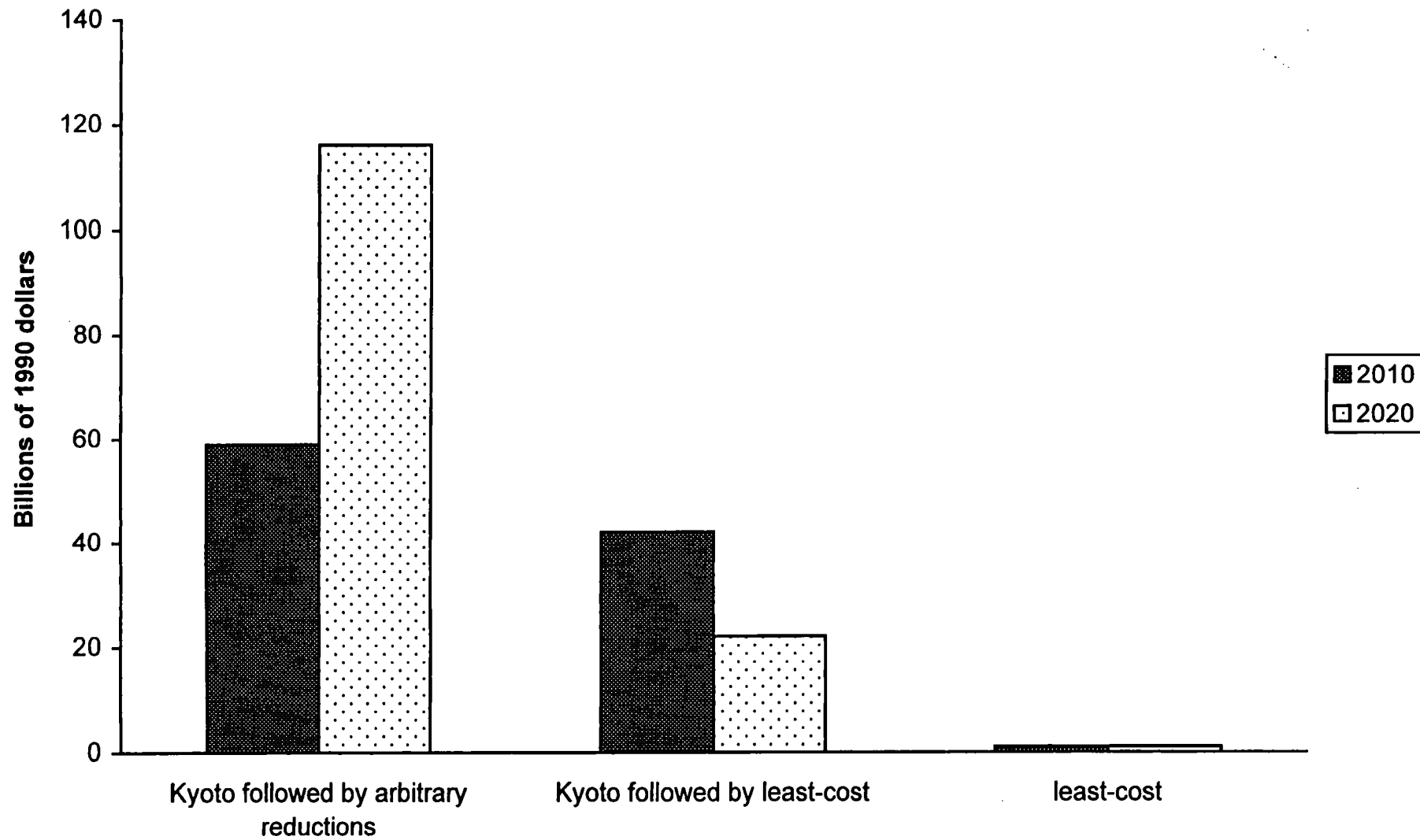
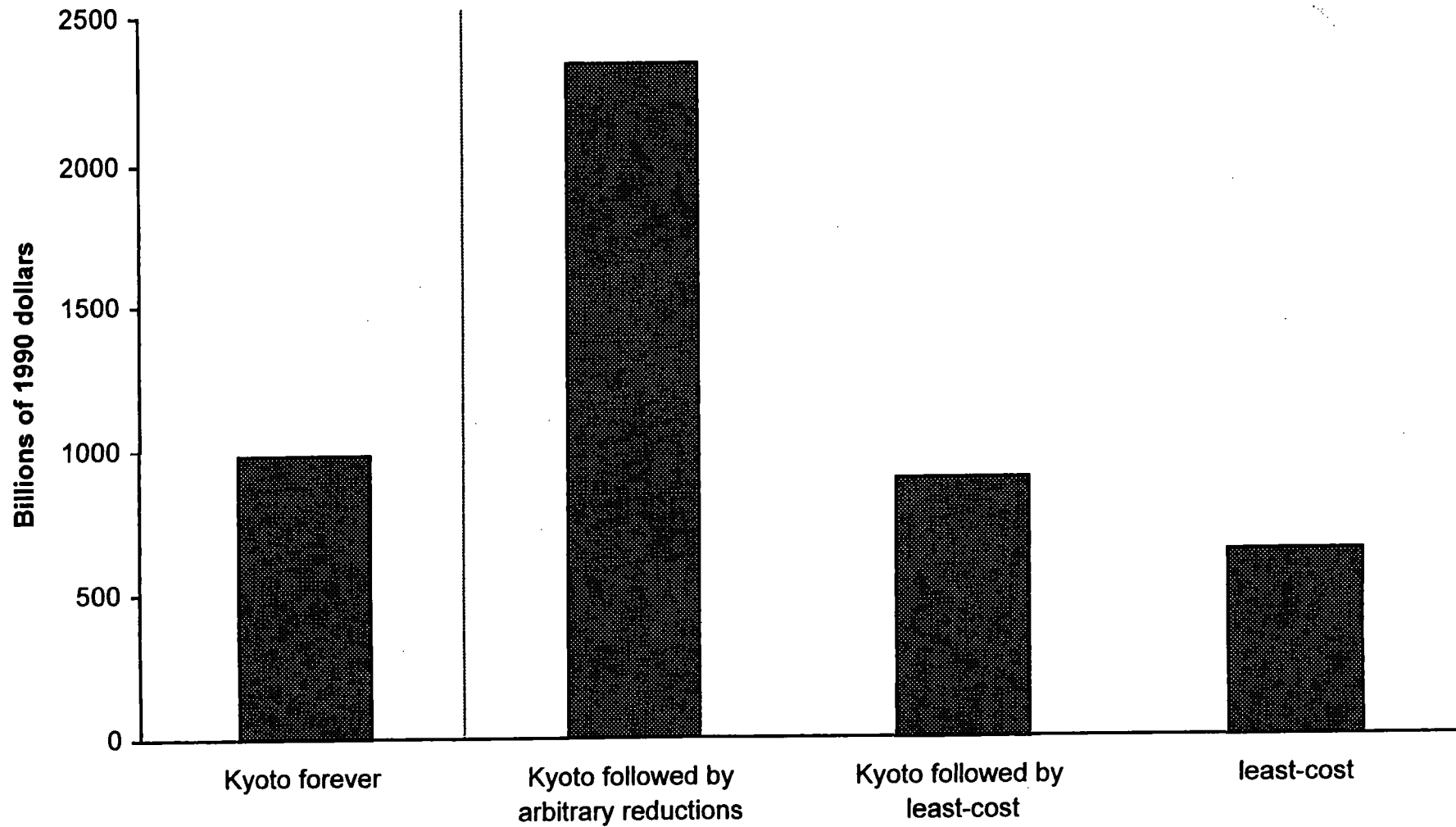


Figure 7.3 US GDP Losses Under Alternative 550ppmv Stabilization Scenarios



**Figure 7.4 Global Consumption Losses through 2100 Discounted to 1990 at 5% --
Kyoto Forever vs. Three Scenarios for Stabilizing Concentrations at 550ppmv**



improvement, but is still 40% more expensive than embarking on the most cost-effective mitigation pathway from the outset.

What is surprising is that "Kyoto Forever" turns out to be more expensive than "Kyoto followed by least cost" or "least cost". "Kyoto Forever" results in sharper global emission reductions during the early decades of the 21st century. It does not, however, succeed in stabilizing emissions, much less concentrations. By contrast, the other scenarios all lead to stabilization at 550ppmv. In other words, "Kyoto Forever" ends up costing more, and it buys less long-term protection.

8. Further comments

Some suggest that models such as MERGE tend to *overestimate* the costs of mitigation. They argue that, when prospects for technical progress are incorporated, the costs of a carbon constraint, even a sharp near-term constraint, will be minimal. We, too, are optimistic about the outlook for technical innovation. Indeed, such innovation is embedded both in our reference case and in the policy scenarios. The disagreement is over the rate at which such progress will occur. We do not believe that economically competitive substitutes will become available at such a rate as to trivialize the costs of a Kyoto-like Protocol.

A more valid concern may be that we are *underestimating* the costs of a carbon constraint. There are several reasons why this may be the case. To begin with, optimization models assume that decision makers have perfect foresight. That is, they assume that investors are fully informed about the nature of future constraints, and act accordingly. Given the present state of uncertainty, this is highly unlikely. Models such as MERGE also tend to ignore short-term macro shocks. For example, the higher energy prices brought about by a carbon constraint are likely to be inflationary. If this leads to higher interest rates, investment may be dampened. The result would be a slowdown in economic growth.

In addition, we assume that policies will be efficient. That is, market mechanisms will be chosen over "command and control" approaches to accomplishing environmental objectives. Whereas, in recent years, there has been an increasing trend toward market mechanisms, the approach to be taken with climate policy is by no means assured. Moreover, even if such a commitment were made, we have no assurances that the requisite international institutions will be available when needed.

Although it is easy to quibble over the numbers, the real value of analyses lies more in insights than in numerical values. And, indeed we believe that the current exercise has yielded several insights that may be of value to those charged with interpreting the current proposal. Here, we summarize what we have learned:

- First, it is extremely unlikely that a "Kyoto Forever" scenario will stabilize emissions -- much less concentrations. Non-Annex 1 emissions are quickly overtaking those of the OECD and the economies in transition. Hence, meeting the stabilization goal of

the Framework Convention will eventually require the participation of developing countries.

- International cooperation through trade in emission rights is essential if we are to reduce mitigation costs. The magnitude of the savings will depend on several factors. These include the number of countries participating in the trading market, the shape of each country's marginal abatement cost curve, and the extent to which buyers can satisfy their obligation through the purchase of emission rights.
- With regard to the latter, limitations on the purchase of emission rights may be especially costly. In the example explored here, limiting purchases to one-third of a country's obligation increased GDP losses by a factor of at least two and one-half in the year 2010. If proponents of such limitations are successful, they may seriously reduce the benefits from "where" flexibility.
- The issue of monopoly power in markets for emission rights may turn out to be important. This is most likely to occur if trading is limited to Annex 1 and the majority of inexpensive emission rights are concentrated in a small number of countries. If these countries were successful in organizing a sellers' cartel, they might be able to extract sizable rents.
- The near-term costs of the Protocol will depend on expectations regarding the future. Energy investments are typically long-lived. Today's investment decisions are not only influenced by what happens during the next decade, but also by what happens thereafter. Hence, analyses which focus solely on 2010 may be underestimating the costs of Kyoto.
- Finally, and perhaps most importantly, unless the concentration target for CO₂ is well below 550ppmv, the Protocol appears to be inconsistent with a cost-effective long-term strategy for stabilizing CO₂ concentrations. Rather than requiring sharp near-term reductions, it appears that a more sensible strategy would be to make the transition at the point of capital stock turnover. This would eliminate the need for premature retirement of existing plant and equipment and would provide the time that is needed to develop low-cost, low-carbon substitutes.

