1 Econ Analysis

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-Judy

Econ Analysis
C

White House Climate Change Task Force

734 Jackson Place, N.W. - Washington, DC 20503

FAX

To: Jonathan Fr Todd

Organization/Title:

Fax: **Phone:**

Pages (including cover): 4 **Date:** Sept 11

From: Judi Greenwald

Phone: 343 1060

Message:

Jonathan - My home phone # is 301 279 5425 in case you need me tonight or tomorrow.

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Or
"We appreciate the concerns that labor has regarding the potential impacts of climate policies on working Americans. That is why we are working hard to ensure that the policy we ultimately adopt will minimize the impacts on workers. We already are committed to market-based approaches, including emissions trading and joint implementation, that will minimize the impacts. We will also consider, as the study suggests, border adjustments and transition programs."
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MEMORANDUM

TO: Todd Stern, WH
Jeff Hunker, DOC

FROM: Judi Greenwald, WHCCTF

RE: Soon to be released climate change economic analysis

BACKGROUND

I understand that, sometime the week of September 15, The Economic Policy Institute (EPI) will release an analysis of the economic impacts of stabilizing U.S. emissions at 1990 levels in the year 2010. EPI is an independent think tank who is heavily funded by, and sympathetic to, the labor movement.

The analysis was funded by the United Mineworkers and the National Mining Association. The analysis was performed by DRI, Inc, using the DRI macroeconomic model. I believe that EPI's role was to technically and financially manage the contract with DRI.

The Administration's Interagency Analysis Team (IAT) used three models, including the DRI model, for its analysis. The strengths of the DRI model are that it is particularly well suited to looking at short-term transition issues, and it has a lot of rich detail on the important economic and energy sectors. Its weakness is that it does a relatively poor job of examining the very long timeframes that are relevant to climate change policy. The IAT was criticized by several of its peer reviewers for relying too heavily on the DRI model; somel of the reviewers thought that the model should not be used at all for this purpose.

I understand that the assumptions used in the EPI/DRI analysis are somewhat different from the assumptions used by the IAT when it ran the DRI model. For example, the Administration assumed a more optimistic level of energy efficiency innovation than was assumed in the EPI analysis. However, several peer reviewers criticized the IAT for its optimism on this point.

I also understand that the analysis assumes no international emissions trading or joint implementation. (The DRI analysis contained in the June 1997 IAT report did the same thing. The DRI analysis we did assuming trading has never been released. However, we did analyze trading using other models in that report.) I understand that the estimated costs of the EPI analysis are about twice as great as the DRI cost estimate that appeared in that June IAT report (i.e., a 2% peak year loss in GDP vs. a 1% GDP loss; and job losses of 1.5 to 2.6 million vs. 900,000 in the IAT report).

As I learn more, I will provide updates for you.

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--It was funded by the United Mineworkers of America and the National Mining Association.

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--Several of the expert peer reviewers of the Administration's staff climate change analysis said that the DRI model is inappropriate for this sort of long-term analysis.

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Economic Policy Institute

1660 L STREET, NW • SUITE 1200 • WASHINGTON, DC 20036 • 202/775-8810 • FAX 202/775-0819

3rd DRAFT--NOT FOR QUOTATION OR DISTRIBUTION

Accelerating Globalization?
The Economics Effects of Climate Change Policies on U.S. Workers

Robert E. Scott
August 14, 1997

Executive Summary

The Framework Convention on Climate Change, which the U.S. and other countries signed in 1992, commits the signatory countries to limit, and ultimately reduce, their emissions of greenhouse gases. These measures were designed to limit the damages which could result from climate changes associated with increasing concentrations of these gases in the world's atmosphere. Most GHGs are generated through the burning of fossil fuels, so reducing their emissions will require limits on energy use. The signatories to the Convention are now engaged in negotiations that could lead to a treaty with binding commitments to reduce GHG emissions at a Conference of the Parties in Kyoto, Japan in December 1997.

This report examines the costs to the U.S. economy of some of the policies that have been proposed to limit GHG emissions. While there have been a number of studies of the costs of these policies, inadequate attention has been given to the effects of greenhouse gas policies on the distribution of income. We analyze a set of possible GHG policies using the DRI/McGraw-Hill model of the economy, and we find that these policies could have significant costs for the economy, especially in the next ten to fifteen years, and that their distributional effects would be even larger than their effects on the overall level of output. Policies designed to stabilize U.S. emissions of greenhouse gases at 1990 levels in 2010 — the least restrictive policies now being discussed for the Kyoto negotiations — could reduce the level of national output by 1.8 to 2% in the short run, relative to the base case of no GHG policies. Because of the increase in real energy prices, consumption would fall even more, from 2.2 to 2.5%, relative to the base-case forecast. If GHG emissions are reduced by 10% in 2010, then the short-run costs increase sharply, to 2.9% of GDP and 3.6% of consumption.

The effects of GHG policies on the distribution of income and employment should be considered in the broader context of overall labor market trends. U.S. production workers have

experienced a steady erosion in their real wages since at least 1973 (Mishel, *et al* 1997). Wages are eroding for a number of reasons, including declining rates of unionization, falling real values of the minimum wage, deregulation and increased rates of immigration. Rapid growth in foreign trade and investment are also important causes of declining real wages. Unless these issues are considered in the development of GHG policies, those measures will exacerbate the effects of globalization on American workers. Without offsetting measures, these policies can lead to further downward pressure on the wages of the three-quarters of the workforce that does not have a college degree.

The DRI/McGraw-Hill model shows that GHG policies could cut wage growth in half over the next two decades. In the short run, 1.5 to 2.6 million jobs fewer would be created, and in the long run there will be substantial shifts in employment and population between industries and regions of the country. Even in the long run, after the initial recession caused by the shock of adjusting to higher energy prices is absorbed, total employment would still be lower with GHG policies than without them. In addition, 400,000 to 500,000 high-paying job opportunities in mining, transportation and public utilities would be eliminated (relative to base-case forecasts), while 240,00 to 290,000 jobs would be created in low-wage retail trade sectors. In addition, 180,000 to 340,000 high-wage manufacturing jobs would also be eliminated if GHG emission quotas were allocated to industry (rather than auctioned to raise government revenues).

Coal, in particular, is the most carbon-intensive of all the fossil fuels, so all GHG policies will have a disproportionately large impact on this industry. Coal output is projected to fall by 45 to 50% in 2020, relative to a base case with no restrictions on carbon emissions. This will eliminate 35,000 to 38,000 jobs in this industry by 2020, which is already forecast to lose 36,000 jobs in the base case. GHG policies will double projected job losses in this hard-hit sector. Other individual industries that would be especially hard hit by GHG policies include rubber and plastics footwear, leather footwear and related goods, kitchen products, apparel, toys, and various other mining industries (fertilizers, nonferrous metals and iron and ferroalloy ores).

The DRI/McGraw-Hill model, like most other macroeconomic models, is not designed to fully capture the effects of greenhouse gas policies on patterns of trade or foreign investment flows. Most models assume that the U.S. will continue to purchase most of its imports from other developed countries, which will also need to limit greenhouse gas emissions. However, higher energy prices will increase the competitiveness of exporters based in low-wage developing countries, who will capture a growing share of the U.S. market. The trade deficit will expand dramatically, because rising energy prices will make imports more attractive and our exports less competitive. Increases in energy prices, and in the trade deficit, will cause the shift of resources out of mining and manufacturing into services and other low-wage sectors of the economy that was noted above. This could amplify labor-market problems that will result from GHG policies.

The model forecasts that the trade deficit, as a share of GDP, will increase by 1.3 to 2.1 percentage points if GHG emissions are reduced to 1990 levels in 2010. Imports would increase by $175 to $240 billion per year. But these estimates may be too low. Multinational firms in

developed countries will have additional incentives to shift investment to the developing countries, if those countries do not face limits on their emissions of greenhouse gases. The DRI/McGraw-Hill model does not include the effects of plant closures or investment diversion to countries excluded from the agreement, so it may underestimate the effects that GHG policies will have on the U.S. trade deficit, and on manufacturing output, employment, and wages.

