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LDC's

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probability - low

check GDP growth
assumptions for
FSU, China

MEMORANDUM

TO: Jeff Frankel

FROM: Joe Aldy

DATE: August 27, 1997

RE: International transfers attributable to Annex I and worldwide permit trading

International trade in carbon emissions should allow for firms in the United States to purchase lower cost reductions abroad. While these reductions through international trade should reduce the costs of complying with a climate agreement, they would also result in substantial transfers of income across countries. Based on the latest round of SGM modeling runs¹, we assessed the magnitudes of these transfers by country.

Countries Buying Permits

Regardless of trading scheme (Annex I or worldwide), the U.S. is the largest buyer of permits in the year 2050 under four targets and timetables scenarios: Peak in 2015, 1990 Levels in 2010, -10% of 1990 Levels in 2010, and 1995 Levels in 2010. With the exception of the period 2010 to 2030 in the 1995 scenario with Annex I trading, the U.S. is always the largest buyer of permits in the world (see attached charts). Under these scenarios, the U.S. would buy between about \$25 billion and \$80 billion of permits in 2050 under Annex I trading, and between approximately \$25 billion and \$40 billion of permits in 2050 under worldwide trading from other countries.

Scenario	Value of Permits Purchased by U.S. in 2050, Annex I only	Value of Permits Purchased by U.S. in 2050, Worldwide
Peak in 2015	\$57 billion	\$25 billion
1990 in 2010	\$54 billion	\$24 billion
-10% of 1990 in 2010	\$79 billion	\$38 billion
1995 in 2010	\$25 billion	\$24 billion

In addition to the U.S., Western Europe and Japan are significant purchasers of international permits, ranking second and third by 2050 in all scenarios. In the 1995 Level in 2010 with Annex I trading only scenario, every Annex I country is a purchaser of permits by 2050 except for the Former Soviet Union nations and Australia.

¹ These are the runs received on 8/21/97.

From Joint Implementation to Technology Transfer Credits

The Current U.S. Position on JI. The U.S. has proposed that Annex I countries be given credit for emissions reductions in other nations which, by some metric, are additional to the existing path of emissions. While this position has substantial business support in the U.S. it has, perhaps surprisingly, been met with strong opposition from the developing world. This appears to be largely based on the fact that the developing countries see little advantage to themselves from a JI system, despite the implied valuable technology transfer, since U.S. firms get all the credit

An Alternative: Technology Transfer Credits. Under this system, developing countries would directly reap the benefits from carbon-reducing investments made within their borders. More specifically:

- The World Bank, or some other multilateral institution, would be authorized to issue Technology Transfer Credits (TTCs) for investments that offer incremental reductions from business-as-usual emissions in developing countries. Incrementality would be assessed by independent engineers, either through a comparison to existing average emissions for an investment of that type, or through estimates of how this project deviates from the minimum cost project that ignores carbon reduction. One credit would be issued for each ton of incremental carbon reduction.
- The credits would be issued directly to the country in which the investment takes place. These credits could be used in a number of ways:
 - They could be traded into the Annex I international trading scheme, with the developing country receiving the current market clearing price as a cash transfer
 - They could be directly used to pay down existing debt to the World Bank or other multilateral institutions
 - Some share of the credits could be given to the investing companies as an inducement to place their investment in that country, and as an incentive to attract the most incrementally beneficial project. For example, companies could offer to bid a power plant contract, with the winner receiving a share of the credits for the incremental reduction in emissions.
- The bottom line is that, with the TTC system, developing countries *win in two ways*: they get a cutting edge technology transfer, and they get a cash transfer.
- For U.S. companies, this alternative is much better than the absence of JI, which is currently strongly opposed by the developing world. They will undoubtedly share in the credits received by developing countries, providing an extra return to environment-friendly investments abroad.
- This approach can also be molded to be responsive to the Brazil plan supported by

Countries Selling Permits

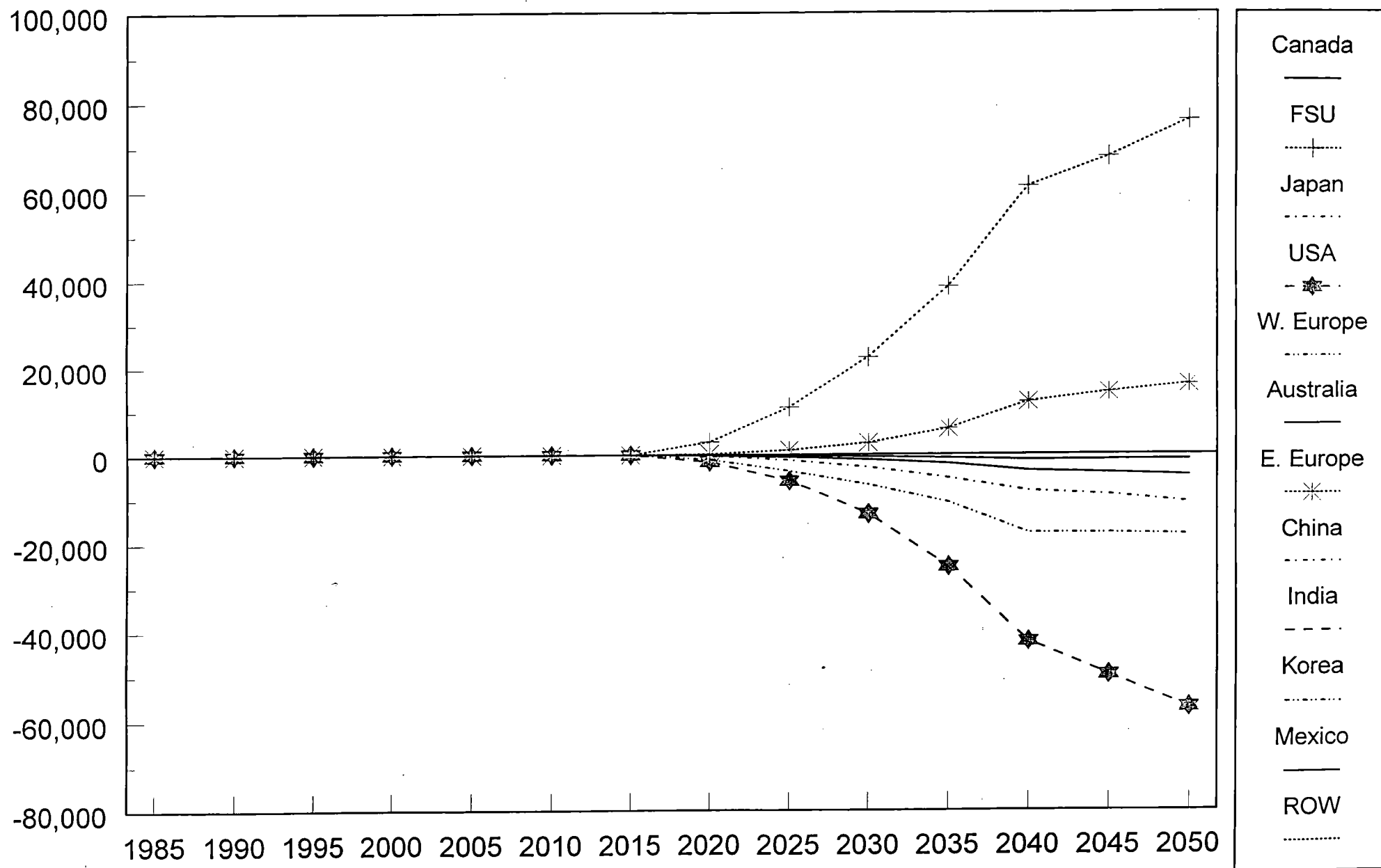
In all of the Annex I trading only scenarios, Former Soviet Union nations are the dominant sellers by 2050, with Eastern Europe second in all but the 1995 Level scenario. For worldwide trading, China is the dominant seller in all scenarios by 2050, followed by the Former Soviet Union and then the conglomeration of the Rest of the World (except for the 1995 scenario, where the Former Soviet Union countries buy permits). Eastern Europe becomes a purchaser of permits by 2050 in the worldwide trading cases. Under these trading schemes, the Former Soviet Union and China would receive substantial cash inflows for their permits.