References

- ¹ Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", Third Session Kyoto, 1-10 December.
- ² 105th Congress, 1st Session (1997), S. Res. 98.
- ³ Intergovernmental Negotiating Committee for A Framework Convention on Climate Change (1992). Fifth Session, Second Part, New York, 30 April-9 May.
- ⁴ IPCC (1997). "Stabilization of Atmospheric Greenhouse Gases: Physical, Biological and Socio-Economic Implications", Technical Paper III.
- ⁵ Intergovernmental Negotiating Committee for A Framework Convention on Climate Change (1992), op. cit.
- ⁶ Manne, A., Mendelsohn, R., and Richels, R. (1995). "MERGE: a model for evaluating regional and global effects of GHG reduction policies", *Energy Policy*, 3 (1).
- ⁷ Manne, A., and Richels, R. (1995). "The Greenhouse Debate: economic efficiency, burden sharing and hedging strategies", *The Energy Journal*, 16 (4).
- ⁸ IPCC (1994). *Climate Change 1994*, Cambridge University Press.
- ⁹ Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", op. cit.
- ¹⁰ Richels, R., Edmonds, J., Gruenspecht, H., and Wigley, T. (1996). "The Berlin Mandate: The Design of Cost Effective Mitigation Strategies", EMF-14, Working Paper 3, Stanford University, Stanford, CA.
- ¹¹ Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", op. cit.
- ¹² Conference of the Parties (1997). "Kyoto Protocol to the United Nations Framework Convention on Climate Change", op. cit.
- ¹³ 105th Congress, 1st Session (1997), S. Res. 98.
- ¹⁴ Intergovernmental Negotiating Committee for A Framework Convention on Climate Change (1992), op. cit.
- ¹⁵ Wigley, T., Richels, R., and Edmonds, J. (1996). "Economic and Environmental Choices in the Stabilization of Atmospheric CO₂ Concentrations", *Nature*, Vol. 379, 18 January.

Appendix A. Modeling international trade in the energy-intensive sectors

MERGE 3.0 has recently been modified to include the possibility of trade in EIS (energy-intensive sectors). EIS is an aggregate including ferrous and non-ferrous metals, chemicals, nonmetallic minerals, paper, pulp and print. This aggregate does not include the energy-intensive industry of petroleum refining. The model may be run either with or without EIS trade.

The new feature is introduced in a way that preserves the basic simplifying characteristics of the ETA-MACRO submodel. That is, energy, capital and labor are substitutes that enter into an aggregate production function. They produce a numeraire good which may be used for consumption, investment and interindustry payments for energy costs.

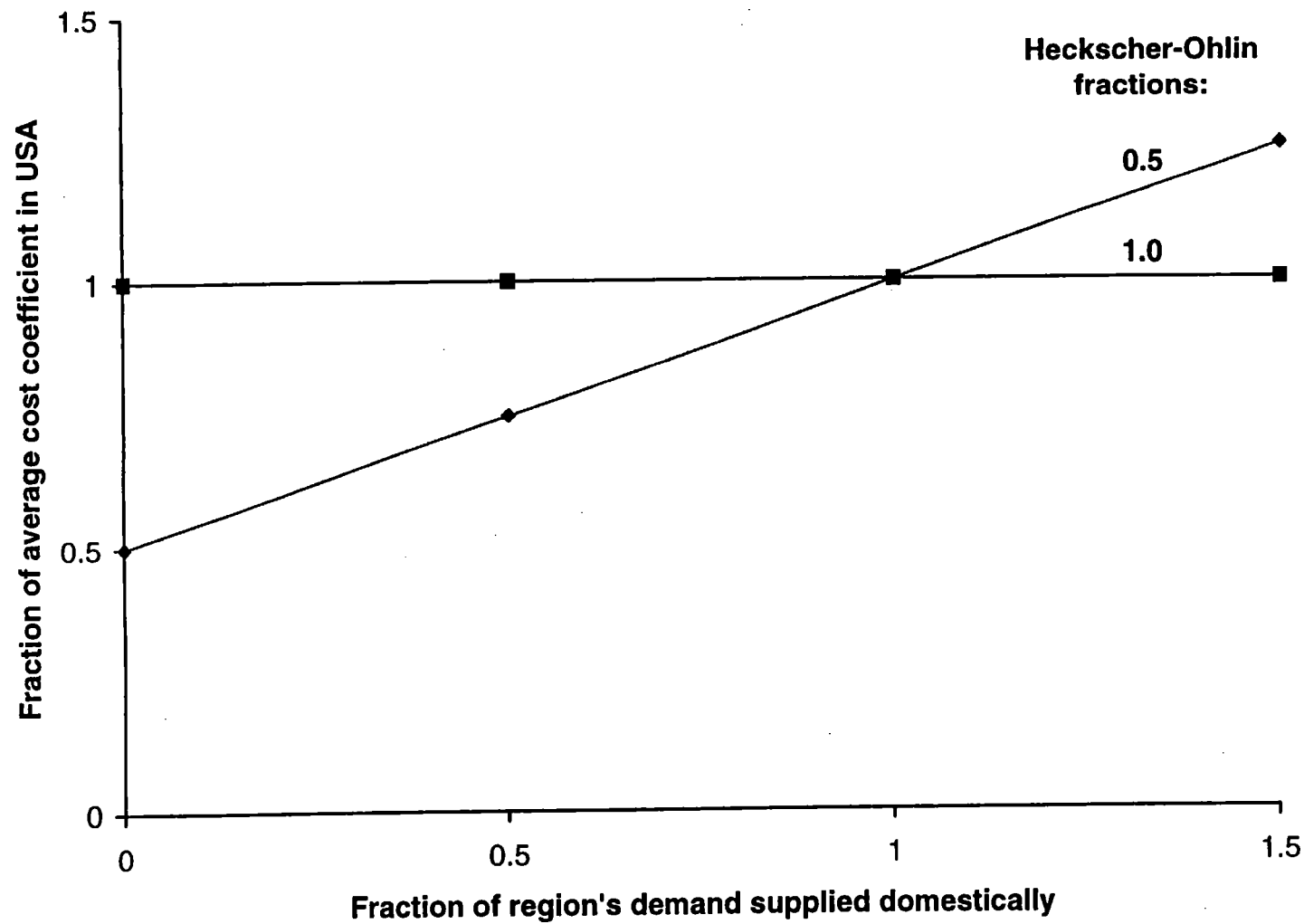
It is assumed that trade will continue to represent a relatively small amount of each region's total internal demand for EIS. The GTAP (General Trade Analysis Program, 1992) data base is employed to estimate each region's EIS demands. In all other respects, the model is the same as MERGE 3.0.

For projecting the impact of the Kyoto protocol, each region is taken to be self-sufficient at base year energy prices. Changes in the location of production are attributed primarily to changes in the cost of energy. At base year prices in the USA, 85% of the cost of EIS consisted of non-energy inputs (labor, shipping, capital, iron ore, etc.), and 15% of the cost consisted of energy inputs (half electric and half non-electric). Under these conditions, a doubling of energy prices would imply only a 15% increase in the cost of EIS. This is why it is assumed that the demand for EIS is inelastic with respect to the price of energy. For projecting future demands, the income elasticity is taken to be 0.5.

For modeling purposes, we have supposed that the marginal supplies of EIS in all regions are determined by the same international technology that prevails in the USA. Each region has the same energy-EIS production ratio. For non-energy inputs, each supply curve is linear. Its positive slope serves the same purpose as an Armington elasticity describing substitution between foreign and domestic goods. This is the way in which we avoid penny-switching as a characteristic solution mode.

The slope of the non-energy supply curve is described as a Heckscher-Ohlin fraction. If this fraction is unity, EIS is viewed as a perfectly homogeneous commodity. Small changes in energy costs will then lead to large changes in the international location of production. If this fraction is less than unity, the supply function is less elastic, and the changes in location will be less dramatic. (See Figure A.1.)

**Figure A.1 EIS Supply Curves --
Marginal Cost of Non-Energy Inputs to EIS**



5.7
3500
308
458

5.8
3500
348
120

The Kyoto Treaty: Economic and Environmental Consequences

Jeffrey Frankel

Member, President's Council of Economic Advisers

comments for presentation at

Climate Change Policy:

Practical Strategies to Promote Economic Growth and Environmental Quality

forum sponsored by American Council for Capital Formation

The National Press Club, Sept. 23, 1998 +

I will make some general comments about the Administration position on the Kyoto Agreement, before commenting on the excellent paper of Alan Manne and Rich Richels.

The Administration Economic Analysis

The key bottom line of the economic analysis that we released in July was as follows, in qualitative terms: *Given key elements of the Agreement and of Administration policy (including tradeable permits and other flexibility features), the U.S. economic impacts are likely to be modest.*

Those key features are of several sorts. The Administration insisted that the design of the agreement be market-based, flexible, and global. The flexibility comes in three categories:

- "When" flexibility
 - 1st-period reductions less drastic than some countries wanted
 - targets phrased as multi-year averages
 - banking
- "What" flexibility
 - 6 gases included, not just carbon dioxide
 - sinks
- "Where" flexibility
 - international trading in emission permits
 - CDM

Finally, we require a global solution, to address a global problem.

- Without meaningful LDC participation, the President will not submit the Treaty for Senate ratification

Economic analysis of climate change policy is difficult for many reasons, which again fall into three categories.

- It is impossible to put a single monetary number on the benefits of averting Global Climate Change. It is difficult enough to put numbers on the economic costs of a 2-to-6

degree F increase in temperature or a 6-inch to 3-foot rise in sea level, which is what the IPCC scientists are forecasting for the next 100 years. But that difficulty pales next to the uncertainties surrounding the appropriate discount rate, danger of catastrophic climate events, and appropriate risk aversion.

- Some terms of the international agreement are still uncertain.
- Econometric models are subject to inevitable limitations. Some models are good at some things, other at others. No one model does it all. The estimates of each are subject to wide bands of uncertainty,

Despite these difficulties, we used some estimates based on Battelle Labs' SGM (directed by Jae Edmonds), a model that is well-designed to handle international trading. The most important quantitative findings, supporting the qualitative finding that I led with, were as follows.

- Full and successful implementation of Annex I trading would reduce costs by one-half, relative to a situation where each country had to satisfy its commitment domestically.
- Full and successful implementation of global trading (including developing countries) would reduce costs by 80-87%.
- Global trading would reduce resource costs by an estimated \$7-\$12 b/yr in 2010, which is 0.1 % GDP in 2010. This is a cost that I would describe as, if anything, less than modest.
- The effect on the price of carbon is estimated at \$14-\$23/ton.
 - Δ price of natural gas = 3-5 %
 - Δ price of fuel oil = 5-9 %
 - Δ price of gasoline = 4-6¢ / gal.
 - Δ price of electricity = 3-4 %
- Effect on the energy bill of the average household is estimated at \$70-\$110

The SGM model, along with the MERGE model of Manne and Richels and many other leading econometric models, participates in the Stanford-based Energy-Modeling Forum. The most recent compilation by the EMF of the results of ten of these models shows the SGM, the model that we used, in the middle of the pack of estimates of the costs of Kyoto, when standardizing on the policy experiment under consideration. The SGM's estimates of costs in 2010 near the median in the experiment with no international trading or in the case with Annex I trading. With full global trading, SGM cost estimates are a bit below the median, but far from the lowest of the models.

In one respect, our estimates are optimistic: we cannot be sure of getting full developing-country participation in the near future. But in other respects they are conservative. They omit some factors that would reduce the net costs of the agreement:

- The Administration proposal for Federal electricity restructuring, which we consider part of our energy-and-environment policy, would save approximately \$20 billion in costs -- potentially enough to offset the increase in the household energy bill.
- Allowance for sinks, such as land forestation, would potentially reduce the need for emission reductions substantially.
- The President's proposal to allocate \$6.3 billion over the next five years in Research and Development and tax breaks to develop and disseminate carbon-saving technologies could further reduce costs if it were enacted and if some of the technological payoff were to come in the next ten years. To be conservative, we assumed that it did not.
- Ancillary non-climate benefits, such as the health benefits of reduced air pollution could reduce net costs by an estimated one-quarter.
- Of course, the most important factor that has been left out of the above assessment is the benefit of mitigating climate change itself. (A full cost-benefit analysis would include mitigation in the benefits column. The only reason we have not done so, explained repeatedly above, is the difficulty in coming up with a number to capture the monetary benefits.) But nobody should lose sight of our ultimate objective -- keeping our planet the hospitable home that we enjoy today.

The Manne-Richels paper

Alan Manne and Rich Richels have done some of the most important and pioneering work in the economic modeling of climate change policy. They have been at the frontier, being the first, for example, to address the theoretically optimal time-path of GHG emissions over the coming century to get to a given environmental goal in terms of concentrations in the atmosphere. In their latest paper they have updated their model, and included analysis of some of the policy questions that are most topical in the ongoing negotiations.