Greenhouse gas policies are likely to apply market-based mechanisms to discourage energy use. These could include a tax on the carbon content of fuels, or a system of permits that are auctioned to the highest bidder. This report considers two systems of permits, rather than a direct carbon tax, in which markets ration energy use. Either system will generate substantial amounts of revenue for either the government, or the holders of private permits. If revenues are collected by the government and used to reduce public borrowing, then sustained losses in consumption will result. If the permits are granted to businesses, corporate profits will increase dramatically and labor's share of national income will decline sharply. Total before tax corporate profits would increase by over $1 trillion per year in 2020, if the permits are granted to businesses.

On the other hand, the expected costs of GHG policies, at least at the macroeconomic level, are not larger than some other recent policy initiatives, such as the U.S. defense build-up in the 1980s. This report makes no assessment of the potential benefits of GHG policies, in terms of potential risks or damages that could be avoided, nor does it take a position on the advisability of adopting any further policies to restrict GHG emissions. However, we strongly suggest that if such policies are implemented, two specific, additional measures are needed to limit their disruptive effects on the economy, and on the lives of American workers.

The first concerns the treatment of developing countries in the Kyoto negotiations. In July, 1997 the U.S. Senate unanimously endorsed a resolution which required that developing countries be included in any climate change agreement to be signed by the President. However, it will not be sufficient to include these countries in a broad framework agreement, if firms are allowed to take advantage of lower energy prices and less restrictive emission limits by moving plants and production to the developing countries.

It is possible to reduce or eliminate the negative effects of GHG policies on U.S. trade and investment. One way to achieve this goal would be to establish a border equalization tax policy. This tax would rebate the cost of emission limits on the energy content of exports, and assess an equivalent fee on products imported into the U.S. This kind of tax would eliminate the incentive to import goods and move plants abroad to escape U.S. emission limits. Since the U.S. currently has a large trade deficit, it could also generate revenues for the U.S. treasury. Other policies which could reduce the effects of GHG policies on trade and foreign investment include quotas on energy intensive imports, and safeguard measures to limit import surges.

The second policy that would be needed is a set of measures that would provide substantial assistance to the workers and communities damaged by the creation of greenhouse gas policies. For workers, such a program should involve meaningful retraining opportunities, and

several years of income support while involved in those activities. For particularly hard hit sectors and regions, special programs could be required to provide for early retirements, buyouts and to ensure continuation of health and pension benefits. For communities, there are many options including, but not limited to, industrial and R&D policy support, alternative energy investment and public investment in mass transit, bike paths and other measures designed to reduce neighborhood energy use while creating attractive community living spaces. Resources needed to support these programs could be funded through carbon taxes or permit sale revenues.

Worker retraining policies, especially in the trade adjustment area, have established a poor track record, which may raise questions about the wisdom of incorporating such measures into a GHG policy or treaty package. These policies have failed for several reasons. They have historically been poorly funded, not providing sufficient resources for meaningful retraining nor the time and family income needed to sustain it. In addition, commitments have often been dishonored in the past, when funding for adjustment programs was terminated or drastically reduced after the policy had been implemented. However, more broadly-based development and retraining programs have had demonstrable effects on output and employment at the regional level. In particular, investments in infrastructure, such as roads, utilities and startup facilities, have been successful tools in regional development policies. When coupled with adequate investments in retraining and income maintenance for displaced workers, there is every reason to believe that well-funded, community-based, adjustment programs could offset some of the negative distributional consequences of GHG policies.

Finally, these results must be qualified by noting two major areas of uncertainty. First, there are many unknowns about the costs of reducing emissions. The DRI model provides *one* way to estimate those costs. This model could overstate or understate the costs of reducing GHG emissions. If the energy efficiency of the economy grows more slowly than is expected in the base case, then greater reductions in energy use will be required to meet any given standard, which would dramatically increase the costs of compliance. On the other hand, in the past such modeling exercises have produced estimates that have proved, in retrospect, to significantly overestimate the costs of new pollution controls. Examples include the costs of reducing asbestos, cotton dust and vinyl chloride emissions.

In addition, there is substantial uncertainty about the pace of global warming and the precise climactic impact of a given volume of CO_2 emissions. As noted above, any potential benefits of climate change policies, including the explicitly economic benefits, have not been considered in these calculations. Some studies have found that the benefits of GHG reduction are less than the costs of the policies considered here, and that optimal levels of control would therefore be less restrictive or that limits should be phased-in over a longer time-span. Other studies forecast that the costs of GHGs will rise sharply in the future, and that the overall costs of control will be lower the sooner steps are taken to limit or reduce GHG emissions. For these reasons, this report does not take a position on the advisability of adopting further policies to restrict GHG emissions. Further study is clearly required in the areas noted above, whether new GHG policies are adopted in Kyoto, or not, to improve the policy making process in the future.

Accelerating Globalization?
The Economics Effects of Climate Change Policies on U.S. Workers

Robert E. Scott

Introduction

The Framework Convention on Climate Change, which the U.S. and other countries signed in 1992, committed the U.S. and other countries to a voluntary plan to reduce emissions of greenhouse gases. In 1995, at the first Conference of the Parties (COP-I), a document was produced which established a process designed "to elaborate policies and measures" which would "set quantified limitation and reduction objectives within specified time frames, such as 2005, 2010, and 2020" for greenhouse gas (GHG) "emissions by sources and removals by sinks."[1] At COP-II in 1996, the U.S. first endorsed the concept of "legally binding" emission targets. The signatories to the Convention are now engaged in negotiations that could lead to a treaty with binding commitments at the third Conference of the Parties in Kyoto, Japan in December 1997.

There is a high level of uncertainty about the benefits of policies to avoid climate change. In fact, it is precisely the because of the existence of this uncertainty about the effects, and the costs, of climate change, that some economists have taken an interest in the theoretical aspects of climate change modeling (see, for example, Nordhaus 1994). Some have found that there are greater incentives to implement policies to reduce GHG emissions than would exist if the costs of climate change were known with certainty.

Because of the uncertainly surrounding the benefits of climate change policy, most analysts have focused on an assessment of the costs of GHG policies.[2] However, little attention has been paid to the distributional implications of climate change policies. This paper examines

these issues using a model developed by DRI/McGraw-Hill (1997). The results of this modeling exercise are analyzed and contrasted with a recent administration study of the costs of climate change policies (Interagency Analytic Team 1997). DRI/McGraw-Hill also prepared the most extensively cited model used in the IAT report. We refer here to that earlier effort as the IAT model.

There have been a number of surveys of the cost of climate change policies.[3] We rely on some of these studies in our analysis. This report contributes an analysis of the distribution of the costs of climate change policies across society to the debate. We make no assessment of the potential benefits of GHG policies, in terms of potential risks or damages that could be avoided, nor do we take a position on the advisability of adopting any further policies to restrict GHG emissions. However, we strongly suggest that if such policies are implemented, two specific, additional measures are needed to limit their disruptive effects on the economy, and on the lives of American workers. It is important to consider such policies before the U.S. position in the Kyoto negotiations is finalized.

We begin by describing the baseline forecasts for the economy (the business as usual case) and then review the overall effects of potential GHG policies on output (GDP) and consumption, including a comparison of the DRI/McGraw-Hill (1997) results with those of the IAT. The next section considers the effects of these policies on key sectors of the economy, including employment, wages, profits, and foreign trade. We then examine GHG policy effects on industries and regions of the economy. The paper concludes with a discussion of policy implications and areas for future research.

The Macroeconomic Impacts of GHG Policies

The model used in this study is the DRI/McGraw-Hill macro-economic model. This is a short-run forecasting model with an input-output-based structure. Some analysts have criticized the use of the DRI model to analyze issues such as GHG policies because of its short-run orientation, arguing that the policies proposed should be designed to reduce energy use and carbon emissions over the next century.[4] However, the policies discussed in IAT (1997) would take effect in the year 2000 and be phased in over 10 years. They would have substantial short-run impacts on economic output, which would exceed the costs identified in the other long-run models used in the IAT report.[5] Therefore, it is appropriate to examine these adjustment costs when considering the distributional effects of GHG policies.

Many models have estimated the costs of stabilizing the emissions of carbon, on a national basis, at 1990 levels by the year 2010. This scenario has become the standard of comparison for modeling of the costs of GHG policies. The IAT chose this scenario as a baseline, and also ran a number of "sensitivity-test" scenarios which varied key assumptions, including a range of targets between 90% and 110% of 1990 level emissions in the year 2010. Most scenarios assume that emissions are held constant after the target is achieved in 2010. The European Union has proposed emission reductions of 15% of 1990 levels by 2010 as a starting point for the the Kyoto-round negotiations. It is also important to point out that ultimate stabilization of atmospheric CO_2 and climate may require further reductions in global emission levels beyond these targets.[6] Therefore adjustment costs could continue and expand if future COP meetings results in additional, increasingly restrictive agreements to reduce GHG emissions in the Annex-I countries, as seems likely.