Scenario	Value of Permits Sold by FSU in 2050, Annex I only	Value of Permits Sold by China in 2050, Worldwide
Peak in 2015	\$76 billion	\$22 billion
1990 in 2010	\$73 billion	\$21 billion
-10% of 1990 in 2010	\$108 billion	\$36 billion
1995 in 2010	\$30 billion	\$31 billion

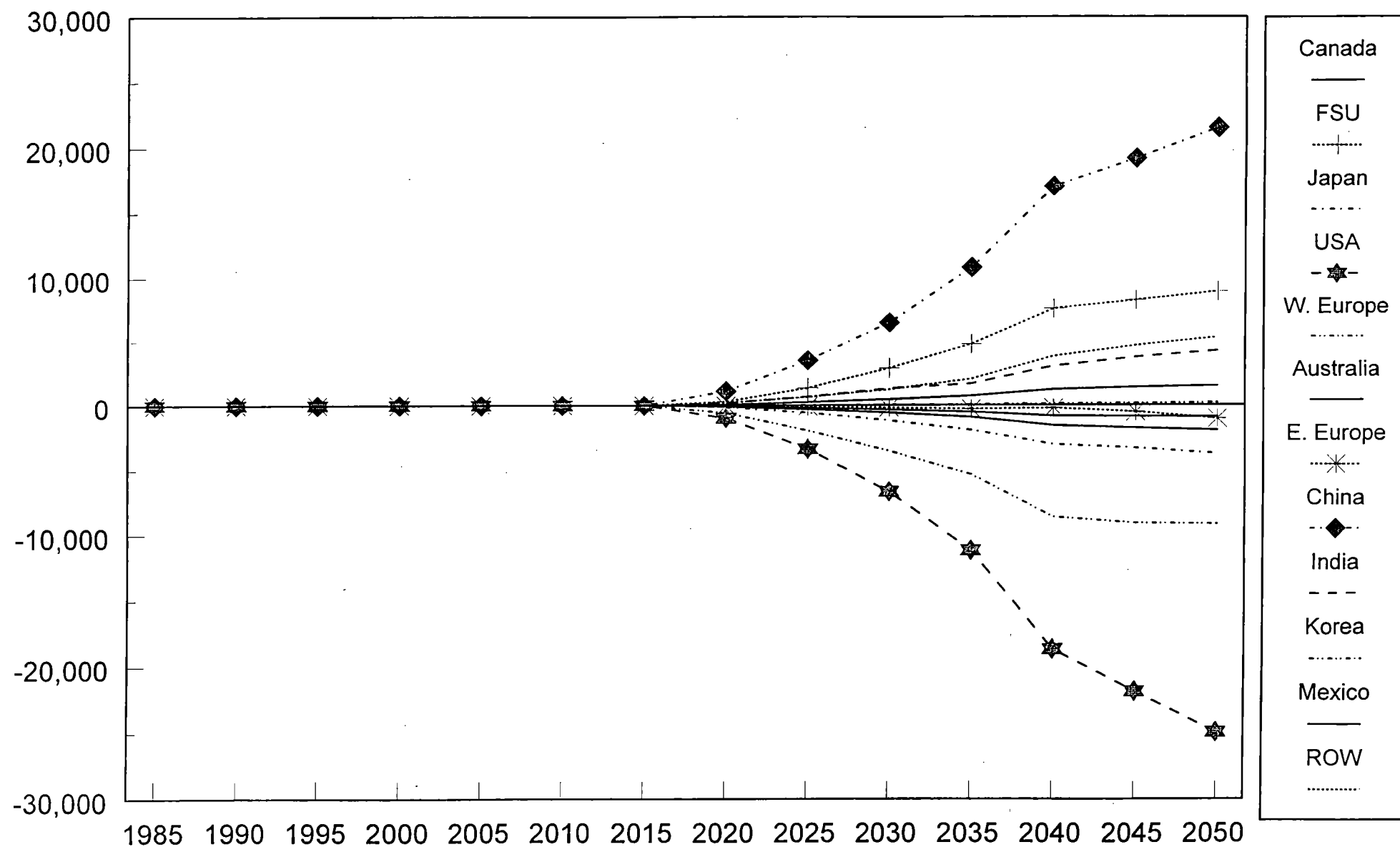
Note that SGM generates outputs for the following countries and regions:

Australia
Canada
China
Eastern Europe
Former Soviet Union
India
Korea
Mexico
Rest of the World
United States
Western Europe