In particular, of the various questions still to be settled in international negotiations, the two most important both receive useful analysis here. The first is what would be the likely effect of the caps on trading that have been proposed by European countries; the second is the importance of participation by developing countries. That first question, regarding trading caps, has shaped up to be probably the most contentious at the upcoming Buenos Aires negotiations. The second issue may be the most contentious thereafter.

I already have explained that the ability to buy and sell emission permits is critical to our view of the Kyoto Protocol. It allows us to achieve the same environmental goal at lower economic costs. The Manne-Richels estimates using their MERGE model are in this regard very similar to ours: trading among the "Annex I" countries reduces costs by more than half.

Unfortunately, not all countries share the American enthusiasm for trading. Some

countries, particularly the EU, are not completely convinced of the case in favor of trading. They insist that trading should be only supplemental, by which I fear they mean that the United States must accomplish most of its reductions (relative to the Business as Usual path) through domestic reductions, rather than purchases. Some Europeans may be driven by a primitive distrust of trading in general, analogous to those who believe that everybody should grow his or her own food. Others are in effect protesting the allocation of emission rights at Kyoto, believing the US and FSU allocations to be too generous. This is what it must mean to complain that the US needs to make more of a domestic sacrifice, or that Russia shouldn't be allowed to sell hot air. (It is not always easy to distinguish that belief from a -- logically quite distinct -- failure to understand that for any given allocation of emission rights, trading lowers the cost of the same environmental outcome. One of the great feats of Kyoto is that the Annex I countries were able to agree on the allocation of property rights, in a context where many of us had thought the political obstacles might be insuperable.)

In any case, some Europeans want to place quantitative limits on how much countries can buy. Such limits would operate as import quotas do for trade in agricultural commodities and other goods. They have the same drawbacks: they would artificially raise the price of emissions in the buying country, they would introduce an extra degree of complication, government bureaucracy, and rent-seeking into the marketplace, and they would generally impede efficiency. The US has said that it will not agree to trading limitations at Buenos Aires.

We have estimated that such limits could raise the cost of compliance substantially for the United States, and even more so for Europeans and others. A 50% limit rule could raise the price of carbon by an estimated 157 %. **[HOW MUCH DOES THIS RAISE COSTS?]** These estimates are based on an application of the SGM model of Battelle Labs [and they assume the regime we aspire to: participation and trading among key developing countries in addition to Annex I].

Manne and Richels consider a related experiment, what would happen if a limit were imposed on purchases equal to 1/3 of countries' commitments. Estimated costs are 2 ½ to 3 times higher than under full and unconstrained trading.

Even if we succeed in overcoming European objections to trading at Buenos Aires, a second -- even more daunting -- hurdle awaits us: convincing the developing countries to participate in the effort in a more meaningful way than they have in the past.

US Senators say we need developing country participation because otherwise we will lose competitiveness. I agree that we need the developing countries, but I would phrase the reasons differently. Any major structural change in the economy (like an increase in the price of energy) is likely to result in the expansion of some sectors and the contraction of others. The Manne-Richels paper reports likely negative effects -- "loss in competitiveness" -- in energy-intensive manufactures. But, as the paper mentions, other sectors will gain competitiveness. It is not clear that the overall effect will be negative. I am not aware of a study that has been able to address

that question.¹

The reasons we need the LDCs are, rather:

- they are the fastest-growing emitters (so “fairness” demands their inclusion),
- without participation by the developing countries problems of free-riding and leakage would render an agreement ineffective at its environmental goals,
- their participation is needed to reduce economic costs to US compliance [by as much as 80% in our estimates, somewhat less in Manne-Richels], and
- the Senate will not ratify a treaty without them.

Manne and Richels offer estimates of the magnitude of leakage -- that is, the possibility that reductions in emissions in the industrialized countries under the agreement would be partly offset by increases in emissions in non-participating developing countries. They look at two sources of leakage: first the effect that lower demand for petroleum products in the industrialized countries would have, via a decline in world prices, on demand in non-participating countries; and second the effect of a contraction in output of energy-intensive sectors in industrialized countries and an expansion in non-participating countries. Conclusion: “...[N]either of the two trade alternatives leads to a dramatic increase in carbon emissions outside Annex I. Apparently there is an international leakage problem, but it appears to be of manageable dimensions.” This is a useful result (though I think that we need to refine and extend estimates of leakage).

Conclusion

I conclude simply by noting that the threat of global climate change is real, that prudence demands we respond, and that the Kyoto Protocol and the President’s policies to address the threat entail only modest economic costs.

¹ It is even less clear that the US trade deficit will get larger, which is what some people apparently have in mind by “competitiveness.” Indeed, if we are buying emissions from abroad, elementary application of the transfer problem framework says that our trade balance in goods and services should improve.



Joseph E. Aldy
09/21/98 02:26:56 PM

Record Type: Record

To: Jeffrey A. Frankel/CEA/EOP
cc: Quindi C. Franco/CEA/EOP
Subject: Re: task I need by Tuesday

Regarding your two questions:

1) MERGE has higher permit prices than SGM in part because SGM assumes higher rates of energy efficiency under BAU outside the US (especially FSU) than MERGE, indicating that there are more paper tons available. Also, I believe the difference in the U.S. cost curves reflect differences in elasticities (e.g., natural gas supply). Finally, many of the MERGE analyses include banking (having not seen this most recent paper, I'm not sure if the latest batch of analyses include banking), which tend to bump up the permit price in the first commitment period.

2) The resource costs of a trading constraint is really sensitive to an assumption about the competitiveness of the international market. If it is competitive, the supply of paper tons result in a very low international price and subsequently low transfers. In this scenario, resource costs are actually a little lower than the no-constraint situation. However, if the sellers can sell at higher prices (e.g., if they were discriminating monopolists, and sold at the U.S. domestic price), the resource costs would more than double. It might be best to sidestep this issue and just focus on permit price and resulting energy prices.

Joe

The Kyoto Treaty: Economic and Environmental Consequences

Jeffrey Frankel

Member, President's Council of Economic Advisers

comments for presentation at

*Climate Change Policy:
Practical Strategies to Promote Economic Growth and Environmental Quality*

forum sponsored by American Council for Capital Formation
The National Press Club, Sept. 23, 1998

margo
congressman
Knuttenberg
advocacy

I will make some general comments about the Administration position on the Kyoto Agreement, before commenting on Rich Richels excellent paper. by 1 + Alan Maunp

The Administration Economic Analysis

The key bottom line of the economic analysis that we released in July was as follows, in qualitative terms: *Given key elements of the Agreement and of Administration policy (including tradeable permits and other flexibility features), the U.S. economic impacts are likely to be modest.*

Those key features are of several sorts. The Administration insisted that the design of the agreement be market-based, flexible, and global. The flexibility comes in three categories:

- "When" flexibility
 - 1st-period reductions less drastic than some countries wanted
 - targets phrased as multi-year averages
 - banking
- "What" flexibility
 - 6 gases included, not just carbon dioxide
 - sinks
- "Where" flexibility
 - international trading in emission permits
 - CDM

Finally, we require a global solution, to address a global problem.

- Without meaningful LDC participation, the President will not submit the Treaty for Senate ratification

Economic analysis of climate change policy is difficult for many reasons, which again fall into three categories.

- It is impossible to put a single monetary number on the benefits of averting Global Climate Change. It is difficult enough to put numbers on the economic costs of a 2-to-6

Knollenberg. Advocacy.

Bottom line

Flexibilities

when
what
where

Global

Difficulties of analysis

Findings A27rdy $\frac{1}{2}$ Global 80-87? Costs \$7-\$125 = 0.1% GOR

P \$14-\$23 / ton

Energy bill \$70-\$110

EMF to: scm, with MERGE. scm at median. (Less than n under full global tradg)

Conservative in that units...

MANNE-RICHELIS

Frontier. E.g. theoretically optimal time path.

Update model, ind. analysis of policy questions most typical: caps + LDC

Importance of unrestricted tradg.

M-R: $\frac{1}{2}$ ^{savings}, like ourEur. ~~report~~ concluded. Complementarity.

Distrust. "Allocators too generous"

Q limits. Like quotas. Raise price

Our est 50% ME $\Rightarrow$ $\Delta P_c \approx 157\%$ M+R purchases $\frac{1}{3}$ commitment $\Rightarrow$ costs $2\frac{1}{2}$ -3x higher

Convincing LDCs.

Congress: need LDCs for competitiveness / to

Agree need.

But reasons different.

Any structural change some + some -

Need LDCs

• fastest-growing (fairness)

• reduce US costs 80%

• free-riding + leakage

• Senate won't ratify

Leakage

M+R

2 sources.

"manageable"

science "balance of evidence" $\Rightarrow$ moderate 1st step. with tradg + LDC it is modest.

The Kyoto Treaty: Economic and Environmental Consequences

Jeffrey Frankel

Member, President's Council of Economic Advisers

comments for presentation at

Climate Change Policy:

Practical Strategies to Promote Economic Growth and Environmental Quality

forum sponsored by American Council for Capital Formation
The National Press Club, Sept. 23, 1998 +

I will make some general comments about the Administration position on the Kyoto Agreement, before commenting on the excellent paper of Alan Manne and Rich Richels.

The Administration Economic Analysis

The key bottom line of the economic analysis that we released in July was as follows, in qualitative terms: *Given key elements of the Agreement and of Administration policy (including tradeable permits and other flexibility features), the U.S. economic impacts are likely to be modest.*

Those key features are of several sorts. The Administration insisted that the design of the agreement be market-based, flexible, and global. The flexibility comes in three categories:

- | | | |
|---------------------|---|---|
| "When" flexibility | • | 1st-period reductions less drastic than some countries wanted |
| | • | targets phrased as multi-year averages |
| | • | banking |
| "What" flexibility | • | 6 gases included, not just carbon dioxide |
| | • | sinks |
| "Where" flexibility | • | international trading in emission permits |
| | • | CDM |

Finally, we require a global solution, to address a global problem.

- Without meaningful LDC participation, the President will not submit the Treaty for Senate ratification

Economic analysis of climate change policy is difficult for many reasons, which again fall into three categories.

- It is impossible to put a single monetary number on the benefits of averting Global Climate Change. It is difficult enough to put numbers on the economic costs of a 2-to-6

degree F increase in temperature or a 6-inch to 3-foot rise in sea level, which is what the IPCC scientists are forecasting for the next 100 years. But that difficulty pales next to the uncertainties surrounding the appropriate discount rate, danger of catastrophic climate events, and appropriate risk aversion.

- Some terms of the international agreement are still uncertain.
- Econometric models are subject to inevitable limitations. Some models are good at some things, other at others. No one model does it all. The estimates of each are subject to wide bands of uncertainty,

Despite these difficulties, we used some estimates based on Battelle Labs' SGM (directed by Jae Edmonds), a model that is well-designed to handle international trading. The most important quantitative findings, supporting the qualitative finding that I led with, were as follows.

- Full and successful implementation of Annex I trading would reduce costs by one-half, relative to a situation where each country had to satisfy its commitment domestically.
- Full and successful implementation of global trading (including developing countries) would reduce costs by 80-87%.
- Global trading would reduce resource costs by an estimated \$7-\$12 b/yr in 2010, which is 0.1 % GDP in 2010. This is a cost that I would describe as, if anything, less than modest.
- The effect on the price of carbon is estimated at \$14-\$23/ton.
 - Δ price of natural gas = 3-5 %
 - Δ price of fuel oil = 5-9 %
 - Δ price of gasoline = 4-6¢ / gal.
 - Δ price of electricity = 3-4 %
- Effect on the energy bill of the average household is estimated at \$70-\$110

The SGM model, along with the MERGE model of Manne and Richels and many other leading econometric models, participates in the Stanford-based Energy-Modeling Forum. The most recent compilation by the EMF of the results of ten of these models shows the SGM, the model that we used, in the middle of the pack of estimates of the costs of Kyoto, when standardizing on the policy experiment under consideration. The SGM's estimates of costs in 2010 near the median in the experiment with no international trading or in the case with Annex I trading. With full global trading, SGM cost estimates are a bit below the median, but far from the lowest of the models.