Baseline forecasts

DRI/McGraw-Hill (1997) assumes that real GDP growth will average two percent per year between 2000 and 2010, and 1.5% per year thereafter. GDP growth declines after 2010 because the rate of growth of the labor force declines from about one percent per year between 2000 and 2010 to 0.5% per year thereafter, as the baby boom generation begins to exit the labour force. The energy intensity of the economy is forecast to decline by one percent per year throughout the forecast period. Carbon emissions therefore increase 1.3 percent per year between 2000 and 2010 and 0.8% per year thereafter.

Total carbon emissions in the baseline case are 1,746 million metric tons (MMT) in 2010 and 1,894 MMT in 2020. Actual emissions in 1990 in the U.S. were 1323 MMT, according to DRI/McGraw-Hill (1997).[7] Therefore total emissions in the baseline case grow 32.0% and 43.2%, respectively, in 2010 and 2020 in this model. These are the amounts by which carbon emissions would have to be reduced to stabilize emissions at 1990 levels.[8] Some fuels, such as natural gas and petroleum, emit much less carbon per unit of energy released, so energy use would not have to fall by this amount if fuel switching were to occur (as is assumed in the DRI model).

Policy Scenarios

It is assumed that a system of tradeable carbon emission permits is announced and implemented beginning in 2000. The number of permits in circulation is reduced each year from 2000 to 2010, until the emissions target is achieved. Permits are not traded internationally, but are tradeable within the domestic market, to facilitate adjustment at least possible cost. Three cases are analyzed[9]:

Case 1: **(Grandfathered Permits)**. Allowance are issued to industry at no cost. Emissions are stabilized at 1990 levels in 2010.

Case 2: **(Grandfathered Permits, 90% of '90 Emissions)**. Allowances are issued to industry at no cost. Emissions stabilized at 90% of 1990 levels in 2010.

Case 3: **(Auction, Deficit Reduction)** Allowances auctioned by U.S. Government, no revenue recycling. Emissions stabilized at 1990 levels in 2010.

Carbon prices range from $180 to $200 per ton in 2010 and $270 to $320 per ton 2020 in DRI/McGraw-Hill (1997), as shown in **Table 1**. These prices have very different effects on different types of fuel, as noted above. Gasoline prices increase only 31.5% to 49.2% in 2010, for example ($.41 to $.63/gallon). However, coal prices rise much more rapidly, 450% to 680%, because coal has a much higher carbon content per unit of energy, as noted above. Natural Gas, which is one of the most carbon-efficient fuels, rises substantially more in price than gasoline because fuel switching sharply increases demand, and capacity is slow to respond.

Energy prices in the IAT draft report are compared in the bottom two sections of Table 1. The base case prices are nearly identical in the two studies. However, carbon prices are much lower in the IAT scenarios. There are two reasons for this. First, the IAT model assumes slightly higher baseline improvements in energy efficiency (1.25% vs. 1.0% per year). Therefore, carbon emissions in 2020, for example, are projected to be 1805 MMT in the IAT base case, versus 1894 MMT in DRI/McGraw-Hill (1997), a difference of about 5%. Second, and more importantly, the IAT report apparently assumes larger price and substitution elasticities than DRI/McGraw-Hill (1997). The IAT report has been criticized because "The price elasticities for energy demands need further explanation. Some very rough ...calculations suggest that they may

be on the high side.[10]" These comments suggest that the estimates in DRI/McGraw-Hill (1997) may be more reliable than those developed for the IAT.[11]

Effects on Output and Consumption

Figure 1 shows that in the cases considered here, GHG policies could have significant costs for the economy, especially in the next ten to fifteen years. Policies designed to stabilize U.S. emissions of greenhouse gases at 1990 levels in 2010 — the least restrictive policies now being discussed for the Kyoto negotiations — could reduce the level of national output by 1.8 to 2% in the short run. If GHG emissions are reduced by 10% in 2010, then the short-run costs increase sharply, to 2.9% of GDP and 3.6% of consumption. The maximum impact occurs in 2007 in all three scenarios, seven years after the permit system begins to be phased in, but three years before emissions are fully reduced to the target level. Output falls because of the increase in energy prices, shown in Table 1 above, which depresses consumption and investment spending.

Overall inflation rates, shown in **Figure 2,** rise by 0.25 to 1 percentage points during the initial implementation period. By 2020, in the grandfathered permits cases, the cumulative effect of these price effects causes a 7% to 9% increase in the level of the GDP price deflator, relative to the base case, because businesses will pass along the cost of permits to their customers. This increase in the *level* of the GDP deflator is permanent, even though inflation returns to base case levels by 2015.

If permits are auctioned by the government, the policy will have a more depressing effect on output, because the permit fees will cause a sharp, permanent increase in government savings. The effect of the permits is similar to that of a tax increase. Inflation increases in the short run, and then falls below the base case after 2008, reflecting the permanent suppression of demand

caused by this policy.

In all three scenarios, investment recovers and is increased as a share of GDP, relative to the base case, as shown in Figure 10, below. Firms and consumers increase their spending on capital goods to increase energy efficiency, effectively substituting capital for energy and accelerating the replacement of the existing capital stock. For example, total purchases of vehicles in 2020 in the three policy scenarios are 200,000 to 500,000 units higher than in the base case.

The increase in investment is effectively financed through a forced increase in national savings in the three policy scenarios. If permits are auctioned and firms are allowed to capture the resulting revenue streams (which will occur if permits are "grandfathered" to existing users of energy), business revenues and profits will increase sharply. Part of these retained earnings will then be available to finance increased investment spending. Savings through the federal budget also increase in all three models, after an initial adjustment period. If permits are grandfathered, then corporate profit tax revenues will increase. If the permits are auctioned by the government, then the revenues will flow directly into the treasury. The model assumes in all cases that the government uses the increased revenues to reduce the deficit or, if there is a surplus, to reduce the stock of outstanding federal debt, increasing the effective rate of government savings.

The increase in national savings and investment that would result from a system of energy permit sales is a key element in all models of the effects of GHG policies. In the long run, the increase in savings and investment causes GDP to be higher in 2020 than in the base case, in all three scenarios, as shown in Figure 1. Furthermore, GDP is growing 0.1 to 0.2 percentage points faster than in the base case in all three scenarios in 2020. Hence, the stimulus to investment

provided by GHG policies could slightly increase the underlying rate of growth of the domestic economy, in the long run. However, the assumption that permit sales would increase national savings is highly questionable, for reasons discussed below. In the absence of the stimulus to savings and investment, GDP levels and growth rates would be lower throughout the forecast period.

Figure 3 demonstrates that the increase in real energy prices has a bigger effect on consumption than it does on output. GHG policies have a larger impact on consumption than on GDP for at least two reasons. First, a larger share of output is devoted to investment, for reasons explained above, and thus consumption must decline as a share of national income. Second, the increase in energy prices will force consumers to reduce real purchases of other goods, holding everything else constant (unless overall demand for energy is price elastic, which is not the case in most models).

Consumption losses reach a peak of 2.2 to 3.6 percent in 2007, relative to the base case, as shown in Figure 2. Consumption also recovers, following the GDP path in figure 1. However, overall consumption levels remain about one-half percent below the base case in 2020 in all three scenarios, despite the increased levels of output in that year, reflecting the increase in savings discussed above.

It is also important to compare these potential consumption losses with other major policy changes. For example, the decline in defense spending since 1986 has increased consumption by at least 4% in 1997, relative to an alternative scenario with stable shares of defense spending in GDP. Similarly, the military build-up from 1976-86 reduced consumption by several percentage points. The macroeconomic costs of GHG policies are, therefore, not extraordinary when

compared with other important public policies.

Comparisons with IAT Estimates.