Millions of 1992\$

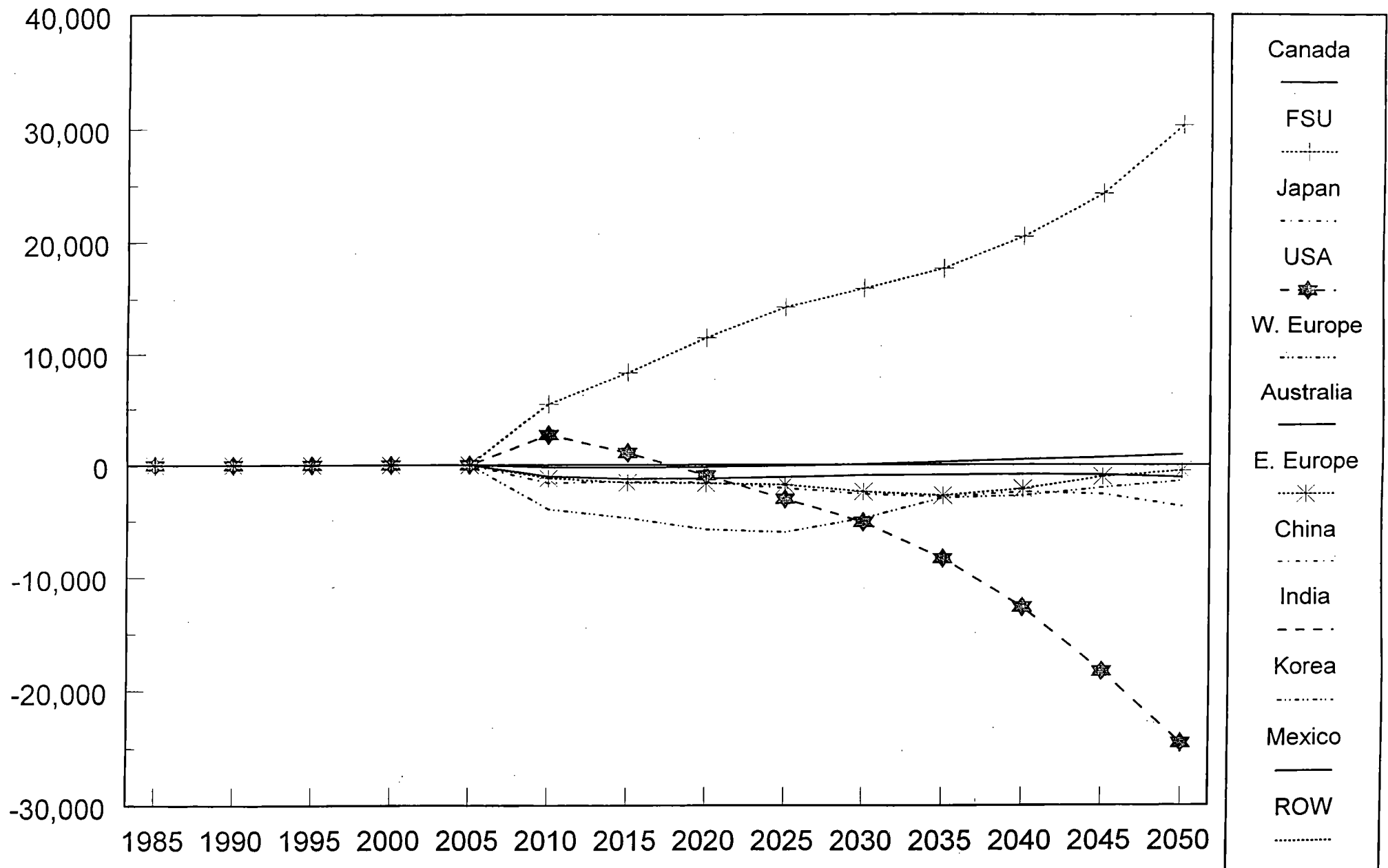


Millions of 1992\$



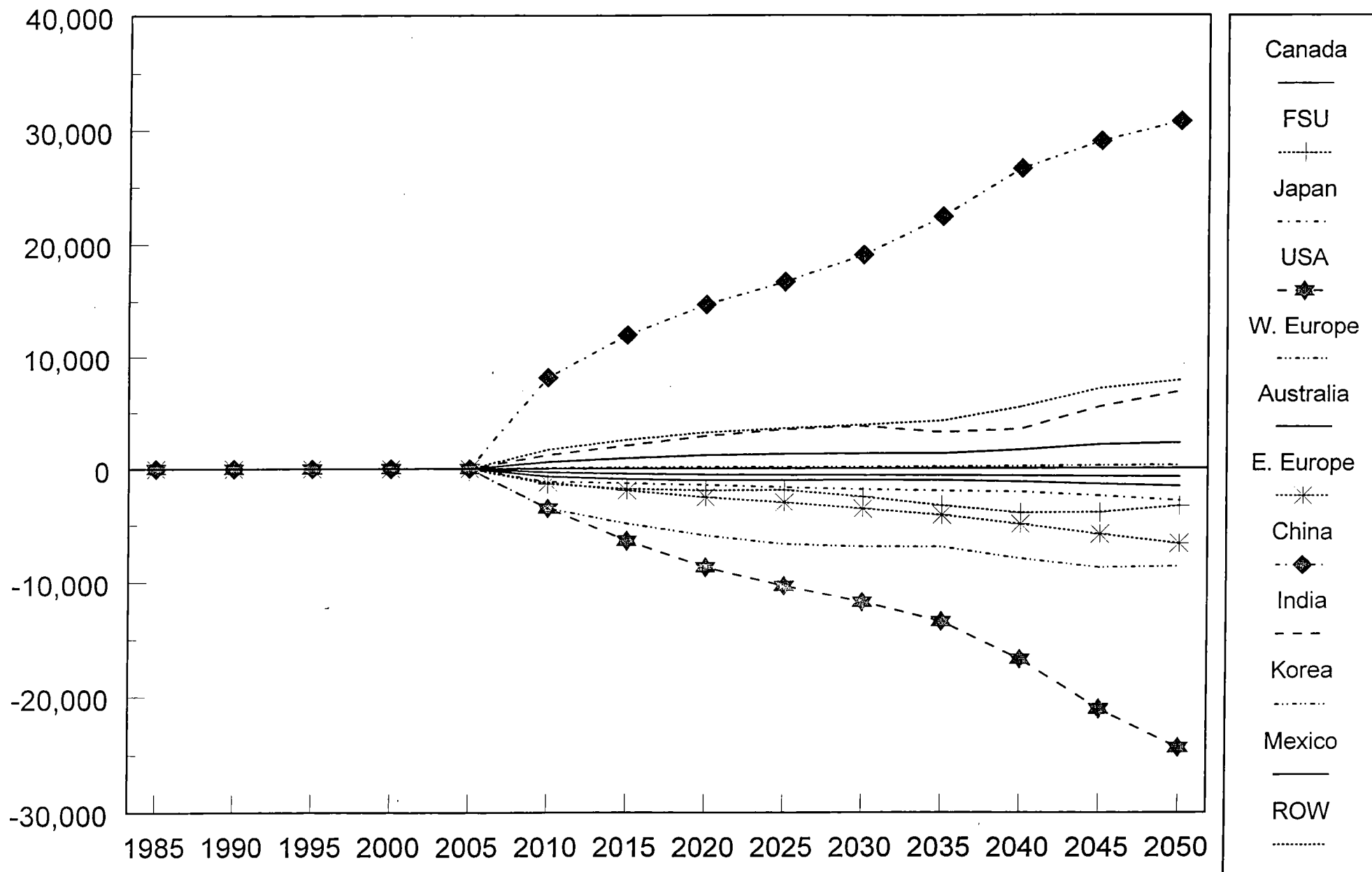
International Transfers from Permit Trading, 1995 in 2010, Annex I Trading, SGM6