In one respect, our estimates are optimistic: we cannot be sure of getting full developing-country participation in the near future. But in other respects they are conservative. They omit some factors that would reduce the net costs of the agreement:

- The Administration proposal for Federal electricity restructuring, which we consider part of our energy-and-environment policy, would save approximately \$20 billion in costs -- potentially enough to offset the increase in the household energy bill.
- Allowance for sinks, such as land forestation, would potentially reduce the need for emission reductions substantially.
- The President's proposal to allocate \$6.3 billion over the next five years in Research and Development and tax breaks to develop and disseminate carbon-saving technologies could further reduce costs if it were enacted and if some of the technological payoff were to come in the next ten years. To be conservative, we assumed that it did not.
- Ancillary non-climate benefits, such as the health benefits of reduced air pollution could reduce net costs by an estimated one-quarter.
- Of course, the most important factor that has been left out of the above assessment is the benefit of mitigating climate change itself. (A full cost-benefit analysis would include mitigation in the benefits column. The only reason we have not done so, explained repeatedly above, is the difficulty in coming up with a number to capture the monetary benefits.) But nobody should lose sight of our ultimate objective -- keeping our planet the hospitable home that we enjoy today.

The Manne-Richels paper

Alan Manne and Rich Richels have done some of the most important and pioneering work in the economic modeling of climate change policy. They have been at the frontier, being the first, for example, to address the theoretically optimal time-path of GHG emissions over the coming century to get to a given environmental goal in terms of concentrations in the atmosphere. In their latest paper they have updated their model, and included analysis of some of the policy questions that are most topical in the ongoing negotiations.

In particular, of the various questions still to be settled in international negotiations, the two most important both receive useful analysis here. The first is what would be the likely effect of the caps on trading that have been proposed by European countries; the second is the importance of participation by developing countries. That first question, regarding trading caps, has shaped up to be probably the most contentious at the upcoming Buenos Aires negotiations. The second issue may be the most contentious thereafter.

I already have explained that the ability to buy and sell emission permits is critical to our view of the Kyoto Protocol. It allows us to achieve the same environmental goal at lower economic costs. The Manne-Richels estimates using their MERGE model are in this regard very similar to ours: trading among the "Annex I" countries reduces costs by more than half.

Unfortunately, not all countries share the American enthusiasm for trading. Some

countries, particularly the EU, are not completely convinced of the case in favor of trading. They insist that trading should be only supplemental, by which I fear they mean that the United States must accomplish most of its reductions (relative to the Business as Usual path) through domestic reductions, rather than purchases. Some Europeans may be driven by a primitive distrust of trading in general, analogous to those who believe that everybody should grow his or her own food. Others are in effect protesting the allocation of emission rights at Kyoto, believing the US and FSU allocations to be too generous. This is what it must mean to complain that the US needs to make more of a domestic sacrifice, or that Russia shouldn't be allowed to sell hot air. (It is not always easy to distinguish that belief from a -- logically quite distinct -- failure to understand that for any given allocation of emission rights, trading lowers the cost of the same environmental outcome. One of the great feats of Kyoto is that the Annex I countries were able to agree on the allocation of property rights, in a context where many of us had thought the political obstacles might be insuperable.)

In any case, some Europeans want to place quantitative limits on how much countries can buy. Such limits would operate as import quotas do for trade in agricultural commodities and other goods. They have the same drawbacks: they would artificially raise the price of emissions in the buying country, they would introduce an extra degree of complication, government bureaucracy, and rent-seeking into the marketplace, and they would generally impede efficiency. The US has said that it will not agree to trading limitations at Buenos Aires.

We have estimated that such limits could raise the cost of compliance substantially for the United States, and even more so for Europeans and others. A 50% limit rule could raise the price of carbon by an estimated 157 %. These estimates are based on an application of the SGM model of Battelle Labs [and they assume the regime we aspire to: participation and trading among key developing countries in addition to Annex I].

Manne and Richels consider a related experiment, what would happen if a limit were imposed on purchases equal to 1/3 of countries' commitments. Estimated costs are 2 1/2 to 3 times higher than under full and unconstrained trading.

Even if we succeed in overcoming European objections to trading at Buenos Aires, a second -- even more daunting -- hurdle awaits us: convincing the developing countries to participate in the effort in a more meaningful way than they have in the past.

US Senators say we need developing country participation because otherwise we will lose competitiveness. I agree that we need the developing countries, but I would phrase the reasons differently. Any major structural change in the economy (like an increase in the price of energy) is likely to result in the expansion of some sectors and the contraction of others. The Manne-Richels paper reports likely negative effects -- "loss in competitiveness" -- in energy-intensive manufactures. But, as the paper mentions, other sectors will gain competitiveness. It is not clear that the overall effect will be negative. I am not aware of a study that has been able to address

that question.¹

The reasons we need the LDCs are, rather:

- they are the fastest-growing emitters (so “fairness” demands their inclusion),
- without participation by the developing countries problems of free-riding and leakage would render an agreement ineffective at its environmental goals,
- their participation is needed to reduce economic costs to US compliance [by as much as 80% in our estimates, somewhat less in Manne-Richels], and
- the Senate will not ratify a treaty without them.

Manne and Richels offer estimates of the magnitude of leakage -- that is, the possibility that reductions in emissions in the industrialized countries under the agreement would be partly offset by increases in emissions in non-participating developing countries. They look at two sources of leakage: first the effect that lower demand for petroleum products in the industrialized countries would have, via a decline in world prices, on demand in non-participating countries; and second the effect of a contraction in output of energy-intensive sectors in industrialized countries and an expansion in non-participating countries. Conclusion: “[N]either of the two trade alternatives leads to a dramatic increase in carbon emissions outside Annex I. Apparently there is an international leakage problem, but it appears to be of manageable dimensions.” This is a useful result (though I think that we need to refine and extend estimates of leakage).

Conclusion

I conclude simply by noting that the threat of global climate change is real, that prudence demands we respond, and that the Kyoto Protocol and the President’s policies to address the threat entail only modest economic costs.

¹ It is even less clear that the US trade deficit will get larger, which is what some people apparently have in mind by “competitiveness.” Indeed, if we are buying emissions from abroad, elementary application of the transfer problem framework says that our trade balance in goods and services should improve.

The Kyoto Treaty: Economic Consequences

Jeffrey Frankel

Member, President's Council of Economic Advisers

Sept. 23, 1998 +

The Administration Economic Analysis

The key bottom line of the economic analysis that we released in July was as follows, in qualitative terms: *Given key elements of the Agreement and of Administration policy (including tradeable permits and other flexibility features), the U.S. economic impacts are likely to be modest.*

Those key features are of several sorts. The Administration insisted that the design of the agreement be market-based, flexible, and global. The flexibility comes in three categories:

- "When" flexibility
 - 1st-period reductions less drastic than some countries wanted
 - targets phrased as multi-year averages
 - banking
- "What" flexibility
 - 6 gases included, not just carbon dioxide
 - sinks
- "Where" flexibility
 - international trading in emission permits
 - CDM

Finally, we require a global solution, to address a global problem.

- Without meaningful LDC participation, the President will not submit the Treaty for Senate ratification

Economic analysis of climate change policy is difficult for many reasons, which again fall into three categories.

- It is impossible to put a single monetary number on the benefits of averting Global Climate Change. It is difficult enough to put numbers on the economic costs of a 2-to-6 degree F increase in temperature or a 6-inch to 3-foot rise in sea level, which is what the IPCC scientists are forecasting for the next 100 years. But that difficulty pales next to the uncertainties surrounding the appropriate discount rate, danger of catastrophic climate events, and appropriate risk aversion.
- Some terms of the international agreement are still uncertain.
- Econometric models are subject to inevitable limitations. Some models are good at some things, other at others. No one model does it all. The estimates of each are subject to wide bands of uncertainty,

Despite these difficulties, we used some estimates based on Battelle Labs' SGM (directed by Jae Edmonds), a model that is well-designed to handle international trading. The most important quantitative findings, supporting the qualitative finding that I led with, were as

follows.

- Full and successful implementation of Annex I trading would reduce costs by one-half, relative to a situation where each country had to satisfy its commitment domestically.
- Full and successful implementation of global trading (including developing countries) would reduce costs by 80-87%.
- Global trading would reduce resource costs by an estimated \$7-\$12 b/yr in 2010, which is 0.1 % GDP in 2010. This is a cost that I would describe as, if anything, less than modest.
- The effect on the price of carbon is estimated at \$14-\$23/ton.
 - Δ price of natural gas = 3-5 %
 - Δ price of fuel oil = 5-9 %
 - Δ price of gasoline = 4-6¢ / gal.
 - Δ price of electricity = 3-4 %
- Effect on the energy bill of the average household is estimated at \$70-\$110

The SGM model, along with the MERGE model of Manne and Richels and many other leading econometric models, participates in the Stanford-based Energy-Modeling Forum. The most recent compilation by the EMF of the results of ten of these models shows the SGM, the model that we used, in the middle of the pack of estimates of the costs of Kyoto, when standardizing on the policy experiment under consideration. The SGM's estimates of costs in 2010 near the median in the experiment with no international trading. With full global trading, SGM cost estim. the lowest of the models.

In one respect, our estimates are optimistic: country participation in the near future. But in other some factors that would reduce the net costs of the :

- The Administration proposal for Federal elec of our energy-and-environment policy, would potentially enough to offset the increase in th
- Allowance for sinks, such as land forestation, emission reductions substantially.
- The President's proposal to allocate \$6.3 billic five years in Research and Development and tax breaks to develop and disseminate carbon-saving technologies could further reduce costs if it were enacted and if some of the technological payoff were to come in the next ten years. To be conservative, we assumed that it did not.

- Ancillary non-climate benefits, such as the health benefits of reduced air pollution could reduce net costs by an estimated one-quarter.
- Of course, the most important factor that has been left out of the above assessment is the benefit of mitigating climate change itself. (A full cost-benefit analysis would include mitigation in the benefits column. The only reason we have not done so, explained repeatedly above, is the difficulty in coming up with a number to capture the monetary benefits.) But nobody should lose sight of our ultimate objective -- keeping our planet the hospitable home that we enjoy today.



Jeffrey A. Frankel
09/30/98 04:51:38 PM

Record Type: Record

To: Awilkes @ mindspring.com @ inet

cc: Lisa D. Branch/CEA/EOP

Subject: my comments from 9/23 forum



as re KYOTACCF.RCH requested by Margo Thorning. The file is in WordPerfect. But I suspect that you will be able to read it with a Microsoft Word program.

OFFICERS

Chairman: Dr. Charles E. Walker
 former Deputy Secretary of the Treasury,
 Chairman, Walker and Walker LLC
 President: Mark A. Bloomfield, Esq.
 Senior Vice President: Mari Lee Dunn
 Senior Vice President and Director of Research: Dr. Margo Thorning

ACCF

DISTINGUISHED FELLOWS OF THE ACCF CENTER FOR POLICY RESEARCH

Environmental Policy Fellow, 1997-98

Hon. Richard Schmalensee*
 Gordon Y. Billard Professor of
 Economics and Management
 Massachusetts Institute of Technology

TCW Fellow, 1997-98

Dr. Thomas Horst
 former Director of the International Tax Staff,
 U.S. Department of the Treasury
 Managing Director, Horst, Frisch, Clowery & Finan

BOARD OF SCHOLARS

Dr. B. Douglas Bernheim
 Professor of Economics
 Stanford University

Hon. Michael J. Boskin
 Tully M. Friedman Professor of Economics
 and Senior Fellow, Hoover Institution
 Stanford University

Hon. David F. Bradford
 Professor of Economics and Public Affairs
 Princeton University

Dr. Lawrence H. Goulder
 Associate Professor of Economics
 Stanford University

Dr. John D. Graham
 Professor of Policy and Decision Sciences
 Harvard School of Public Health

Dr. Robert E. Hall
 Professor of Economics and
 Senior Fellow, Hoover Institution
 Stanford University

Prof. Arnold C. Harberger
 Professor of Economics
 University of California at Los Angeles

Dr. Dale W. Jorgenson
 Frederic Eaton Abbe Professor of Economics
 Harvard University

Dr. Alan S. Manne
 Professor Emeritus, Operations Research
 Stanford University

Dr. Charles McLure, Jr.
 Senior Fellow, Hoover Institution
 Stanford University

Dr. Roger B. Porter
 Professor of Government and Business
 John F. Kennedy School of Government
 Harvard University

Dr. James M. Poterba
 Mitsui Professor of Economics
 Massachusetts Institute of Technology

Dr. John B. Shoven
 Charles Schwab Professor of Economics
 Stanford University

Hon. Murray L. Weidenbaum
 Mallinckrodt Distinguished University Professor
 Washington University

Hon. Ed Zschau
 Professor of Management
 Graduate School of Business Administration
 Harvard University

BOARD OF TRUSTEES

Thomas D. Campbell
 President
 Thomas D. Campbell and Associates

Dr. George N. Carlson
 Partner
 Arthur Andersen & Co.