The IAT estimates generated much smaller projections of the losses than would result under similar policy scenarios. For example, **Figure 4** compares predicted changes in total consumption from the base case, assuming grandfathered permits in both the IAT and the DRI/McGraw-Hill (1997) models. The maximum loss in the IAT model, of 1.4%, occurs two years earlier (2006) and is only 55% as large as the maximum loss in the DRI/McGraw-Hill (1997) model of 2.5% of base consumption. The difference between the two forecasts reflects the two key differences in energy forecasts: 1) lower base case energy use in the IAT model; and 2) higher price elasticities in that model.

The Reliability of Critical Assumptions

There are substantial economic and practical reasons to question some of the assumptions underlying both the IAT and the DRI/McGraw-Hill (1997) models. One key assumption concerns they way that revenues from the sale of permits are used in the economy. **Figure 5**, which contrasts two scenarios from the IAT report, illustrates the effects of different ways of handling permit revenues on total consumption in the U.S. If permit revenues are recycled to consumers, rather than being used for deficit reduction, losses to consumers will not fade away overtime.[12] In this case, consumption will fall and remain at a lower level throughout the forecast period. Given the political realities of the federal budget processes, it is highly unlikely that permit revenues of the type envisioned here would be used to reduce the budget deficit or the federal debt. For example, forecasts in mid-1997 that the federal budget could achieve a small surplus within the next few years if the economy continues to grow at its current pace have generated a

wide range of proposals for using projected revenues for new tax cuts, and/or public spending increases. Therefore, national savings are unlikely to increase as assumed in these models.

Higher levels of federal spending for consumption purposes, for example for defense spending, will not stimulate growth in the way envisioned in the DRI model. Thus the permits are not likely to stimulate as much growth in GDP, nor as rapid a recovery, as is forecast in either the DRI/McGraw-Hill (1997) or IAT (1997). On the other hand, some type of public investment, in areas such a R&D, educational programs and other types of public infrastructure, could have an even larger impact on productivity and economic growth rates than the private investment spending that drives the DRI/McGraw-Hill results. Therefore, the ultimate effects of GHG policies on the economy will be heavily effected by the ways in which the resulting revenues are utilized.

For these reasons it is unlikely that all of the GHG revenue collected by the government would go to deficit reduction. Some federal revenues will probably be returned to consumers (through tax cuts) or otherwise result in new public consumption expenditures. While tax cuts or other expenditures could stimulate the economy, they could not offset the depressing effects of GHG policies. Therefore, output is likely to fall with GHG policies, in the long run, in contrast with the case reviewed here.[13] Figure 4 shows that consumption will fall when the permit system is put in place in 2000, recover slightly, and then begin to decline again. The sustained decline is caused by the increase in the cost of carbon permits and energy prices shown in Table 1, above.[14] The increased cost of energy puts an increasing drag on the rate of growth of economic output. This is the most important long-run cost of GHG policies.

The initial decline in consumption shown in Figure 4 is smaller if all the revenues are

returned to consumers, perhaps through reductions in income or other labor taxes (such as the social security tax). This "revenue neutral" policy has a less depressing effect on total output and consumption than the grandfathered permits policy. Losses begin to increase in 2015 because of the long-run effects of higher energy prices. The losses and distortion effects shown in Figure 4 would increase with the size of the effective carbon tax. Permit fees as large as those estimated in DRI/McGraw-Hill (1997, $180 to $320 per ton, Table 1 above) would have proportionately larger effects on consumption than the IAT cases (in which permit fees are only $95 per ton in 2010 and $125 in 2020).

One final economic reason for questioning the results of both the IAT and DRI/McGraw-Hill (1997) is that investment may not respond in the way assumed in the models. In each case (except for the auction, 100% to consumer case shown in Figure 4), it is assumed that increases in savings by the business and government sector stimulate an equivalent amount of domestic investment. However, even though corporate retained earnings would rise sharply if permits were grandfathered to existing energy users, there is no guarantee that the resulting excess cash would be invested in the U.S. Investment opportunities elsewhere in the world could be more attractive, particularly if there are parts of the world not subject to GHG policies (as discussed below). In fact, recent empirical research has shown that in the long run, about one-quarter of any given change in savings has flown out of the U.S. in the past. This ratio could change in the future, as well. For these reasons, investment (and therefore GDP and consumption) might not receive the stimulus expected in the IAT and DRI/McGraw-Hill (1997) models even if savings are increased. In fact, increased corporate earnings could accelerate capital flight problems that are discussed below.

On balance, we expect that GHG policies designed to stabilize emissions at 1990 levels will reduce consumption by at least $50 to $100 billion per year, on average, between 2000 and 2020. Losses are likely to continue and grow in the future because the policies will reduce the economy's potential growth rate, because permit revenues are likely to be spent on tax cuts or new public expenditures, and because savings and investment will be diverted to other countries because of the effects of GHG policies on economic incentives. However, the Kyoto negotiations also need to consider the distribution of the benefits and the costs of these policies.

Distributional Effects of GHG Policies

Since 1973, U.S. production workers have experienced a steady decline in their real wages and earnings, as shown in **Figure 6.** After rising steadily at an average rate of $0.14 per hour (in $1982) through 1973, real compensation began to decline steadily thereafter at a rate of $.035 per hour. This decline in production worker incomes contrasts sharply with the continued growth in real hourly earnings of the top twenty percent of the labor force, which has been maintained throughout the 1980s and 1990s. Earnings inequality, the gap between the top and bottom classes of wages earners, has increased sharply as a result. For example, the ratio of the top to the bottom deciles of workers has increased from 3.7 to 4.5 since 1973, an increase of more than 20%.

Wages have been eroding and income inequality has been increasing for a number of reasons, including declining rates of unionization, falling real values of the minimum wage, deregulation and increased rates of immigration. Rapid growth in foreign trade and investment are also important causes of declining real wages (Mishel, Bernstein and Schmitt, 1997). Unless these issues are considered in the development of GHG policies, those measures will exacerbate

the effects of globalization on American workers. Recent reports suggest that trade may be responsible for at least 20 to 25% of the increase in U.S. income inequality in this period (Tyson, 1997).[15] With these facts in mind, we turn next to an analysis of the effects of GHG policies on labor and other factors of production, and then examine the effects of GHG policies on trade in some detail.

The effects of GHG policies on employment in DRI/McGraw-Hill (1997) are illustrated in **Figure 7.** As GDP and consumption fall after the permit system is introduced, unemployment (not shown) rises initially and peaks (relative to the base case) in 2006. Overall, unemployment (not shown) is increased by 0.6 to 1.1 percentage points in 2006, a significant amount, but less than in a typical recession, for example. Job displacement peaks in 2007 or 2008 and persists, as shown in Figure 7, even as excess unemployment is eliminated. Displacement persists though at lower levels, throughout the forecast period because real wages are depressed by the rise in energy prices (and the overall price level), causing workers to drop out of the labor force. Job losses are especially large in the scenario with the lowest emission targets (grandfathered permits, 90% of '90 emissions), in which energy prices must rise most rapidly.

GHG policies have a strikingly consistent, negative impact on real wages, as shown in **Figure 8.**[16] The rate of growth in real wages is reduced by 0.4 to 0.55 percentage points immediately after the introduction of the permit system in 2000. These reductions in real wage growth, relative to the base case, persist for over a decade. The losses are largest with the most restrictive emission limits (90% of '90 emissions), and least for the case with grandfathered permits and 1990 emission targets. In the latter case there is a small, offsetting, positive effect from the increased ability of corporations to grant wage increases when permits are

grandfathered, which increases corporate revenues.

The decade-plus suppression of wage growth rates could cumulatively reduce the growth in the level of real wages by more than 50% between 1995 and 2020, relative to the base case, as shown in **Figure 9.** Real wages decline in all three scenarios between 2000 and 2006, and by 2020 they are only 3% to 4% higher than they were in 1995 (versus a 9% increase in the base case). This translates into an average growth rate of less than 0.2% per year. With such low rates of wage growth the continued increase in inequality will lead to falling wages for most workers. Only the top groups of wage earners are likely to experience any real wage gains over this period.

Impacts on the Business Sector

If permits are granted to businesses currently using energy, then these business will effectively capture a huge stream of income equal to the value of those permits. They can choose to either use the permits themselves, or sell them to other users on the open market. The advantages of this system are that: 1) as the number of permits in circulation is reduced between 2000 and 2010, the lowest cost means of eliminating energy use will be identified by market forces; and 2) the grandfathering of permits will provide some compensation to businesses that will face higher costs of energy because of the implementation of GHG policies.