Millions of 1992\$



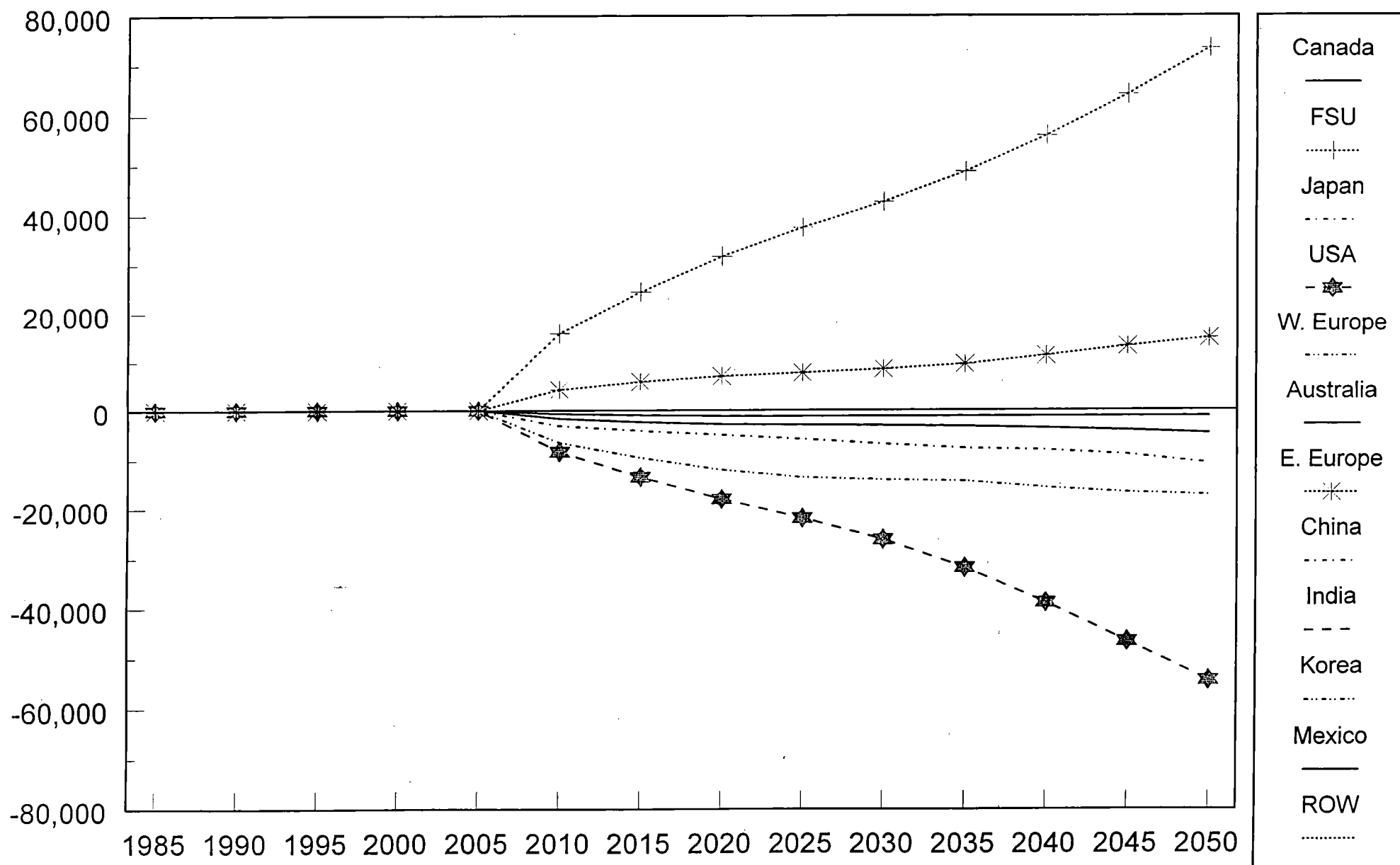
International Transfers from Permit Trading, 1995 in 2010, Worldwide Trading, SGM7

Millions of 1992\$



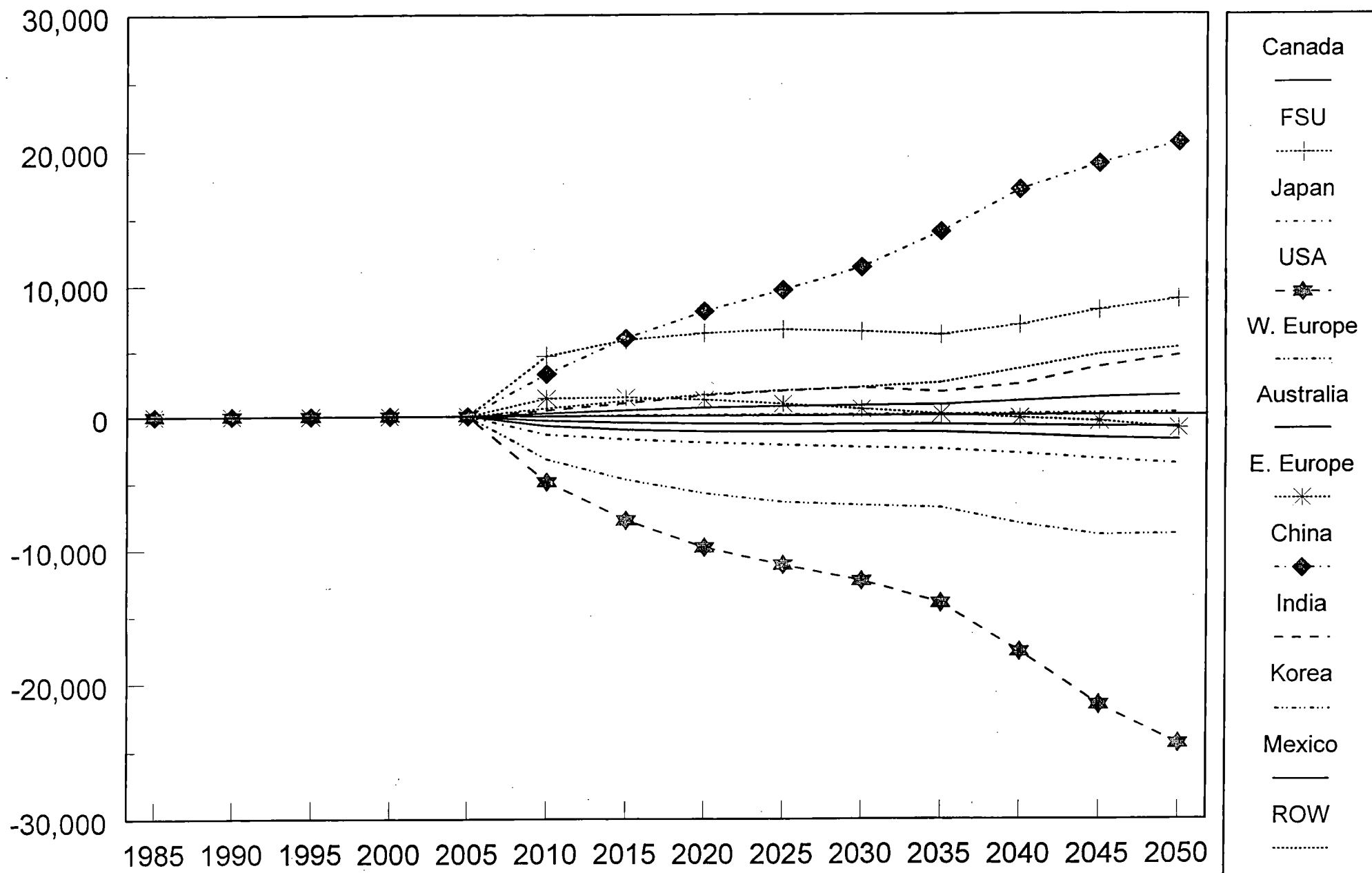
International Transfers from Permit Trading, 1990 in 2010, Annex I Trading, SGM3