Maxine C. Champion
 Vice-President, Government and
 International Relations
 Nestle USA, Inc.

Ernest S. Christian, Jr., Esq.
 Attorney-at-Law

Dr. Kathleen B. Cooper
 Chief Economist
 Exxon Corporation

Paul R. Huard
 Senior Vice-President,
 Policy and Communications
 National Association of Manufacturers

Hon. Manuel H. Johnson
 former Vice-Chairman
 Board of Governors of
 the Federal Reserve System

Dr. Rudolph G. Penner
 former Director
 Congressional Budget Office

Larry W. Pollock
 Vice-President and Director of Taxes
 Weyerhaeuser Company

Mrs. John P. Renshaw
 Thomas White
 Chairman and Chief Executive Officer
 Enron Ventures Corp.

*Member, Board of Scholars

AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH

September 28, 1998

The Honorable Jeffrey A. Frankel
 Member
 Council of Economic Advisers
 314 Old Executive Office Building
 Washington, D.C. 20502

Dear Jeff:

Thanks again for your participation at our September 23 forum, *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality*. It was a big success and we have had many favorable comments.

We will be publishing the conference proceedings in early 1999 as a monograph. In order to include your comments, we need to have a 4-6 page, double-spaced paper in Microsoft Word, if possible, either by e-mail (awilkes@mindspring.com) or on a diskette with a hard copy for confirmation (mail or fax the hard copy following an e-mail). We will also need the data points for any charts you would like to include if you have not already sent them to us. Please refer to the enclosed *Guidelines for Authors* for assistance in revising your paper for publication.

To meet our publication deadline, we would appreciate receiving your revised written comments by October 14, 1998. If you would like a copy of your transcript from the conference, please let me know.

Again, thank you very much for taking part in our very successful forum.

Sincerely,



Margo Thorning

MT/dk
 Enclosure

GUIDELINES FOR AUTHORS

To assist you in preparing your paper for presentation at our symposium and for subsequent publication, please follow these guidelines.

1. Manuscript

Submit your paper either on a diskette clearly labeled with the software used, title of paper, and author's name, or via e-mail as an attachment (awilkes@mindspring.com). Please enclose a hard copy with the diskette, or mail or fax one following the e-mail for confirmation purposes. You should avoid excessive formatting in your word processing program—most formatting such as blank lines between paragraphs, excess tabs, and headings in all upper case will need to be painstakingly removed or replaced during the typesetting process.

2. Artwork (tables, figures, charts)

Figures and charts should be produced clearly in black and white. If bars or sections need to be distinguished, do not use shades of gray—photocopying will make them indistinguishable. Patterns such as hash marks or dots are better choices. Keep all tables, figures, and charts on the same clearly labeled diskette. Please be sure to supply legible data points, preferably in a spreadsheet program such as Microsoft Excel. We will then use these data points to recreate all figures in Adobe Illustrator, since programs such as Excel and PowerPoint do not produce "publishable" formats. If your material cannot be read by our computers or we are unable to recreate it from supplied data points, we will be unable to use the material. All artwork should be placed at the end of the paper, not within the text itself.

3. Source lines for artwork

Please supply source lines for all artwork provided; type the source information under the piece of artwork (author, publication title, publication state and city, publication date). It is your responsibility to obtain written permission from the source to reprint material in our book if you are not the original source.

4. References/Footnotes/Endnotes

Please include complete references/notes with each draft. We follow the *Chicago Manual of Style, 13th Edition*, University of Chicago Press. If using the author-date reference system, a brief citation is placed in the text (Author Last Name Date), and a list of works cited is placed at the end of the text. The basic format for citations in this list is, in alphabetical order by author:

Author Last Name, Initial. Initial. Year. Article title. *Magazine or Journal Title* volume number: page number.
Author Last Name, Initial. Initial. Year. *Title of Book*. City of publication: Publisher.

An alternative is the endnote system, whereby a superscript number is placed in text and the corresponding number with note is placed at the end of the paper. The basic style for endnotes is:

1. Author First Name Author Last Name, *Title of Book* (City of publication: Publisher, year), page number.
2. Author First Name Author Last Name, "Article Title," *Magazine or Journal Title* volume number (Month year): page number.

5. Proofing and editing

After submitting your paper, you will receive a hard copy of your manuscript with any edits marked along with a copy of the typeset layout. Proof carefully—the author is the best person to see where any material was inadvertently dropped or altered. Please make any final changes to the typeset copy and return.

For further guidance, please contact the ACCF Center for Policy Research.

September 1998

ACCF

AMERICAN COUNCIL FOR CAPITAL FORMATION

FAX TRANSMISSION COVER SHEET

DATE: 9/21/98

TO: Jeffrey Frankel

FROM: ☐ Mark Bloomfield
☐ Mari Lee Dunn
☒ Margo Thornling
☐ Ernestine Johnson
☐ Angela Wilkes

FAX PHONE #: 395-6958

PAGES (including cover): 2

Contact Stacy at (202) 293-5811 if there is any problem.

NOTE:

Attached is an updated agenda for our September 23 forum in which you are participating.

I very much look forward to seeing you. If you have any questions, please do not hesitate to call at 202-293-5811.

Margo

Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality

cc: J A

September 23, 1998

National Press Club, 14th and F Streets, N.W., 13th floor, Washington, D.C.

8:00 Jeff will attend
7:15-8:00 a.m. **REGISTRATION**
8:00-9:00 a.m. **WELCOME**
Mark Bloomfield
President
ACCF Center for Policy Research
**BREAKFAST ADDRESS: A CONGRESSIONAL
PERSPECTIVE ON CLIMATE CHANGE ISSUES**

Introduction: William F. O'Keefe
Executive Vice President and
Chief Operating Officer
American Petroleum Institute

Speaker: Hon. Joe Knollenberg (R-MI)
Member
House Appropriations Committee

9:00-10:00 a.m. **THE KYOTO TREATY: ECONOMIC AND
ENVIRONMENTAL CONSEQUENCES**

Moderator: Margo Thorning
Senior Vice President and
Director of Research
ACCF Center for Policy Research

Paper: Richard Richels
Director, Global Climate Change Research
EPRI

Respondents: Jeffrey A. Frankel
Member
Council of Economic Advisers
Richard Schmalensee
Gordon Y Billard Professor of
Economics and Management
Massachusetts Institute of Technology

10:00-11:00 a.m. **THE ROLE OF ENERGY IN THE U.S. ECONOMY**

Moderator: J. Jon Doggett
Senior Director, Governmental Relations
American Farm Bureau Federation

Paper: John R. Moroney
Professor of Economics
Texas A&M University

Respondents: Joyce Y. Brinner
Principal
Standard & Poor's DRI
Michael Buckner
Director of Research
United Mine Workers of America

11:00 a.m.-noon **REMOVING THE OBSTACLES FOR LONG-TERM
TECHNOLOGICAL INNOVATION TO REDUCE
CO₂ EMISSIONS**

Moderator: Rae Cronmiller
Environmental Counsel
National Rural Electric
Cooperative Association

AGENDA

Paper: Jae Edmonds
Technical Leader of Economic Programs
Pacific Northwest National Laboratory

Respondents: Alan S. Manne
Professor Emeritus, Operations Research
Stanford University
Thomas G. Marx
Director of Economic Studies
General Motors Corp.

Noon-1:45 p.m. **LUNCHEON ADDRESS: AN URBAN PERSPECTIVE
ON CLIMATE MITIGATION POLICY**

Introduction: Mark Bloomfield
President
ACCF Center for Policy Research

Speaker: Arthur Fletcher
Chairman
National Black Chamber of Commerce

1:45-2:45 p.m. **TRADABLE PERMITS FOR CO₂ EMISSIONS:
OBSTACLES TO A FUNCTIONAL
INTERNATIONAL SYSTEM**

Moderator: LaVaughn M. Henry
Climate Change and Regulatory Economics
Manager, Worldwide Public Policy Office
Ford Motor Company

Paper: A. Denny Ellerman
Executive Director
MIT Center for Energy and
Environmental Policy Research

Respondents: David Harrison, Jr.
Vice President
National Economic Research Associates
W. David Montgomery
Vice President
Charles River Associates, Inc.

2:45-3:45 p.m. **TECHNOLOGICAL DEVELOPMENT AND CO₂
REDUCTION IN ENERGY USE: OUTLOOK FOR
NEAR-TERM PROGRESS**

Moderator: Margo Thorning
Senior Vice President and
Director of Research
ACCF Center for Policy Research

Paper: Henry Jacoby
Pounds Professor of Management
Massachusetts Institute of Technology

Respondents: Elmer C. Holt
Senior Economist, Office of Policy and
International Affairs
U.S. Department of Energy
Ronald J. Sutherland
Senior Economist
American Petroleum Institute

AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH

1750 K Street, N.W., Suite 400, Washington, D.C. 20006-2302 • 202/293-5811 • 202/785-8165 FAX • info@accf.org E-MAIL • Web site: <http://www.accf.org>

TOTAL P.02

ACCF

AMERICAN COUNCIL FOR CAPITAL FORMATION

FAX TRANSMISSION COVER SHEET

DATE: 8/14/98

TO: Hon. Jeffrey Frankel

FROM: ☐ Mark Bloomfield
☐ Mari Lee Dunn
☒ Margo Thornling
☐ Ernestine Johnson
☐ Angela Wilkes

FAX PHONE #: 395-6958

PAGES (including cover): 2

Contact Doreen at (202) 293-5811 if there is any problem.

NOTE:

Attached is an updated agenda
for our Sept. 23 Conference.

Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality

September 23, 1998 • The National Press Club • 13th floor, 14th and F Streets, N.W. • Washington, D.C.

7:15-7:45 a.m. **REGISTRATION**

7:45 a.m. **WELCOME**

Mark Bloomfield
President
ACCF Center for Policy Research

7:45-9:00 a.m. **BREAKFAST ADDRESS:**

A CONGRESSIONAL PERSPECTIVE

Speaker: Hon. E. James Schembrenner, Jr. (R-WI)
Chairman
House Science Committee

9:00-10:00 a.m. **THE KYOTO TREATY: ECONOMIC AND ENVIRONMENTAL CONSEQUENCES**

Paper: Richard Richels
Director, Department of Energy
Analysis and Planning
Electric Power Research Institute

Respondents: Jeffrey Frankel
Member
Council of Economic Advisers
Richard Schmalensee
Gordon Y. Billard Professor of
Economics and Management
Massachusetts Institute of Technology

10:00-11:00 a.m. **THE ROLE OF ENERGY IN THE U.S. ECONOMY**

Paper: John Moroney
Texas A&M University

Respondents: Joyce Brinner
Principal
Standard & Poor's DRI
Michael Buckner
Director of Research
United Mine Workers of America

11:00 a.m.-noon **REMOVING THE OBSTACLES FOR LONG-TERM TECHNOLOGICAL INNOVATION TO REDUCE CO₂ EMISSIONS**

Paper: Jae Edmonds
Technical Leader of
Economic Programs
Pacific Northwest
National Laboratory

Respondents: Alan S. Manne
Professor Emeritus,
Operations Research
Stanford University
Thomas Marx
Director of Economic Studies
General Motors Corp.

Noon-1:45 p.m. **LUNCHEON ADDRESS:
AN URBAN PERSPECTIVE ON
CLIMATE MITIGATION POLICY**

Speaker: Arthur Fletcher
Chairman
National Black Chamber
of Commerce

1:45-2:45 p.m. **TRADABLE PERMITS FOR CO₂ EMISSIONS:
OBSTACLES TO A FUNCTIONAL
INTERNATIONAL SYSTEM**

Paper: A. Denny Ellerman
Executive Director, MIT Center for Energy
and Environmental Policy Research

Respondents: David Harrison, Jr.
Vice President and Director of
Environmental Practice
National Economic
Research Associates
W. David Montgomery
Vice President
Charles River Associates, Inc.