Businesses will capture a huge stream of revenues, which will grow in value with the prices of permits, if the permits are grandfathered, or given away, as shown in **Figure 10**. Corporate profits (before taxes) are forecast to rise steadily in the base and auction, deficit reduction cases from $500 billion in 1995 to $1.6 trillion in 2020. This reflects both the growth of the capital intensity of the economy (the capital stock is growing faster than in the base case)

and an increase in the expected returns to capital, as well as the general growth in real output. If permits are grandfathered, annual corporate profits in 2020 will increase by an additional $1.1 to $1.2 trillion dollars, an increase of about 66%, as a result of the infusion of GHG permit revenues and associate increases in the prices of domestic products.[17]

Investment as a share of GDP will increase in all three GHG scenarios, as shown in **Figure 11.** Higher energy prices will increase the levels of investment in both residential and non-residential goods, including houses, cars and producer durable equipment (production machinery). This will have important side effects, by stimulating the production of capital goods and construction sectors, as shown below. The increase in investment, if it materializes, is the key to generating increased levels of GDP in the DRI/McGraw-Hill forecasts.

Increases in the level of profits will cause profits to rise sharply as a share of GDP in the two cases where permits are given to businesses (grandfathered), as shown in **Figure 12.** This massive increase in profits reflects returns on the incremental investment shown in Figure 11, and also returns on the asset value of carbon permits in circulation. In the DRI/McGraw-Hill model, increasing profits have a positive macroeconomic impact, because they provide savings to fund the investment growth. However, rising profits, as a share of national income, also imply a fall in the labor share of income, providing further evidence that production workers will be squeezed by GHG policies. The profit share of output increases by an astounding 9.4 and 11.2 percentage points, respectively, in the two cases with grandfathered permits in 2020, with the larger effect occurring with the restrictive target of 90% of '90 emissions. Such massive increases in capital's share of national income would virtually ensure a massive increase in the inequality of income distributions in the U.S. Owners of capital, overwhelmingly concentrated in the top 5% of all

households, would enjoy a massive shift of income from the rest of society, as a result of the grandfathering of permits to businesses.

Effects of GHG Policies on Trade and Investment flows

By 2020, U.S. Imports would rise sharply under GHG policies because higher energy prices would make foreign goods (made with cheaper energy inputs) more attractive, as shown in **Figure 13.** In the short run, as output falls due to the introduction of the permit system, imports will decline slightly. After 2007 they surpass the base case (no GHG policies), and by 2020 they are $175 to $275 billion higher than in the base case. Imports rise most rapidly under the scenario with the most restrictive limits on GHG gases (90% of '90 emissions), because the high costs of carbon permits. The auction, deficit reduction case has the smallest effect on imports, because output is slightly lower than in the case with grandfathered permits (at '90 emission levels).

Real exports, shown in **Figure 14** would fall below base case exports until at least 2013, for all three policy scenarios. Exports recover somewhat thereafter, because of the effects of increased domestic productivity. In particular, in case 2 (permits auctioned, revenues used for deficit reduction) exports are $25 billion higher than in the base case by 2020.

On balance, the increase in imports is considerably larger than the increase of exports, in the long run, in all three cases. Therefore the trade deficit (imports less exports) increases sharply as a share of GDP, as shown in **Figure 15.** The balance improves slightly during the initial impact recession between 2000 and 2010, but the deficit expands rapidly thereafter. By 2020, the deficit has increased to between 6.0% and 7.5% of GDP, as compared with a 1997 deficit of approximately 2% of GDP. The trade deficit is forecast to grow substantially in the base case, as well. However, the GHG policies would add between $149, $287 and $240 billion to the trade

deficit in 2020 in cases 1 through 3, respectively. The trade deficit would increase by 1.3, 2.7 and 2.1 percentage points of GDP in the respective cases.

Deficit increases of this size would have huge impacts on traded goods, especially manufacturing-sector products. We have estimated that $1 billion worth of exports would generate approximately 14,000 domestic jobs, including direct and indirect employment effects, in 1995 (Scott and Lee, 1997). Using this multiplier, the forecast increases in the trade deficit could eliminate between 2 and 4 million jobs in goods producing and related industries. As shown below, the DRI/McGraw-Hill industry projections for 2020 do not reflect employment losses of these magnitudes, because the model assumes that the economy returns to full employment and displaced workers are reabsorbed into other industries by that time.[18] However, if the forecast changes in trade flows are correct, then 2 to 4 million fewer jobs will exist or be created in industries producing traded goods, and related inputs, could occur with GHG policies, as compared with base case employment forecasts. In the long run, increased imports will cause shifts in employment within the manufacturing sector, and between manufacturing and services. As a result, gross job displacement is likely to exceed the net job losses that are discussed below.

If GHG policies do eliminate such a large number of manufacturing jobs, they will have a much larger impact on wages and incomes, especially for non-college educated workers, than is suggested by the DRI/McGraw-Hill macroeconomic model, because wages and incomes are much higher in manufacturing than in other sectors of the economy. Further research is needed to separately estimate the effects of GHG policies on the wages and incomes of blue- and white-collar workers.

There is also a more fundamental set of international trade and investment issues that are

not addressed in the DRI model, as suggested by outside reviewers of the IAT, noted above. The DRI model assumes that the share of imports coming from the Annex-I countries (that will impose GHG emission limits) and non-Annex-I countries (which will presumably not be limited, for some time to come) will remain fixed in the base case. However, the structure of trade flows has shifted rapidly in the past 10 years, even without the incentives provided by GHG policies. The share of U.S. imports originating in the developing countries increased from 29.1% in 1978 to 36.4% in 1990, even while the ratio of imports to value added in the manufacturing sector was increasing sharply, from 18.3% to 30.7% (Sachs and Shatz 1994, 10 and 12).

GHG policies will also create incentives to accelerate the pace of globalization and integration of the world economy. Globalization will take at least two forms. First, the share of U.S. imports originating in developing countries will grow, even more rapidly than it has in the past (for example, Mexico and China have experienced some of the most rapid rates of growth in U.S. imports in the 1990s). Second, investment will be diverted from the U.S. to non-Annex I countries, especially Mexico and other countries with large supplies of low-wage, semi-skilled labor. The pool of investment capital available for investing abroad could also be increased if grandfathered permit policies are implemented, as shown above. For the past two decades trade has grown twice as fast as world income, and foreign direct investment has grown four times as fast as income. Globalization is likely to accelerate if GHG policies are implemented that do not limit or otherwise control production shifts designed to escape GHG limits.

Sectoral and Regional Impacts of GHG Policies

Tables 2 and 3 forecast the effects of GHG policies on total and sectoral employment, at a fairly aggregated level in the economy (1- and 2-digit SIC categories of output). Employment

changes in 2007 (Table 2) will be dominated by the initial reduction in output, relative to the base case, as noted above. Employment changes will be almost universally negative, and will be spread more or less evenly across the economy. Total losses are greatest when GHG limits are most restrictive (90% of '90 emissions). DRI/McGraw-Hill predicts that a net total of 1.5 to 2.6 million jobs, or about 1.0% to 1.8% of total employment in the base case, will be lost in this first recession. At the high levels of aggregation shown in Table 2, only the energy-related sectors are predicted to experience very large job losses in the short run, including mining (down 11.5% to 15.4%) and petroleum refining (down 2.5% to 7.4%)

In 2020 employment changes are more mixed (Table 3). Total employment declines by 400,000 to 1 million jobs (0.1% to 0.4% of base case employment in 2020), because of the reduction in real wages discussed above. However, employment grows in some sectors (such as other services, retail trade and durable goods) while declining in others (including mining, transportation and non-durables manufacturing). Contract construction employment increases in the two cases with less restrictive limits on carbon emissions because of increased levels of investment. Significant employment losses spread to a much wider range of industries, as the effects of higher energy costs and related changes in other costs are spread throughout the economy. Mining losses rise to 22% to 24% of the base case and petroleum refining employment declines by 17% to 24%. Several industries are forecast to have significant job losses under grandfathered permits, but gains when permits are auctioned and the revenues used to reduce the federal deficit or increase savings, including apparel products, leather products, electrical machinery and miscellaneous manufacturing. These are all sectors that are open to international competition, where production is highly sensitive to wage levels. Nominal wages would be about

six percent lower than in the base case by 2020 in the auction, deficit reduction scenario. However, wages are higher than in the base case when permits are grandfathered, which explains why employment impacts differ at the sectoral level in these scenarios.[19]

Employment shifts between industries could contribute to the downward pressure on wages discussed above. **Table 4** reproduces forecasts for employment changes in 2020 from table 3 for a selected group of the most highly aggregated industries, and also includes information on average production worker wages in these sectors in 1995. This table strikingly illustrates one reason why wages grow so slowly in these scenarios. 400,000 to 500,000 job opportunities in mining, transportation and public utilities, where wages averaged between $14.22 and $15.32 per hour, would be eliminated (relative to base-case forecasts), while 240,00 to 290,000 jobs would be created in retail trade, which had wages averaging $7.70 per hour in 1995. In addition, 180,000 to 340,000 manufacturing jobs, paying between $11.60 and $12.90 per hour, would also be eliminated if GHG emission quotas were allocated to industry (rather than auctioned to raise government revenues). This process of structural change resulting from GHG policies will contribute to increasing inequality within labor markets in the U.S.