Millions of 1992\$



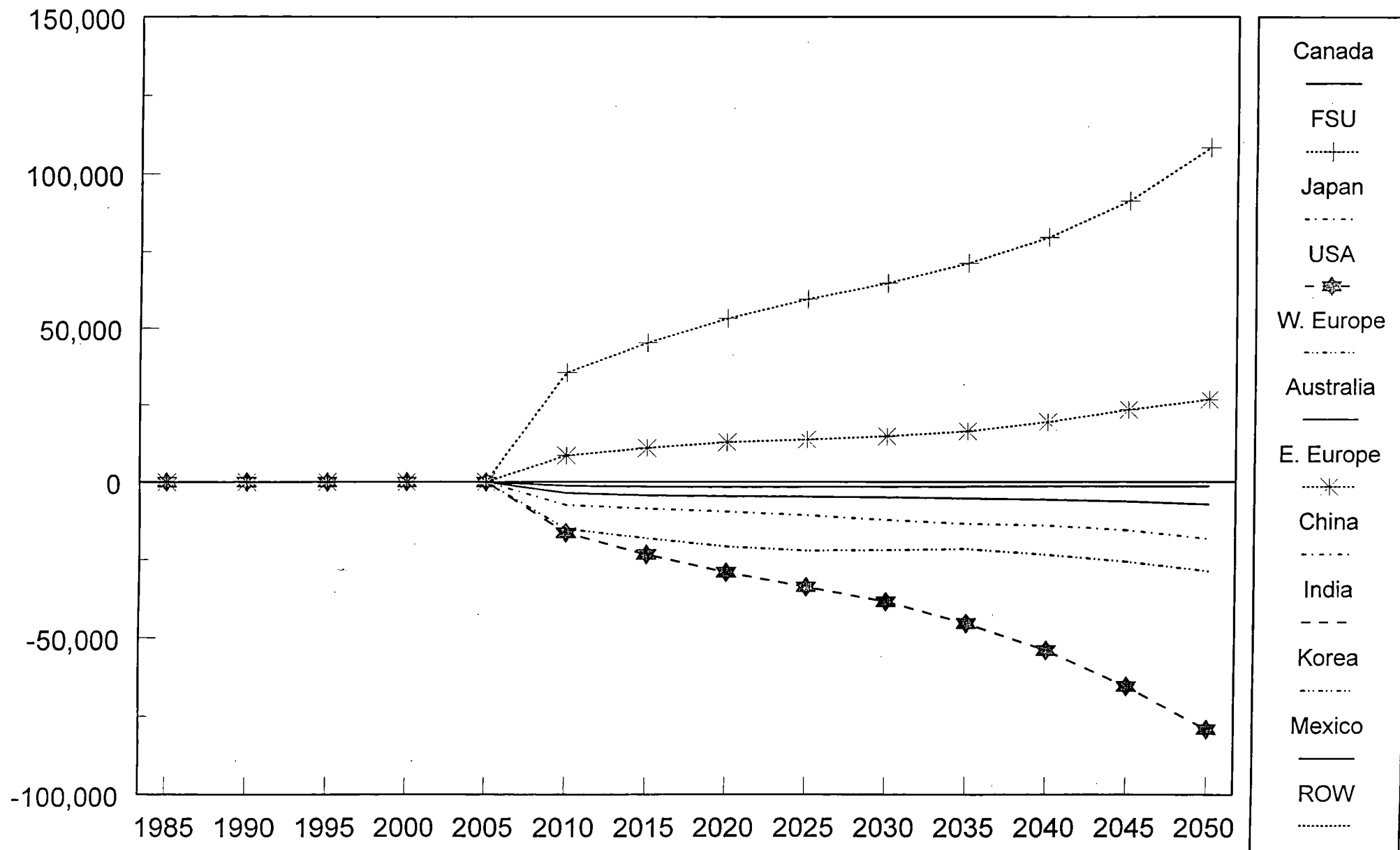
International Transfers from Permit Trading, 1990 in 2010, Worldwide Trading, SGM4