2:45-3:45 p.m. **TECHNOLOGICAL DEVELOPMENT AND
CO₂ REDUCTION IN ENERGY USE:
OUTLOOK FOR NEAR-TERM PROGRESS**

Paper: Henry Jacoby
Massachusetts Institute of Technology

Respondents: Eric Peterson*
Director, Office of Budget, Planning,
and Customer Service
U.S. Department of Energy
Ronald Sutherland
Senior Economist
American Petroleum Institute

*invited

A public policy forum sponsored by the ACCF Center for Policy Research

MARGO THORNING

September 11, 1998

TO: Dr. Frankel

Attached is Richard Richels' paper that he will be presenting to your panel, "The Kyoto Treaty: Economic and Environmental Consequences," at our September 23 forum.

Please call if you have any questions.

THE KYOTO PROTOCOL: A COST-EFFECTIVE STRATEGY FOR MEETING ENVIRONMENTAL OBJECTIVES?

PAPER

ALAN S. MANNE
PROFESSOR EMERITUS, OPERATIONS RESEARCH
STANFORD UNIVERSITY

AND

RICHARD G. RICHEL
DIRECTOR, GLOBAL CLIMATE CHANGE RESEARCH
ELECTRIC POWER RESEARCH INSTITUTE

DRAFT

DO NOT CITE OR QUOTE WITHOUT PERMISSION

PREPARED FOR
**CLIMATE CHANGE POLICY: PRACTICAL STRATEGIES TO PROMOTE
ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY**
A SYMPOSIUM SPONSORED BY THE
AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH
NATIONAL PRESS CLUB
WASHINGTON, D.C.
SEPTEMBER 23, 1998

AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH

1750 K Street, N.W., Suite 400, Washington, D.C. 20006-2302 • 202/293-5811 • 202/785-8165 FAX • info@accf.org E-MAIL • Web site: <<http://www.accf.org>>

OFFICERS

Chairman: Dr. Charles E. Walker
former Deputy Secretary of the Treasury,
Chairman, Walker and Walker LLC
President: Mark A. Bloomfield, Esq.
Senior Vice President: Mari Lee Dunn
Senior Vice President and Director of Research: Dr. Margo Thorning

DISTINGUISHED FELLOWS OF THE ACCF CENTER FOR POLICY RESEARCH

Environmental Policy Fellow, 1997-98

Hon. Richard Schmalensee*
Gordon Y Billard Professor of
Economics and Management
Massachusetts Institute of Technology

TCW Fellow, 1997-98

Dr. Thomas Horst
former Director of the International Tax Staff,
U.S. Department of the Treasury
Managing Director, Horst, Frisch, Clowery & Finan

BOARD OF SCHOLARS

Dr. B. Douglas Bernheim
Professor of Economics
Stanford University

Hon. Michael J. Boskin
Tully M. Friedman Professor of Economics
and Senior Fellow, Hoover Institution
Stanford University

Hon. David F. Bradford
Professor of Economics and Public Affairs
Princeton University

Dr. Lawrence H. Goulder
Associate Professor of Economics
Stanford University

Dr. John D. Graham
Professor of Policy and Decision Sciences
Harvard School of Public Health

Dr. Robert E. Hall
Professor of Economics and
Senior Fellow, Hoover Institution
Stanford University

Prof. Arnold C. Harberger
Professor of Economics
University of California at Los Angeles

Dr. Dale W. Jorgenson
Frederic Eaton Abbe Professor of Economics
Harvard University

Dr. Alan S. Manne
Professor Emeritus, Operations Research
Stanford University

Dr. Charles McLure, Jr.
Senior Fellow, Hoover Institution
Stanford University

Dr. Roger B. Porter
Professor of Government and Business
John F. Kennedy School of Government
Harvard University

Dr. James M. Poterba
Mitsui Professor of Economics
Massachusetts Institute of Technology

Dr. John B. Shoven
Dean, School of Humanities and Sciences
Stanford University

Hon. Murray L. Weidenbaum
Mallinckrodt Distinguished University Professor
Washington University

Hon. Ed Zachau
Professor of Management
Graduate School of Business Administration
Harvard University

BOARD OF TRUSTEES

Thomas D. Campbell

President
Thomas D. Campbell and Associates

Dr. George N. Carlson
Partner
Arthur Andersen & Co.

Maxine C. Champion
Vice-President, Government and
International Relations
Nestle USA, Inc.

Ernest S. Christian, Jr., Esq.
Attorney-at-Law

Dr. Kathleen B. Cooper
Chief Economist
Exxon Corporation

Paul R. Huard
Senior Vice-President,
Policy and Communications
National Association of Manufacturers

Hon. Manuel H. Johnson
former Vice-Chairman
Board of Governors of
the Federal Reserve System

Dr. Rudolph G. Penner
former Director
Congressional Budget Office

Larry W. Pollock
Vice-President and Director of Taxes
Weyerhaeuser Company

Mrs. John P. Renshaw

Thomas White
Chairman and Chief Executive Officer
Enron Ventures Corp.

ACCF

AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH

July 27, 1998

The Honorable Jeffrey A. Frankel
Member
Council of Economic Advisers
314 Old Executive Office Building
Washington, D.C. 20502

Dear Dr. Frankel:

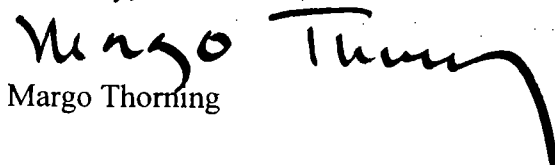
I am writing to thank you for agreeing to be a respondent at our September 23 forum, "Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality," sponsored by the ACCF Center for Policy Research. The day-long session will be held at the National Press Club, 529 14th Street, N.W., Washington, D.C.

Your panel, "The Kyoto Treaty: Economic and Environmental Consequences," is scheduled from 9:00-10:00 a.m. The papergiver, Richard Richels, director, Department of Energy Analysis and Planning, Electric Power Research Institute, is preparing a paper that we will send to you in advance of the meeting. The other respondent on your panel is Richard Schmalensee, Gordon Y Billard Professor of Economics and Management, Massachusetts Institute of Technology. We would be delighted to have you attend as much of the rest of the symposium as your schedule allows.

We ask that you plan on about 10 minutes for your remarks and an additional 10 minutes for questions and answers. The audience for our symposium will include some 100-150 individuals from among our corporate and association supporters, Hill and Administration staff, representatives from other countries, and international organizations, and the media. The edited proceedings will be published as a book. We would appreciate receiving your written comments (4-8 double-spaced pages) within two weeks after the conference. In addition to the hard copy, we would also like to receive the computer diskette of your paper in WordPerfect (5.1 or Windows 6.0) or Microsoft Word, if possible.

I look forward to working with you.

Sincerely,


Margo Thorning

*Member, Board of Scholars

GUIDELINES FOR AUTHORS

To assist you in preparing your paper for presentation at our symposium and for subsequent publication, please follow these guidelines.

1. Hard copy manuscript

Submit your paper on 8 1/2" x 11" paper, double-spaced (including notes and references) using 1" left and right margins. Place page numbers in the upper right-hand corner. Include a diskette clearly labeled with the software used, title of paper, and author's name along with the hard copy. Please avoid excessive formatting in your word processing program—most formatting such as blank lines between paragraphs, excess tabs, and headings in all upper case will need to be painstakingly removed or replaced during the typesetting process.

2. Artwork (tables, figures, charts)

Figures and charts should be produced clearly in black and white. If bars or sections need to be distinguished, do not use shades of gray—photocopying will make them indistinguishable. Patterns such as hash marks are a better choice. Keep all tables, figures, and charts on the same diskette. Clearly label the diskette with the title of the work and the software program(s) used (for text, Microsoft Word or WordPerfect 5.1 is preferable). Please be sure to supply clearly legible data points, preferably in a spreadsheet program such as Microsoft Excel. We will then use these data points to recreate all figures in Adobe Illustrator, since programs such as Excel and PowerPoint do not produce "publishable" formats. If your material cannot be read by our computers or we are unable to recreate it from supplied data points, we will be unable to use the material. All artwork should be placed at the end of the paper, not within the text itself.

3. Source lines for artwork

Please supply source lines for all artwork provided; type the source information under the piece of artwork (author, publication title, publication state and city, publication date). It is your responsibility to obtain written permission from the source to reprint material in our book if you are not the original source.

4. References/Footnotes/Endnotes

Please include complete references/notes with each draft. We follow the *Chicago Manual of Style, 13th Edition*, University of Chicago Press. If using the author-date reference system, a brief citation is placed in the text (Author Last Name Date), and a list of works cited is placed at the end of the text. The basic format for citations in this list is, in alphabetical order by author:

Author Last Name, Initial. Initial. Year. Article title. *Magazine or Journal Title* volume number:page number.
Author Last Name, Initial. Initial. Year. *Title of Book*. City of publication: Publisher, year.

An alternative is the endnote system, whereby a superscript number is placed in text and the corresponding number with note is placed at the end of the paper. The basic style for endnotes is:

1. Author First Name Author Last Name, *Title of Book* (City of publication: Publisher, year), page number.
2. Author First Name Author Last Name, "Article Title," *Magazine or Journal Title* volume number (Month year): page number.

For further guidance, please contact the ACCF Center for Policy Research.

September 1997

Chairman: Dr. Charles E. Walker
 former Deputy Secretary of the Treasury,
 Chairman, Walker and Walker LLC
 President: Mark A. Bloomfield, Esq.
 Senior Vice President: Mari Lee Dunn
 Senior Vice President and Director of Research: Dr. Margo Thorning

ACCF

AMERICAN COUNCIL FOR CAPITAL FORMATION
 CENTER FOR POLICY RESEARCH

July 21, 1998

The Honorable Jeffrey A. Frankel
 Member
 Council of Economic Advisers
 314 Old Executive Office Building
 Washington, D.C. 20502

Dear Dr. Frankel:

I am writing to invite you to be a respondent at our September 23 forum, "Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality," sponsored by the ACCF Center for Policy Research. The day-long session will be held at the National Press Club, 529 14th Street, N.W., Washington, D.C. A preliminary agenda is enclosed as well as background on the ACCF.

Your panel, "The Kyoto Treaty: Economic and Environmental Consequences," is scheduled after the breakfast address. The paper giver for this panel is Dr. Richard Richels, director, Department of Energy Analysis and Planning, Electric Power Research Institute. Dr. Richard Schmalensee, Gordon Y Billard Professor of Economics and Management, Massachusetts Institute of Technology, has agreed to be a respondent.

We ask that you plan on about 10 minutes for your remarks. The audience for our symposium will include some 100-150 individuals from among our corporate and association supporters, Hill and Administration staff, representatives from other countries, and international organizations, and the media. The edited proceedings will be published as a book. We would appreciate receiving your written comments (4-8 double-spaced pages) within two weeks after the conference. In addition to the hard copy, we would also like to receive the computer diskette of your paper in WordPerfect (5.1 or Windows 6.0) or Microsoft Word, if possible (see enclosed "Author's Guidelines").

Sincerely,

Margo Thorning

Enclosures

DISTINGUISHED FELLOWS OF THE ACCF CENTER FOR POLICY RESEARCH
 Environmental Policy Fellow, 1997-98
 Hon. Richard Schmalensee*
 Gordon Y Billard Professor of Economics and Management
 Massachusetts Institute of Technology
 TCW Fellow, 1997-98
 Dr. Thomas Hori
 former Director of the International Tax Staff,
 U.S. Department of the Treasury
 Managing Director, Hori, Frisch, Clowery & Finen
BOARD OF SCHOLARS
 Dr. B. Douglas Bernheim
 Professor of Economics
 Stanford University
 Hon. Michael J. Boskin
 Tully M. Friedman Professor of Economics
 and Senior Fellow, Hoover Institution
 Stanford University
 Hon. David P. Bradford
 Professor of Economics and Public Affairs
 Princeton University
 Dr. Lawrence H. Goulder
 Associate Professor of Economics
 Stanford University
 Dr. John D. Graham
 Professor of Policy and Decision Sciences
 Harvard School of Public Health
 Dr. Robert E. Hill
 Professor of Economics and
 Senior Fellow, Hoover Institution
 Stanford University
 Prof. Arnold C. Harberger
 Professor of Economics
 University of California at Los Angeles
 Dr. Dale W. Jorgenson
 Frederic Eaton Abbe Professor of Economics
 Harvard University
 Dr. Alan S. Manne
 Professor Emeritus, Operations Research
 Stanford University
 Dr. Charles McLure, Jr.
 Senior Fellow, Hoover Institution
 Stanford University
 Dr. Roger B. Porter
 Professor of Government and Business
 John F. Kennedy School of Government
 Harvard University
 Dr. James M. Poterba
 Mitsui Professor of Economics
 Massachusetts Institute of Technology
 Dr. John B. Shoven
 Dean, School of Humanities and Sciences
 Stanford University
 Hon. Murray L. Weidenbaum
 Mallinckrodt Distinguished University Professor
 Washington University
 Hon. Ed Zschau
 Professor of Management
 Graduate School of Business Administration
 Harvard University
BOARD OF TRUSTEES
 Thomas D. Campbell
 President
 Thomas D. Campbell and Associates
 Dr. George N. Carlson
 Partner
 Arthur Andersen & Co.
 Maxine C. Champion
 Vice-President, Government and
 International Relations
 Nestle USA, Inc.
 Ernest S. Christian, Jr., Esq.
 Attorney-at-Law
 Dr. Kathleen B. Cooper
 Chief Economist
 Exxon Corporation
 Paul R. Huard
 Senior Vice-President,
 Policy and Communications
 National Association of Manufacturers
 Hon. Manuel H. Johnson
 former Vice-Chairman
 Board of Governors of
 the Federal Reserve System
 Dr. Rudolph G. Penner
 former Director
 Congressional Budget Office
 Larry W. Pollock
 Vice-President and Director of Taxes
 Weyerhaeuser Company
 Mrs. John F. Renshaw
 Thomas White
 Chairman and Chief Executive Officer
 Enron Ventures Corp.