DRI/McGraw Hill also provides detailed forecasts at the 3 digit level for industries, and at the 2 digit level for the 10 census regions of the U.S. **Table 5** reports the industries that are predicted to gain or lose more than 5% of base-case employment in 2020. Losses outweigh gains in Table 4, in several ways. The number of industries experiencing losses of more than 5% of output is more than twice as large as the number with gains of more that 5%. In addition, there are 13 industries that lose more than 10% of output in 2020, including Rubber and Plastics footwear (-56%) coal mining (-45%), other leather goods (-34%) and electric utilities (30%).

However, there are no industries that gain more than 7.1% in total output. These trends reflect the broader tendency for employment to fall in manufacturing, especially durable goods, and rise in services sectors, including education services, retail and wholesale trade and state and local governments, as shown in Tables 3 and 4, above. Other individual industries that would be especially hard hit by GHG policies include kitchen products, apparel, toys, and various other mining industries (fertilizers, nonferrous metals and iron and ferroalloy ores).

Coal mining is one of largest and most heavily affected industries under GHG policies.[20] Coal output is projected to fall by 45 to 50% in 2020, relative to a base case with no restrictions on carbon emissions. The coal industry employed 116,000 workers in 1995. DRI/McGraw-Hill's (1997) base case forecasts that coal industry employment will decline to 80,000 workers in 2020. GHG policies will eliminate another 35,000 to 38,000 jobs in this industry by 2020, reducing total employment to between 42,000 and 45,000 workers. GHG policies will double projected job losses in this hard-hit sector between 1995 and 2020.

The tendency for GHG policies to shift employment from manufacturing to services would be much more pronounced if trade and foreign investment effects were larger, for the reasons noted above. In addition, given the large increase in imports and the trade deficit, shown in Figures 12 and 14 above, DRI may be underestimating the effect of the GHG policies on output at the sectoral level. The shift of employment from manufacturing to services, the growth of imports and the decline in the price competitiveness of U.S. products would all have depressing effects on U.S. wages, for the reasons discussed above.

The shift from manufacturing to services, especially retail trade, is illustrated in Table 6, which summarizes forecast changes in population and employment in the 10 census regions of the

U.S. in 2020, under the case 1 assumptions (grandfathered permits, 1990 emission limits). Manufacturing employment (shown in the last column) declines in 9 of 10 regions, rising only in the Pacific Northwest, where it is attracted by the availability of relatively cheap hydro-powered electricity. Retail trade experiences employment gains in 7 of the 9 regions that experience declining manufacturing employment. Mining, especially coal mining, declines sharply in all regions of the country, as noted above. Construction absorbs some of excess labor in regions that are forecast to enjoy stable or rising population levels because of GHG policies. Overall, employment declines in 6 of the regions (more than 1% in the East South Central and West South Central areas), and population declines in 3 of the 10 regions. Changes in energy costs, and the location of employment opportunities drive population shifts. In general, there is a substantial shift of jobs and population to the Pacific Northwest, with the other 7 regions not noted here experiencing small net gains or losses of jobs and employment in Case 1.

Regional and industrial shifts in production and employment will reinforce the tendency of GHG policies to increase income disparities in the U.S. The movement of labor out of high-wage sectors, such as manufacturing and mining, and into low wage sectors, such as retail trade, will tend to increase income inequality across the U.S., as the supply of good jobs for the bottom three-fourths of the labor force is reduced. Regionally, the Pacific Northwest, which already enjoys relatively high standards of living, will experience employment and population gains, while relatively low-income regions such as the East South Central will experience job and populations losses. These changes will tend to increase the disparity which exists in wages and income distributions among these regions, by increasing labor demands in the regions that gain and reducing labor demand in the regions that lose jobs and population.

Policy Implications and Areas for Future Research

If the U.S. and other countries decide that it is desirable to control GHG emissions, then policies will need to be identified that achieve a desirable path of control at least cost to both developed and developing societies. This discussion is likely to include an assessment of both the optimal overall level and path for GHG controls, but it should also consider sectoral, regional and other adjustment policies needed to minimize the negative effects of GHG policies on the distribution of income. To date, research on optimal GHG policies has focused almost exclusively on the identification of the optimal level and path for these policies. This analysis adds consideration of equity issues to the debate.

Optimal GHG Control Strategies

As noted above, policy makers are discussing a range of goals for the Kyoto-COP-III meetings and potential agreements. These range from stabilizing emissions in the Annex-I countries at 110% of 1990 levels by 2010 (IAT, 1997), or 2020, to reducing them by up to 20% as soon as 2005.[21] DRI/McGraw-Hill (1997) estimates that stabilizing or reducing emissions at 1990 levels will require an effective carbon permit price of $180 to $192/ton in 2010, and $270 to $281 per ton in 2020 (Table 1, above). Further emission reductions would require substantially higher carbon prices.

Nordhaus (1994, 93-96) has developed a simple simulation model of the costs and benefits of global climate change which identifies optimal emission control rates and the carbon taxes needed to achieve those levels of control (the carbon tax would have essentially the same effect as a carbon permit-fee on energy use and carbon emissions). His model suggests that very small and gradual controls are needed, with carbon taxes of only $5.29 per ton (in 1989 $), rising to $17.75

per ton in 2075.[22] He reviews a number of other, earlier studies which also reached similar conclusions. Fankhauser and Tol (1996) also review a number of recent estimates of the marginal damage of a ton of carbon emissions of $5 to $125 per ton of carbon, "with most estimates in the lower end of this range." This literature suggests that the emission limits considered in IAT (1997) and DRI/McGraw-Hill (1997) may be too restrictive, in the sense that marginal costs would exceed marginal benefits at the given levels of carbon emission limits.

Measures to Offset the Effects of GHG Policies on Income Distribution

If any limits on GHG emissions are implemented, then we strongly suggest that two specific, additional measures would be needed to limit the disruptive effects of GHG policies on the economy, and on the lives of American workers. The first concerns the treatment of developing countries in the Kyoto negotiations. In July of 1997, the U.S. Senate unanimously endorsed a resolution which required that developing countries be included in any COP-III agreement to be signed by the President. However, it will not be sufficient to include these countries in a broad framework agreement if firms are allowed to take advantage of lower energy prices and less restrictive emission limits by moving plants and production to developing countries.

It is possible to reduce or eliminate the negative effects of GHG policies on U.S. trade and investment. One way to achieve this goal would be to establish a border equalization tax policy (Hoerner and Mueller, 1993 and 1996). This policy would rebate the cost of emission limits on the energy content of exports, and assess an equivalent fee on products imported into the U.S. Such a tax system would eliminate the incentive to import goods and move plants abroad to escape U.S. emission limits. Since the U.S. currently has a large trade deficit, it would also

generate revenues for the U.S. treasury.

There are other policies that could also reduce the effects of GHG policies on trade and foreign investment, including quotas on energy intensive imports, and safeguard measures to limit import surges. These measures would be less comprehensive than the border tax (since they would only apply to selected imports, and not exports), and could be more difficult to administer. However, they may be less likely to create conflicts with the WTO or GATT principles.

The second policy needed is a set of measures designed to provide substantial assistance to the workers and communities damaged by the creation of greenhouse gas policies. For workers, such a program should involve meaningful retraining opportunities, and several years of income support while involved in those activities. For particularly hard hit sectors and regions, special programs could be needed to provide for early retirements, buyouts and to ensure continuation of health and pension benefits. For communities, there are many options including, but not limited to, industrial and R&D policy support, alternative energy investment and public investment in mass transit, bike paths and other measures designed to reduce neighborhood energy use while creating attractive community living spaces. Resources needed to support these programs could be funded through carbon taxes or permit-sale revenues.