Millions of 1992\$



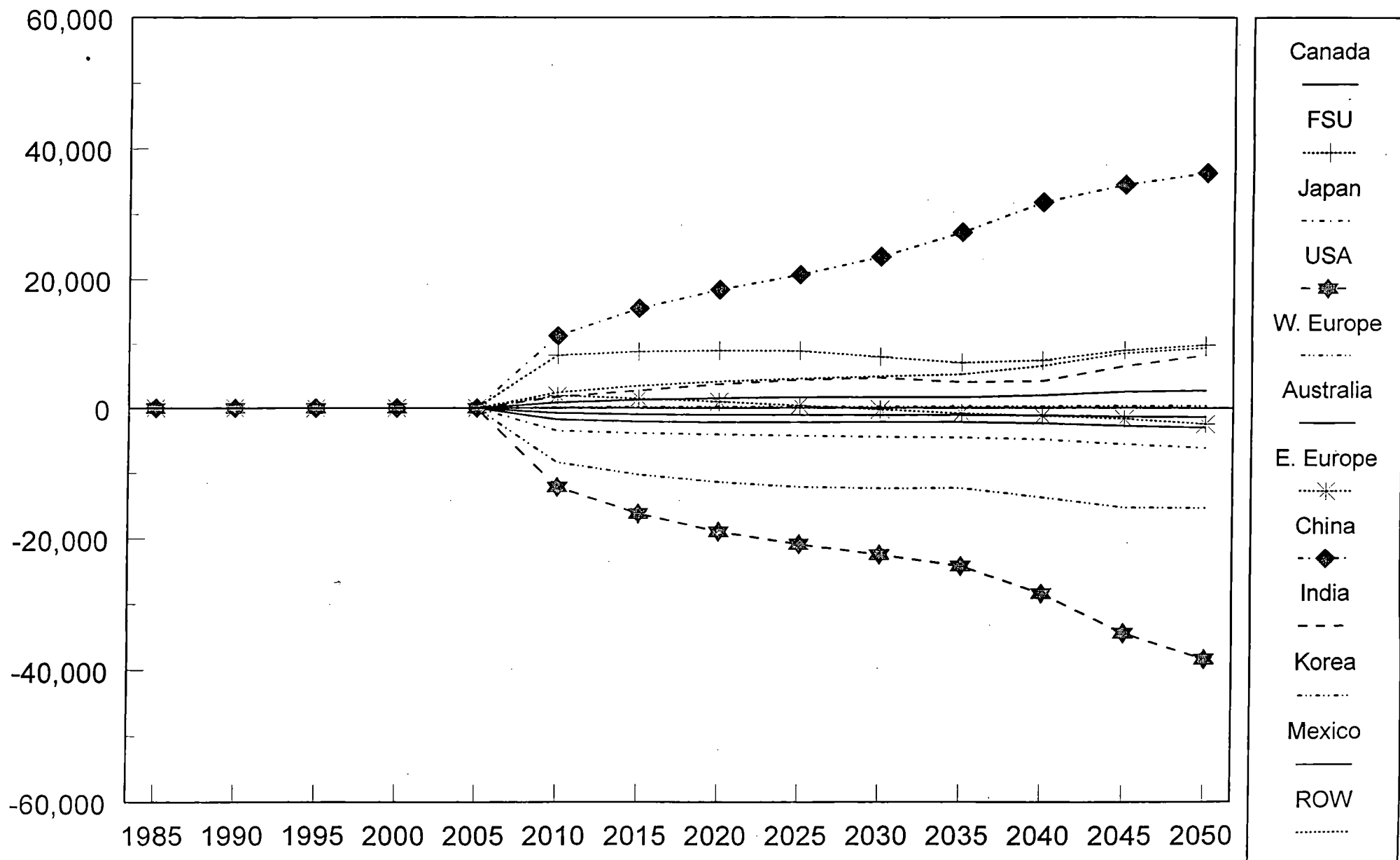
International Transfers from Permit Trading, -10% of 1990 in 2010, Annex I Trading, SGM9

Millions of 1992\$



International Transfers from Permit Trading, -10% of 1990 in 2010, Worldwide Trading, SGM10

Millions of 1992\$





MEMBER

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

August 26, 1997

JAF

MEMORANDUM FOR RAFE POMERANCE, STATE DEPARTMENT

FROM: JEFF FRANKEL 
SUBJECT: Developing Countries Paper (Comments are on Draft #5)

Page 3: The major reasons why we want developing countries participating is not the "competitiveness" issue (which, as you say, is the one that has been articulated by critics), but rather that, without the developing countries, our sacrifices will have been largely in vain, with regard to global emissions and concentrations. This is for two reasons: "free riding" (even if the LDCs don't alter behavior, their emissions will grow rapidly) and "leakage" (efforts by Annex I countries to reduce use of fossil fuels will end up raising fossil fuel use in non-included countries, e.g., via a lower world price of oil). I think you agree with these points. But I would suggest that they be included explicitly.

Page 5: Should the list of middle scenarios include two obvious ones: a moderate path, and a clause making US/Annex I action conditional on developing country agreement to participate?

Page 7: Under "Who:" the last bullet listing triggers should perhaps include in the list emissions per capita.

Page 8: I certainly do not think that common legally binding performance standards would be a good idea.

How to include developing countries?

I've seen some interesting proposals for mathematical formulas to guide the accession of developing countries to a treaty, as their incomes grow. Some proposals are probably too academic to constitute practical treaty language. My own tentative thoughts as to the sort of formulation that might work are as follows.

Middle-income countries could be defined, e.g., as those with per-capita incomes above \$3,000/year (or \$7,000 on a PPP basis). They would be asked at Kyoto to commit (1) to begin reducing emissions growth by some specific date in the future, (2) to agree to a future conference, at which they would be expected to agree on a (still-later) decade for eliminating emissions growth entirely and (3) to agree that the future conference would also set their longer-run emission paths (as some not-yet-specified functions of their populations, incomes, and 1990 emission levels), in such a way that they are treated more and more analogously to the Annex I countries as they grow.

Poor countries would also be asked at Kyoto to agree that if and when they cross the income threshold (e.g., \$3,000/yr.), they too will adopt commitment paths analogous to those of the Annex I and middle-income countries.

This leaves out China and India for the time being. Figuring out what we are going to do about them is beyond me.

To: Dr. Janet Yellen and Dr. Jeff Frankel
Fax #: 395 6958
Re: Climate change -- developing country obligations
Date: October 3, 1997
Pages: 7 .. including this cover sheet.

JLY
JAF
RL
AM FACSIMILE
JA

You have (appropriately) raised the issue of -- once having the negotiating authority -- what do we ask of the major developing countries in Kyoto.

In that connection, the attached paper from the Center for Clean Air Policy lays out an interesting idea for growth baselines -- basically a limitation on the rate of increase in greenhouse gas emissions. I think it an idea with some merit, and would like to talk with you about it. JAH

LDC's

From the desk of...

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**Growth Baselines:
Reducing Emissions and Increasing Investment in Developing Countries
Executive Summary**

While Annex I countries now account for about two-thirds of greenhouse gas emissions and are primarily responsible for the increased concentration of atmospheric carbon dioxide, developing country emissions are growing more quickly and are expected to account for over 40 percent of global emissions by the year 2015. Further, growth in developing country emissions could be even higher if Annex I countries agree to emissions caps but developing countries do not. This is because energy prices in Annex I would rise, resulting in some shift of energy-intensive, export-oriented industries to developing countries. (The magnitude of this economic and emissions leakage is unclear.)