*Member, Board of Scholars

1750 K Street, N.W., Suite 400, Washington, D.C. 20006-2302
 202/293-5811; 202/785-8165 FAX; info@accf.org E-MAIL • http://www.accf.org

7/22 faxed JAF
 bio

for 785-8165

7/21/98

**CLIMATE CHANGE POLICY: PRACTICAL STRATEGIES TO
PROMOTE ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY**

**1998 Environmental Policy Project Sponsored
by the ACCF Center for Policy Research**

Mission of the ACCF Center for Policy Research

The mission of the ACCF Center for Policy Research is to focus the attention of policymakers on Capitol Hill and in the administration and opinion shapers in the media and the private sector on the need for environmental and regulatory policies that enhance both economic growth and environmental quality. To this end, the ACCF Center for Policy Research will sponsor an environmental project on climate policy issues in 1998: *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality*. The Center's proposed 1998 environmental project builds on its earlier projects: *The Impact of Climate Change Policy on Consumers: Can Tradable Permits Reduce the Cost?* (1997), *Climate Change, Regulatory Reform, and U.S. Economic Growth* (1996) and *An Economic Perspective on Climate Change* (1995).

The fact that U.S. environmental regulations impose real costs on society as well as benefits has been documented in previous Center-sponsored studies. An important goal for U.S. policymakers should be to reduce the cost and increase the efficiency of environmental regulations. Greater reliance on the development of new energy-efficient technologies as well as market-based incentives, and on allowing businesses more flexibility in meeting environmental goals, should be the focus of future environmental regulations.

The ACCF Center for Policy Research is the research affiliate of the American Council for Capital Formation. The Center's work complements but differs from other economic policy think tanks because: (1) the Center **concentrates** on the economic impact of environmental policy; (2) the Center **focuses** on solid economic analysis rather than engaging in partisan or ideological efforts; (3) the Center **sets** specific industry concerns in a broad economic context which thereby addresses micro- as well as macroeconomic concerns; and (4) the Center **merges** sound analysis, political acumen, and public relations skills to effectively promote pro-growth environmental policies.

The Center's 1998 Environmental Policy Projects

The Center's 1998 project, *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality*, will feature a public policy forum to be held September 23 at the National Press Club in Washington, D.C. This forum will be the catalyst for presenting provocative new research on climate policy issues facing Congress, the Clinton Administration, and the regulatory agencies. The Center will publish the analyses and commentaries presented at the forum as an attractive monograph and as short special reports that will be distributed to members of the environmental committees of Congress and their staffs, appropriate administration and regulatory officials, and opinion shapers in the media and private sector. In addition, the Center will make the research presented at the forum available on its Web site, <http://www.accf.org>.

AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH

1750 K Street, N.W., Suite 400, Washington, D.C. 20006-2302 • 202/293-5811 • 202/785-8165 FAX • info@accf.org E-MAIL • Web site: <http://www.accf.org>

The Center's sophisticated and comprehensive agenda, targeted at opinion shapers and policymakers, will make its 1998 program an integral part of the economic and environmental policy debate.

***CLIMATE CHANGE POLICY: PRACTICAL STRATEGIES TO PROMOTE
ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY***

September 23, 1998
National Press Club
Washington, D.C.

**Breakfast Address: A Congressional Perspective (Senior Member
of an Environmental Policy Oversight Committee)**

Panel I. The Kyoto Treaty: Economic and Environmental Consequences

This study will examine the prospects for actually implementing the treaty in the United States and the economic impact of reducing U.S. energy use by 30-40 percent from the baseline forecast. It will also analyze the expected "leakage" of investment and jobs to non-Annex I countries if the treaty were implemented in the United States.

Richard Richels of the Electric Power Research Institute will prepare this study. Professor Richard Schmalensee has agreed to be a panelist; other invited panelists will include a representative from a government agency.

Q & A will follow

**Panel II. Technological Development and CO₂ Reduction in Energy Use:
Outlook for Near-Term Progress**

This study will examine the obstacles to the near-term application and development of technological innovation that would enable the United States to reduce its CO₂ emissions by 30-40 percent by 2008-2012. Technological challenges to be overcome in both stationary and mobile source CO₂ emissions will be presented.

Professor Henry Jacoby of MIT will prepare this study. Panelists from academia, Capitol Hill, and government agencies will also be invited.

Panel III. The Role of Energy in the U.S. Economy

This study will examine the major role played by energy in the United States and explain its impact on real economic growth. The importance of energy to consumer living standards and lifestyles will also be illustrated.

Professor John Moroney of Texas A&M University will prepare the study. Panelists from academia, Capitol Hill, and government agencies will also be invited.

**Luncheon Address: The View from the City (An Urban Mayor's
Perspective on Climate Mitigation Policy)**

**Panel IV. Removing the Obstacles for Long-Term Technological Innovation
to Reduce CO₂ Emissions**

This analysis will examine issues such as: (1) What type of R&D is needed to develop carbon-free energy and more efficient technologies; (2) Are there major barriers to the development of new technologies; and (3) How to structure incentives to develop new technologies and to accelerate the turnover of the capital stock.

Dr. Jae Edmonds of Battelle, Pacific Northwest Laboratories will prepare this study. Panelists from academia, Capitol Hill, and government agencies will also be invited.

**Panel V. Tradable Permits for CO₂ Emissions: Obstacles to a Functional
International System**

This project will focus on the issues that need to be resolved before a system of tradable permits to reduce CO₂ emissions can be implemented. Issues to be examined include: (1) How can we involve the developing nations; (2) How can we monitor and enforce CO₂ emission reductions?

Professor Denny Ellerman of the Massachusetts Institute of Technology will prepare this study. Dr. David Harrison, Jr. of National Economic Research Associates, Inc. has agreed to be a panelist. Panelists from academia, Capitol Hill, and government agencies will also be invited.

HOW THE CENTER ACCOMPLISHES ITS MISSION

With its stellar board of directors, highly regarded professional staff, credibility among policymakers and the media, broad base of support, and understanding of the economy policymaking process, the ACCF Center for Policy Research *can* accomplish its mission.

- ***Stellar Board of Directors.*** The Center's board of directors includes recognized economic policy experts from some of America's most distinguished universities, many of whom earlier served in senior policy positions in the government. Noted environmental policy experts on the Center's board include Stanford's Alan S. Manne; Lawrence J. Goulder also of Stanford; John D. Graham, professor of policy and decision sciences, Harvard School of Public Health; and MIT Professor Richard Schmalensee, a pioneer in research on the impact of environmental policy on economic growth.
- ***Highly Regarded Professional Staff.*** The Center's professional staff has a strong academic background in economics, politics, and business.
- ***Credibility with Policymakers and the Media.*** The Center is called on frequently to testify before congressional committees because of its thorough, nonpartisan

research on economic policy issues and often asked to provide off-the-record counsel to members of Congress and their senior staffs. The Center also is a valuable resource for the media. Nationally syndicated columnist Robert Novak perhaps best described the Center's role:

The ACCF Center for Policy Research is one of Washington's most influential policy think tanks. Well-schooled in the arts of both politics and economics, the Center is one of the most effective organizations operating behind-the-scenes in Washington.

- **Broad Base of Support.** The Center's work is supported by all sectors of the American economy, including the financial and industrial communities, venture capital, real estate, small business, foundations, and individuals.

THE CENTER'S UNIQUE ROLE

Many Washington business organizations lack a solid policy analysis and research capacity, and their advocacy therefore suffers. Many think tanks, on the other hand, are relatively isolated from the policy process, and consequently their ability to affect public policy is minimal. The ACCF and the ACCF Center for Policy Research together merge political skills and legislative expertise on tax, regulatory, and environmental policies with a broad policy framework.

First, the ACCF Center for Policy Research brings to bear on the economic policymaking process research and analysis by some of the nation's most credible economic and regulatory policy scholars and analysts. Second, the ACCF Center for Policy Research is a highly regarded resource on sound tax, regulatory, and environmental policies for journalists and editorial boards. This results in a powerful combination of influence and credibility in the Washington economic policy community.

THE CENTER'S TRACK RECORD

The Center is emerging as one of the leading spokesman for sound environmental policies. The Center has published sixteen well-received books on tax and environmental policies, including *Balancing Economic Growth and Environmental Goals*; *Enhancing Environmental Quality Through Economic Growth*, and *An Economic Perspective on Climate Change Policies*, among others. The Center's new volume, *Climate Change Policy, Economic Growth, and Environmental Quality*, containing the proceedings from its 1997 environmental policy forum, will be released in the spring of 1998. Center volumes can be found on the bookshelves of policymakers from both political parties and are circulated to the media around the country. The Center's professional staff frequently serves on U.S. government advisory panels such as the President's Committee on Sustainable Development and participates in advisory groups for international organizations such as the World Bank and the International Finance Corporation, and makes presentations on environmental policy issues at forums, editorial briefings, and on radio and television in the United States and abroad.

ACCF

AMERICAN COUNCIL FOR CAPITAL FORMATION

FAX TRANSMISSION COVER SHEET

DATE: 7/21/98	
TO: The Hon. Jeff Frankel	FAXED Attention: Lisa
FROM:	☐ Mark Bloomfield ☐ Mari Lee Dunn ☒ Margo Thorning ☐ Ernestine Johnson ☐ Angela Wilkes
FAX PHONE #:	958 395-6598
PAGES [including cover]:	6
Contact _____ at (202) 293-5811 if there is any problem.	

NOTE: Dear Dr. Frankel-

We very much hope you can
join us on Sept 23.
I'll call your office to
follow up. Our messenger is
had copy with enclosures
tomorrow

OFFICERS

Chairman: Dr. Charles E. Walker
former Deputy Secretary of the Treasury,
Chairman, Walker and Walker LLC
President: Mark A. Bloomfield, Esq.
Senior Vice President: Mari Lee Dunn
Senior Vice President and Director of Research: Dr. Margo Thorning

ACCF

**DISTINGUISHED FELLOWS OF THE
ACCF CENTER FOR POLICY RESEARCH**
Environmental Policy Fellow, 1997-98
Hon. Richard Schmalensee*
Gordon Y Billard Professor of
Economics and Management
Massachusetts Institute of Technology

TCW Fellow, 1997-98
Dr. Thomas Horst
former Director of the International Tax Staff,
U.S. Department of the Treasury
Managing Director, Horst, Frisch, Clowery & Finan

BOARD OF SCHOLARS
Dr. B. Douglas Bernheim
Professor of Economics
Stanford University
Hon. Michael J. Boskin
Tully M. Friedman Professor of Economics
and Senior Fellow, Hoover Institution
Stanford University

Hon. David F. Bradford
Professor of Economics and Public Affairs
Princeton University

Dr. Lawrence H. Goulder
Associate Professor of Economics
Stanford University

Dr. John D. Graham
Professor of Policy and Decision Sciences
Harvard School of Public Health

Dr. Robert E. Hall
Professor of Economics and
Senior Fellow, Hoover Institution
Stanford University

Prof. Arnold C. Harberger
Professor of Economics
University of California at Los Angeles

Dr. Dale W. Jorgenson
Frederic Eaton Abbe Professor of Economics
Harvard University

Dr. Alan S. Manne
Professor Emeritus, Operations Research
Stanford University

Dr. Charles McLure, Jr.
Senior Fellow, Hoover Institution
Stanford University

Dr. Roger B. Porter
Professor of Government and Business
John F. Kennedy School of Government
Harvard University

Dr. James M. Poterba
Mitsui Professor of Economics
Massachusetts Institute of Technology

Dr. John B. Shoven
Dean, School of Humanities and Sciences
Stanford University

Hon. Murray L. Weidenbaum
Mallinckrodt Distinguished University Professor
Washington University

Hon. Ed Zschau
Professor of Management
Graduate School of Business Administration
Harvard University

BOARD OF TRUSTEES

Thomas D. Campbell
President
Thomas D. Campbell and Associates

Dr. George N. Carlson
Partner
Arthur Andersen & Co.