Worker retraining policies, especially in the trade adjustment area, have a poor track record, which raises questions about the wisdom of incorporating such measures into a GHG policy or treaty package. These policies have failed for several reasons. They have historically been poorly funded, not providing sufficient resources for meaningful retraining nor the time and family income needed to sustain it. In addition, commitments have often been dishonored, when funding for adjustment programs was terminated or drastically reduced after the policy had been

implemented. However, more broadly-based development and retraining programs have had demonstrable effects on output and employment at the regional level. In particular, investments in infrastructure, such as roads, utilities and startup facilities, have been successful tools in regional development policies. When coupled with adequate investments in retraining and income maintenance for displaced workers, there is every reason to believe that well-funded, community-based, adjustment programs could offset some of the negative distributional consequences of GHG policies.

Limitations and Areas for Future Research

These results estimates reviewed in this paper must be qualified by noting two major areas of uncertainty. First, there are many unknowns about the costs of reducing emissions. The DRI model provides *one* way to estimate those costs. This model could overstate or understate the costs of reducing GHG emissions. If the energy efficiency of the economy grows more slowly than is expected in the base case, then greater reductions in energy use will be required to meet any given standard, which would dramatically increase the costs of compliance. On the other hand, in the past such modeling exercises have produced estimates that have proved, in retrospect, to significantly overestimate the costs of new pollution controls. Examples include the costs of reducing asbestos, cotton dust and vinyl chloride emissions (Mendeloff 1988).

In addition, there is substantial uncertainty about the pace of global warming and the precise climactic impact of a given volume of CO_2 emissions. As noted above, any potential benefits of climate change policies, including the explicitly economic benefits, have not been considered in these calculations. Some studies have found that the benefits of GHG reduction are less than the costs of the policies considered here, and that optimal levels of control would

therefore be less restrictive or that limits should be phased-in over a longer time-span. Other studies forecast that the costs of GHGs will rise sharply in the future, and that the overall costs of control will be lower the sooner steps are taken to limit or reduce GHG emissions. For these reasons, this report does not take a position on the advisability of adopting further policies to restrict GHG emissions. Further study is clearly required in the areas noted above, whether new GHG policies are adopted in Kyoto, or not, to improve the policy-making process in the future.

In addition to these general areas of uncertainty, this report has raised a number of specific concerns that require future research. These include the effect of GHG policies on foreign trade and investment, including sectoral details and relationships between the major accounts (merchandise, services, current and capital accounts); and if permits are traded internationally, or joint implementation is allowed (neither of these alternatives was considered in this report), the implications for trade and exchange rates in a general equilibrium context. Another major area of concern is the system for implementing permits, how they will be created and traded, the nature of the property rights involved, and the wealth effects of grandfathering or other forms of distribution to the private sector. There is a related set of issues concerning the distribution of income between labor and capital, and the future rate of return on capital, that GHG policies will also intersect with. Finally, further disclosure, review and debate is needed about the technical assumptions of the models used to analyze GHG policies. This review should include the relevant price and/or substitution elasticities and the potential (and cost) of increasing the energy-efficiency of the domestic economy without GHG policies. Differences in base case level of energy use, during the forecast period, can have a very large impact on the cost of limiting carbon emissions and this issue has not been adequately addressed in the literature.

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Endnotes

1. This section is based on, and the quotes are drawn from Bernstein, Montgomery and Rutherford (1997).

2. Nordhaus (1994), which estimates optimal GHG policies from an explicitly defined welfare model is a notable exception. Other examples include Boyd, Krutilla and Viscusi (1995) and Madisson (1995).

3. See, for example, Hoeller, Dean and Nicolaisen (1991) and Repetto and Austin (1997).

4. See, for example, comments on the IAT draft report in letters released to the House Subcommittee on Energy and Power, as an appendix to Yellen (1997):
Dale Jorgenson and William D. Nordhaus (April 24, 1997) "This model is ... highly inappropriate...extremely sensitive to assumptions about energy prices." The letter also criticized the "use of fixed-coefficient, input-output model." and Raymond J. Kopp (May 15, 1997) stated that the DRI model is "...useful only for the analysis of short-term adjustments, and even here, one should proceed with caution..." because the model is "driven from fixed coefficient input-output tables that can give very distorted views of the adjustment behavior of the economy."

5. The IAT report utilized three models. In addition to the DRI model discussed here, the IAT also developed forecasts for a similar set of policy scenarios using the Markal-Macro and Second Generation Models (SGM). These are simulation-type models that calculate equilibrium output levels, given constraints (such as available energy resources) and a set of initial conditions and assumptions about the structure of the economy. The Markal-Macro and SGM models are not designed to estimate adjustment costs or economic disequilibria that will result from policy changes. Hence the DRI model is better suited to the analysis of displacement issues, while the general class of simulation models are more appropriate for estimating long-run consequences. Note, however, that the IAT was criticized by reviewers for: 1) failing to utilize a full computable general equilibrium model, rather than the Markal-Macro or SGM; and 2) because neither of those models included a well developed foreign trade sector. See comments by Nordhaus and Jorgenson (previously cited), Ray Kopp, John Weyant and Richard Richels, in letters released to the House Subcommittee on Energy and Power, as an appendix to Yellen (1997).

6. See Wiley, T.M.L., R. Richels and J.A. Edmonds 1996.

7. Note that IAT (1997, Table 1) reports that total carbon emissions in 1990 were 1338 MMT, 1.1% more than is reported for 1990 consumption levels in DRI/McGraw-Hill (1997).

8. These target reduction levels are 5% to 8% larger than those required in IAT (1997). The difference is explained by the combination in the IAT report of more rapid declines in the energy intensity of the economy (1.25 percent per year vs. 1.0 percent per year), and the slightly higher baseline level of carbon emissions. The efficiency assumption is the most important difference, by far, between the two baseline cases.

9. A fourth case and a new base case are also analyzed in DRI/McGraw-Hill (1997). These cases assume that the energy intensity of the domestic economy in the "heroic base case" improves at 1.75% per year. This corresponds to a similar scenario in the IAT report. Results parallel those of the cases discussed below. The scenario in case 4 is otherwise identical to case 1 (grand fathered permits). Case 4 and its comparable base case are not analyzed here because the "heroic base case" scenario is highly unlikely to occur.

10. Comments on the IAT draft report released to the House Subcommittee on Energy and Power, as an appendix to Yellen (1997) in letter from Richard Richels, May 30, 1997. See also letter from Larry Goulder, June 2, 1997, "The report seems consistently to employ assumptions and policy scenarios that contribute to low costs of emisssions reductions."

11. This view is also supported by Ray Kopp, in a letter of May 30, 1997, who noted that "All of the departures from AEO97 used in the draft report serve to decreased carbon emissions [in the base case] and therefore make attainment of a 1990 stabilization less costly." (Letter released to the House Subcommittee on Energy and Power, as an appendix to Yellen, 1997).

12. Figure 4 is derived from two of the scenarios shown in Figure 16 (p. 28) of the IAT draft report.

13. However, if public investment were to be increased using GHG revenues, then output and other macroeconomic variables could even more rapidly in the future than in the cases reviewed here. However, increases in public investment would appear less likely to obtain than general or targeted tax cuts, in the present political environment in the U.S.

14. Bovenberg and de Mooij (1994) have shown that, in theory, revenue raising environmental taxes can lower economic output because they "exacerbate, rather than alleviate, preexisting tax distortions." Goulder (1995) develops a general equilibrium model which shows that the problem with the carbon tax is its "focus on intermediate inputs and its relatively narrow base in comparison with income taxes." In principle, raising the cost or limiting the supply of energy inputs will change the shape and position of the production possibility frontier, generally reducing the amount of output that can be generated with any given set of other inputs.

15. Mishel, Bernstein, and Schmitt (1997, 195) estimate that trade could be responsible for more than 30% of the increase in income inequality in the U.S. between 1979 and 1989.