The projected trend in developing country emissions makes it clear that reducing global greenhouse gas emissions will be difficult if not impossible if developing countries do not also adopt emissions commitments. Developing country emissions caps, however, could interfere with the ability of developing countries to achieve economic growth. Even if developing countries were to take much less carbon-intensive development paths than Annex I countries, some increase in carbon emissions will occur. The challenge, then, is to reconcile economic growth in developing countries with greenhouse gas emissions caps for those countries.

We propose that this tension be resolved by applying the concept of "growth baselines". Under this approach, future developing country emissions would be capped at some level below what they are expected to be but above current emissions. This is in contrast to industrialized country emissions, where emissions likely will be capped at or below 1990 levels. One way of establishing growth baselines would be to tie developing country emissions targets to improvements in carbon efficiency, or the amount of carbon emitted per unit of GDP. This formula would accommodate developing country growth but at the same time require reductions in carbon emissions from reference case levels.

The key benefit to developing countries of adopting growth baselines would be substantial flows of investment, if emissions trading were allowed. Many opportunities to reduce emissions at low cost or even a profit exist in these countries; if baselines were set so that developing countries could meet and go beyond their emissions commitments through "no regrets" measures alone, these countries would be able to generate emissions trading opportunities at no cost and then sell emissions allowances to industrialized ones, thereby attracting investment capital.

Because about one dozen countries account for the vast majority of developing country emissions and trade, the Kyoto protocol would need to require commitments from those countries only. Requiring commitments from this small group alone would ensure reductions in global emissions levels and prevent emissions from simply shifting from industrialized countries to developing ones.

Growth Baselines: Reducing Emissions and Increasing Investment in Developing Countries

Introduction

Annex I countries now account for approximately two-thirds of global greenhouse gas emissions (see Table 1) and are primarily responsible for the increased concentration of atmospheric carbon dioxide. It is therefore appropriate that these countries take the lead in addressing global climate change.

Developing country greenhouse gas emissions are growing at a faster rate than Annex I emissions, however, and are expected to account for over 40 percent of global emissions by the year 2015.¹ Further, growth in developing country emissions could be even higher if Annex I countries agree to emissions caps but developing countries do not. This is because the price of energy would rise in Annex I countries, resulting in a shift of energy-intensive, export-oriented industries from Annex I countries to developing countries. (The magnitude of this economic and emissions leakage is unclear and now the subject of much discussion.) This expected growth in developing country emissions and potential leakage of jobs and emissions to these countries are the reasons underlying the Byrd Resolution just passed by the U.S. Senate. This resolution states that the U.S. should not be party to any climate change treaty that does not include developing country commitments.

The projected trend in developing country emissions has clear implications for international climate change policy. Reducing emissions and stabilizing concentrations will be difficult if not impossible if developing countries do not also adopt emissions commitments. The difficulty, of course, is that developing country emissions caps could interfere with the ability of developing countries to achieve economic growth. Industrialized countries have achieved their income and wealth through the use of fossil fuels; consequently, carbon emissions per person generally are much higher in industrialized countries than in developing ones (see the second column of Table 1). While technology innovation and transfer hold long-term promise for reducing developing country carbon emissions, in the near term some increase in carbon emissions is inevitable, even if developing countries take much less carbon-intensive development paths than Annex I countries. The challenge, then, is to reconcile economic growth in developing countries with greenhouse gas emissions caps for those countries.

Growth Baselines and Trading

We propose that this tension be resolved by applying the concept of "growth baselines". Under this idea, future developing country emissions would be capped at some level below what they are expected to be but above current emissions. This is in contrast to what is

¹ U.S. Department of Energy, Energy Information Administration. *International Energy Outlook 1996*.

Table 1
Carbon Emissions, GDP, and Value of Exports
by Country, 1991

	carbon emissions 1991 (million metric tons of carbon)	carbon emissions per capita (metric tons of carbon)	% of Global Carbon Emissions	GDP 1991 (millions USD, 1987)	% of World GDP	Value of Exports 1991 (millions USD, 1987)	% World Exports
Global	6,186	1.15		18,251,761		3,075,361	
G-7	2,320		38%	12,170,897	67%	1,838,059	60%
US	1,310	5.19	21%	4,821,400	26%	421,730	14%
Japan	293	2.37	5%	2,934,607	18%	314,786	10%
Germany	239	3.00	4%	1,423,647	8%	402,843	13%
Great Britain	155	2.67	3%	727,800	4%	184,964	6%
Canada	111	3.93	2%	433,389	2%	127,163	4%
Italy	111	1.95	2%	840,387	5%	169,473	6%
France	100	1.75	2%	939,467	5%	217,100	7%
Former Soviet Union	981	3.36	16%	644,058	4%		
Central and Eastern Europe	215	2.08	3%	180,227	1%	44,085	1%
Australia	70	4.09	1%	224,110	1%	41,854	1%
Memo: Annex I countries not listed here accounted for emissions of approx. 580 MTC in 1991 (9% of global emissions).							
Developing Countries							
China	889	0.60	11%	331,405	2%	70,451	2%
India	195	0.22	3%	319,131	2%	17,664	1%
Mexico	89	1.03	1%	158,250	1%	42,867	1%
South Africa	82	2.17	1%	86,372	0%	23,306	1%
South Korea	73	1.70	1%	193,417	1%	71,870	2%
North Korea	69	3.10	1%	NA	NA	NA	NA
Iran	56	0.92	1%	163,804	1%	15,916	1%
Brazil	59	0.39	1%	290,310	2%	31,620	1%
Indonesia	56	0.30	1%	98,553	1%	29,543	1%
Saudi Arabia	50	3.02	1%	95,951	1%	47,797	2%
Venezuela	33	1.67	1%	54,606	0%	15,519	1%
Argentina	32	0.96	1%	109,232	1%	11,978	0%
Subtotal of Developing Countries Listed	1,482		24%	1,900,831	10%	378,531	12%
Total of Selected Countries	5,068		82%	15,120,123	83%	2,302,529	75%

Sources: CO2 emissions data: Mariand, G., R.J. Andres and T.A.Borden. Global, regional, and national CO2 emissions.

Trends: A Compendium of Data on Global Change. Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center. updated 1997.

GDP data: Energy Information Administration (EIA), US Department of Energy. 1995. *International Energy Annual: International Energy Statistics Through 1995*. EIA: Washington, DC.

Export data: UN Conference on Trade and Development (UNCTAD). 1995. *Handbook of International Trade and Development Statistics*. UNCTAD: Geneva.

likely to happen to industrialized country emissions levels, which, if any of the current proposals are adopted, will be capped at or below 1990 levels.