Maxine C. Champion
Vice-President, Government and
International Relations
Nestle USA, Inc

Ernest S. Christian, Jr., Esq.
Attorney-at-Law

Dr. Kathleen B. Cooper
Chief Economist
Exxon Corporation

Paul R. Huard
Senior Vice-President,
Policy and Communications
National Association of Manufacturers

Hon. Manuel H. Johnson
former Vice-Chairman
Board of Governors of
the Federal Reserve System

Dr. Rudolph G. Penner
former Director
Congressional Budget Office

Larry W. Pollock
Vice-President and Director of Taxes
Weyerhaeuser Company

Mrs. John P. Renshaw

Thomas White
Chairman and Chief Executive Officer
Enron Ventures Corp.

*Member, Board of Scholars

AMERICAN COUNCIL FOR CAPITAL FORMATION CENTER FOR POLICY RESEARCH

July 21, 1998

The Honorable Jeffrey A. Frankel
Member
Council of Economic Advisers
314 Old Executive Office Building
Washington, D.C. 20502

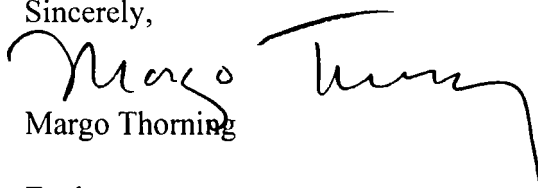
Dear Dr. Frankel:

I am writing to invite you to be a respondent at our September 23 forum, "Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality," sponsored by the ACCF Center for Policy Research. The day-long session will be held at the National Press Club, 529 14th Street, N.W., Washington, D.C. A preliminary agenda is enclosed as well as background on the ACCF.

Your panel, "The Kyoto Treaty: Economic and Environmental Consequences," is scheduled after the breakfast address. The papergiver for this panel is Dr. Richard Richels, director, Department of Energy Analysis and Planning, Electric Power Research Institute. Dr. Richard Schmalensee, Gordon Y Billard Professor of Economics and Management, Massachusetts Institute of Technology, has agreed to be a respondent.

We ask that you plan on about 10 minutes for your remarks. The audience for our symposium will include some 100-150 individuals from among our corporate and association supporters, Hill and Administration staff, representatives from other countries, and international organizations, and the media. The edited proceedings will be published as a book. We would appreciate receiving your written comments (4-8 double-spaced pages) within two weeks after the conference. In addition to the hard copy, we would also like to receive the computer diskette of your paper in WordPerfect (5.1 or Windows 6.0) or Microsoft Word, if possible (see enclosed "Author's Guidelines").

Sincerely,



Margo Thorning

Enclosures

CLIMATE CHANGE POLICY: PRACTICAL STRATEGIES TO PROMOTE ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY

**1998 Environmental Policy Project Sponsored
by the ACCF Center for Policy Research**

Mission of the ACCF Center for Policy Research

The mission of the ACCF Center for Policy Research is to focus the attention of policymakers on Capitol Hill and in the administration and opinion shapers in the media and the private sector on the need for environmental and regulatory policies that enhance both economic growth and environmental quality. To this end, the ACCF Center for Policy Research will sponsor an environmental project on climate policy issues in 1998: *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality*. The Center's proposed 1998 environmental project builds on its earlier projects: *The Impact of Climate Change Policy on Consumers: Can Tradable Permits Reduce the Cost?* (1997), *Climate Change, Regulatory Reform, and U.S. Economic Growth* (1996) and *An Economic Perspective on Climate Change* (1995).

The fact that U.S. environmental regulations impose real costs on society as well as benefits has been documented in previous Center-sponsored studies. An important goal for U.S. policymakers should be to reduce the cost and increase the efficiency of environmental regulations. Greater reliance on the development of new energy-efficient technologies as well as market-based incentives, and on allowing businesses more flexibility in meeting environmental goals, should be the focus of future environmental regulations.

The ACCF Center for Policy Research is the research affiliate of the American Council for Capital Formation. The Center's work complements but differs from other economic policy think tanks because: (1) the Center **concentrates** on the economic impact of environmental policy; (2) the Center **focuses** on solid economic analysis rather than engaging in partisan or ideological efforts; (3) the Center **sets** specific industry concerns in a broad economic context which thereby addresses micro- as well as macroeconomic concerns; and (4) the Center **merges** sound analysis, political acumen, and public relations skills to effectively promote pro-growth environmental policies.

The Center's 1998 Environmental Policy Projects

The Center's 1998 project, *Climate Change Policy: Practical Strategies to Promote Economic Growth and Environmental Quality*, will feature a public policy forum to be held September 23 at the National Press Club in Washington, D.C. This forum will be the catalyst for presenting provocative new research on climate policy issues facing Congress, the Clinton Administration, and the regulatory agencies. The Center will publish the analyses and commentaries presented at the forum as an attractive monograph and as short special reports that will be distributed to members of the environmental committees of Congress and their staffs, appropriate administration and regulatory officials, and opinion shapers in the media and private sector. In addition, the Center will make the research presented at the forum available on its Web site, <http://www.accf.org>.

The Center's sophisticated and comprehensive agenda, targeted at opinion shapers and policymakers, will make its 1998 program an integral part of the economic and environmental policy debate.

***CLIMATE CHANGE POLICY: PRACTICAL STRATEGIES TO PROMOTE
ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY***

September 23, 1998
National Press Club
Washington, D.C.

**Breakfast Address: A Congressional Perspective (Senior Member
of an Environmental Policy Oversight Committee)**

Panel I. The Kyoto Treaty: Economic and Environmental Consequences

This study will examine the prospects for actually implementing the treaty in the United States and the economic impact of reducing U.S. energy use by 30-40 percent from the baseline forecast. It will also analyze the expected "leakage" of investment and jobs to non-Annex I countries if the treaty were implemented in the United States.

Richard Richels of the Electric Power Research Institute will prepare this study. Professor Richard Schmalensee has agreed to be a panelist; other invited panelists will include a representative from a government agency.

**Panel II. Technological Development and CO₂ Reduction in Energy Use:
Outlook for Near-Term Progress**

This study will examine the obstacles to the near-term application and development of technological innovation that would enable the United States to reduce its CO₂ emissions by 30-40 percent by 2008-2012. Technological challenges to be overcome in both stationary and mobile source CO₂ emissions will be presented.

Professor Henry Jacoby of MIT will prepare this study. Panelists from academia, Capitol Hill, and government agencies will also be invited.

Panel III. The Role of Energy in the U.S. Economy

This study will examine the major role played by energy in the United States and explain its impact on real economic growth. The importance of energy to consumer living standards and lifestyles will also be illustrated.

Professor John Moroney of Texas A&M University will prepare the study. Panelists from academia, Capitol Hill, and government agencies will also be invited.

Luncheon Address: The View from the City (An Urban Mayor's Perspective on Climate Mitigation Policy)

Panel IV. Removing the Obstacles for Long-Term Technological Innovation to Reduce CO₂ Emissions

This analysis will examine issues such as: (1) What type of R&D is needed to develop carbon-free energy and more efficient technologies; (2) Are there major barriers to the development of new technologies; and (3) How to structure incentives to develop new technologies and to accelerate the turnover of the capital stock.

Dr. Jae Edmonds of Battelle, Pacific Northwest Laboratories will prepare this study. Panelists from academia, Capitol Hill, and government agencies will also be invited.

Panel V. Tradable Permits for CO₂ Emissions: Obstacles to a Functional International System

This project will focus on the issues that need to be resolved before a system of tradable permits to reduce CO₂ emissions can be implemented. Issues to be examined include: (1) How can we involve the developing nations; (2) How can we monitor and enforce CO₂ emission reductions?

Professor Denny Ellerman of the Massachusetts Institute of Technology will prepare this study. Dr. David Harrison, Jr. of National Economic Research Associates, Inc. has agreed to be a panelist. Panelists from academia, Capitol Hill, and government agencies will also be invited.

HOW THE CENTER ACCOMPLISHES ITS MISSION

With its stellar board of directors, highly regarded professional staff, credibility among policymakers and the media, broad base of support, and understanding of the economy policymaking process, the ACCF Center for Policy Research *can* accomplish its mission.

- ***Stellar Board of Directors.*** The Center's board of directors includes recognized economic policy experts from some of America's most distinguished universities, many of whom earlier served in senior policy positions in the government. Noted environmental policy experts on the Center's board include Stanford's Alan S. Manne; Lawrence J. Goulder also of Stanford; John D. Graham, professor of policy and decision sciences, Harvard School of Public Health; and MIT Professor Richard Schmalensee, a pioneer in research on the impact of environmental policy on economic growth.
- ***Highly Regarded Professional Staff.*** The Center's professional staff has a strong academic background in economics, politics, and business.
- ***Credibility with Policymakers and the Media.*** The Center is called on frequently to testify before congressional committees because of its thorough, nonpartisan

research on economic policy issues and often asked to provide off-the-record counsel to members of Congress and their senior staffs. The Center also is a valuable resource for the media. Nationally syndicated columnist Robert Novak perhaps best described the Center's role:

The ACCF Center for Policy Research is one of Washington's most influential policy think tanks. Well-schooled in the arts of both politics and economics, the Center is one of the most effective organizations operating behind-the-scenes in Washington.

- **Broad Base of Support.** The Center's work is supported by all sectors of the American economy, including the financial and industrial communities, venture capital, real estate, small business, foundations, and individuals.

THE CENTER'S UNIQUE ROLE

Many Washington business organizations lack a solid policy analysis and research capacity, and their advocacy therefore suffers. Many think tanks, on the other hand, are relatively isolated from the policy process, and consequently their ability to affect public policy is minimal. The ACCF and the ACCF Center for Policy Research together merge political skills and legislative expertise on tax, regulatory, and environmental policies with a broad policy framework.

First, the ACCF Center for Policy Research brings to bear on the economic policymaking process research and analysis by some of the nation's most credible economic and regulatory policy scholars and analysts. Second, the ACCF Center for Policy Research is a highly regarded resource on sound tax, regulatory, and environmental policies for journalists and editorial boards. This results in a powerful combination of influence and credibility in the Washington economic policy community.

THE CENTER'S TRACK RECORD

The Center is emerging as one of the leading spokesman for sound environmental policies. The Center has published sixteen well-received books on tax and environmental policies, including *Balancing Economic Growth and Environmental Goals*; *Enhancing Environmental Quality Through Economic Growth*, and *An Economic Perspective on Climate Change Policies*, among others. The Center's new volume, *Climate Change Policy, Economic Growth, and Environmental Quality*, containing the proceedings from its 1997 environmental policy forum, will be released in the spring of 1998. Center volumes can be found on the bookshelves of policymakers from both political parties and are circulated to the media around the country. The Center's professional staff frequently serves on U.S. government advisory panels such as the President's Committee on Sustainable Development and participates in advisory groups for international organizations such as the World Bank and the International Finance Corporation, and makes presentations on environmental policy issues at forums, editorial briefings, and on radio and television in the United States and abroad.

Clinton Presidential Records Digital Records Marker

This is not a presidential record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

This marker identifies the place of a publication.

Publications have not been scanned in their entirety for the purpose of digitization. To see the full publication please search online or visit the Clinton Presidential Library's Research Room.

**American Council for
Capital Formation
&
ACCF Center for
Policy Research**

**1997
ANNUAL
REPORT**

ACCF