One method for establishing growth baselines would be to tie developing country emissions targets to improvements in carbon efficiency. For instance, the new protocol could require the ratio of carbon emissions to gross domestic product (GDP) in developing countries to improve by a particular amount or percentage each year. The formula for this approach is as follows:

$$\text{Emissions Budget} = \text{Gross Domestic Product} \times \text{Carbon Emissions/GDP}$$

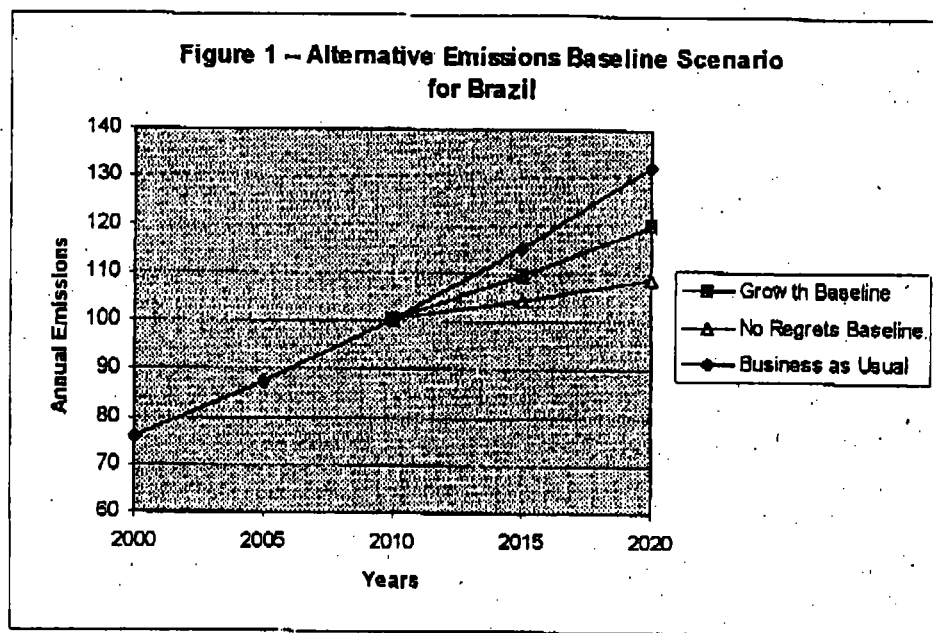
In applying this formula, gross domestic product would not be restrained, but the C/GDP ratio would be tightened every year or budget period. Use of this formula would accommodate developing country economic growth while at the same time ensuring that carbon emissions improved from reference case levels.

The adoption of growth baselines by developing countries would be an engine of investment and growth in developing countries, if an emissions trading system also were established. The driving force behind emissions trading is that some countries will be able to reduce their emissions more cheaply than others. Because industrialized countries already have taken advantage of many of their low-cost opportunities, it is probable that future emissions reductions could be made most cheaply in the developing world. Developing countries therefore would be able to sell emissions allowances to industrialized ones. In fact, U.S. economic modeling has shown that approximately 60 percent of the carbon allowances that the U.S. would purchase after the year 2010 to stabilize its emissions would come from developing countries.² *The establishment of growth baselines in combination with greenhouse gas emissions trading would create a mechanism for directing technology and investment to developing countries.*

To ensure that developing countries would be sellers of emissions allowances while simultaneously ensuring that carbon emissions would be reduced, it would be necessary to set developing country baselines below what emissions would have been otherwise, but high enough to ensure that developing countries could make reductions below target levels through "no regrets" measures -- those that have no net cost or even provides a savings. Figure 1 illustrates this concept by providing alternative scenarios for future emissions from Brazil. The top line in the figure represents the country's "business as usual" emissions, or emissions as currently projected. The middle line represents country emissions if a growth baseline were adopted, while the bottom line represents emissions if available "no regrets" emission reduction measures were taken. (We have assumed that the first year that an emissions cap would apply is 2010.) If Brazil were able to meet and go beyond its emissions commitments through "no regrets" measures (as illustrated in the figure), then at no cost it would be able to generate emissions allowances that it could sell.

² U.S. Government, Interagency Task Force. *Economic Effects of Global Climate Change Policies: Results of the Research Efforts of the Interagency Analytical Team*. June 1997.

In the figure, the allowances that the country could sell are represented by the area between the "growth baseline" line and the "no regrets" line, while the emissions benefits to the world of Brazil adopting an emissions target is represented by the area between the "business as usual" and "growth baseline" lines.) Current data suggest that developing countries could make significant emissions reductions through "no regrets" measures.



Sources: Business as Usual and No Regrets scenarios based on: *Climate Change 1995: Economic and Social Dimensions of Climate Change*. Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change.

The Kyoto protocol would need to require commitments from only the small number of countries that account for the vast majority of developing country emissions (again see Table 1). Generally speaking, only these countries have the potential to significantly affect the global level of carbon dioxide emissions, and only they have developed the industries that would be at a competitive advantage if emissions caps were applied in Annex I countries only. Requiring commitments from this small group alone would ensure that industrial activity and emissions would not simply shift from industrialized countries to developing ones. Additional countries could be brought in as they became significant emitters and developed the resources and capacity needed to participate.

Adoption of emissions targets would require developing countries to establish the laws and institutions needed to quantify, monitor, verify and report their emissions. It would thus be essential that Annex I countries provide needed technical support and resources.

Finally, it should be noted that the negotiations on the General Agreement on Tariffs and Trade (GATT) provide a precedent for the use of growth baselines. In the GATT negotiations, developing country participation was discussed from the start, though it was

recognized that special considerations would be made concerning developing country participation. Setting developing country caps that allowed for emissions growth would differentiate industrialized and developing country commitments in much the same way.

Conclusions

Awarding developing countries growth baselines would have the following advantages:

- Developing countries would be included under the emissions cap, giving them an incentive to reduce fossil fuel use while also accommodating economic growth.
- Developing countries could then participate in emissions trading, which would result in substantial transfers of capital and technology from Annex I countries to developing ones. The reason is that baselines would be set such that developing countries could hold their emissions to below baseline levels for no cost (or even at a savings.) They would thus be able to sell emissions allowances to industrialized countries.
- Bringing developing countries under an emissions cap would solve the problem of emissions and economic leakage. Because energy-intensive, export-oriented businesses everywhere would control their CO₂ emissions, those in developing nations would not enjoy a competitive advantage over those in Annex I countries.
- Finally, a Kyoto protocol that called for developing country commitments to keep emissions below a growth baseline would satisfy the provisions of the Byrd Resolution, clearing the way for ratification of the protocol in the U.S. Senate. U.S. support is crucial in addressing global climate change because the U.S. is now responsible for over 20 percent of CO₂ emissions.