16. The effects on real wages are estimated by dividing the employment cost index by the consumer price index series in DRI-McGraw-Hill (1997, 20 and exhibit 15). The base case value for this series is then contrasted with each of the forecasts to determine the change in the real value of compensation. Note that DRI-McGraw Hill draws a sharp contrast between changes in the nominal wage series for case 3 (permit auctions) which decline sharply, and the other policy cases, where nominal wages increase because of increases in corporate revenues and hence the ability to pay. However, the variation in these results is eliminated when real wage series (and the corresponding differences of consumer prices in each case) are considered.

17. This increase in before-tax corporate profits appears to primarily reflects an increase in the implicit rate of return on capital. The cumulative increase in fixed nonresidential capital between 2000 and 2020 in the three cases analyzed here is between $1.0 and $1.4 trillion, roughly equivalent to the increase in annual corporate profits by 2020. Therefore most of the increase in profits reflects would appear to reflected increased returns on existing capital stock. This implicit forecast of increased returns is unrealistic, unless the world-wide corporate rate return on invested capital rises sharply because of GHG policies. However, an alternative view might treat the incremental profits as the returns on the imputed capital value of carbon emission permits. This view suggests that grandfathering of permits will not only transfer revenues to permit holders, but also new assets with a huge capital value. The implicit rate of return of capital, and wealth transfers associated with the permits, are important issues for future research.

18. Note that the DRI/McGraw-Hill (1997) forecasts for the three scenarios contain puzzling and potentially contradictory results. The Merchandise trade balance worsens by less than $100 billion in each case, although the calculated trade balances (including services) decline much more sharply, as indicated in the text. It is unlikely that services trade can or will account for these differences. In addition, the current account balance *improves* by $87 to $175 billion in the three GHG scenarios, presumably because of the increase in national savings. However, improvements of this magnitude in the current account are unlikely unless they are mirrored in changes in the trade balances, which dominate current account transactions.

19. Exchange rates are essentially unchanged in the DRI/McGraw-Hill (1997) forecasts, so changes in nominal wages and prices directly effect competitiveness. The rigidity of exchange rates in these forecasts is a potential source of error.

20. There is a greater percentage drop in employment in rubber and plastic footwear under GHG policies, as shown in Table 4. However, output in this industry was less than $1 billion in 1995, as compared with coal industry output of over $28 billion in that year.

21. Association of Small Island States, 1995, "Draft Protocol Submitted to the United Nations Framework Convention on Climate Change," as referenced in Repetto and Austin (1997, 1).

22. Nordhaus and Yang (1996) develop a regional bargaining model which generates slightly higher optimal permit prices of roughly $30 per ton of carbon in 2090, versus $21 in the DICE model developed in Nordhaus (1994).

Table 1
Energy Price Comparisons

	2010	2020
DRI/McGraw-Hill Base Case		
Implicit Price of Carbon ($1995)	$0.00	$0.00
Gasoline-Retail ($/gallon)	$1.30	$1.44
Coal-Electric Utility ($/mmBtu)	$1.07	$0.99
Natural Gas-Utility ($/mmBtu)	$2.30	$2.77
Electricity-Weighted Average (cents/	$4.90	$4.95
DRI Case 1-- Grandfathered Permits		
Implicit Price of Carbon ($1995)	$192.00	$281.00
Gasoline-Retail ($/gallon)	$1.73	$2.06
Coal-Electric Utility ($/mmBtu)	$6.23	$8.52
Natural Gas-Utility ($/mmBtu)	$5.28	$7.14
Electricity-Weighted Average (cents/	$8.13	$9.58
Percentage Changes from Base:		
Gasoline	33.1%	43.1%
Coal	482.2%	760.6%
Natural Gas	129.6%	157.8%
Electricity	65.9%	93.5%
DRI Case 2-- Grandfatherhed Permits, 90% of '90 Emissions		
Implicit Price of Carbon ($1995)	$270.00	$320.00
Gasoline-Retail ($/gallon)	$1.94	$2.16
Coal-Electric Utility ($/mmBtu)	$8.34	$8.52
Natural Gas-Utility ($/mmBtu)	$6.51	$7.73
Electricity-Weighted Average (cents/	$9.29	$10.51
Percentage Changes from Base:		
Gasoline	49.2%	50.0%
Coal	679.4%	760.6%
Natural Gas	183.0%	179.1%
Electricity	89.6%	112.3%
DRI Case 3-- Permits Auctioned		
Implicit Price of Carbon ($1995)	180	270
Gasoline-Retail ($/gallon)	$1.71	$2.06
Coal-Electric Utility ($/mmBtu)	$5.90	$8.21
Natural Gas-Utility ($/mmBtu)	$5.17	$7.18
Electricity-Weighted Average (cents/	$8.00	$9.47
Percentage Changes from Base:		
Gasoline	31.5%	43.1%
Coal	451.4%	729.3%
Natural Gas	124.8%	159.2%
Electricity	63.3%	91.3%
Administration-IAT Draft of May 30, 1997		
(1990 Level Case, No International Trading, Permits Auctioned)		
Implicit Price of Carbon ($1995)	95	125
Gasoline-Retail ($/gallon)*	$1.56	$1.73
Percentage Change in Gasoline Pri	19.8%	19.8%
Comparison, DRI (1997) vs. IAT Estimates:		
Implicit Price of Carbon ($1995)	189%	216%
Percentage Change in Gasoline-Ret	160%	218%

*Estimated, assuming "26 cents gallon of refined petroleum product (IAT Draft at 8)". Note that IAT Draft assumes slightly lower gasoline prices in its base case

Source: Economic Policy Institute

Table 2
Employment Change by Industry in 2007
Relative to Base Case

	Grandfathered Permits		Grandfathered Permits, 90% of '90 Emissions		Auction, Deficit Reduction	
	Percent Change	Jobs Lost (thousands)	Percent Change	Jobs Lost (thousands)	Percent Change	Jobs Lost (thousands)
Civilian Employment - HH Survey	-1.3%	(1,800)	-1.8%	(2,600)	-1.0%	(1,500)
Nonagricultural Establishments	-1.3%	(1,800)	-2.0%	(2,700)	-1.2%	(1,600)
Contract Construction	-1.6%	(100)	-2.8%	(170)	-1.3%	(80)
Finance, Insurance & Real Estate	-1.2%	(90)	-1.4%	(110)	-0.3%	(20)
Mining	-13.5%	(70)	-15.4%	(80)	-11.5%	(60)
Transportation and Public Utilities	-2.5%	(170)	-4.2%	(280)	-2.8%	(190)
Total Services	-1.3%	(570)	-2.0%	(880)	-1.0%	(450)
Health Services	-1.3%	(160)	-2.0%	(240)	-1.3%	(150)
Education Services	-0.9%	(20)	-1.3%	(30)	-0.4%	(10)
Other Services	-1.3%	(390)	-2.0%	(610)	-1.0%	(290)
Retail Trade	-1.2%	(290)	-1.9%	(480)	-0.9%	(220)
Wholesale Trade	-0.6%	(50)	-1.3%	(100)	-0.5%	(40)
Federal Government	0.0%	0	0.0%	0	0.0%	0
State and Local Governments	-1.2%	(240)	-1.7%	(340)	-2.3%	(450)
Manufacturing	-1.0%	(180)	-1.2%	(210)	-0.2%	(30)
Nondurables Manufacturing	-1.5%	(110)	-1.7%	(130)	-0.4%	(30)
Food and Products	-0.9%	(15)	-1.2%	(19)	-0.4%	(7)
Tobacco Products	0.0%	0	0.0%	0	0.0%	0
Textiles and Products	-1.8%	(11)	-1.8%	(11)	-0.2%	(1)
Apparel and Products	-3.2%	(23)	-2.5%	(18)	-0.3%	(2)
Paper and Products	-1.2%	(8)	-1.6%	(11)	-0.4%	(3)
Printing and Publishing	-1.1%	(18)	-1.3%	(22)	-0.4%	(6)
Chemicals and Products	-1.3%	(13)	-2.0%	(20)	-0.5%	(5)
Petroleum Products	-4.1%	(5)	-7.4%	(9)	-2.5%	(3)
Rubber and Plastics Products	-1.2%	(12)	-1.4%	(15)	-0.3%	(3)
Leather and Products	-6.0%	(4)	-4.5%	(3)	0.0%	0
Durables Manufacturing	-0.7%	(70)	-0.9%	(90)	0.0%	0
Lumber and Wood Products	-1.3%	(10)	-1.6%	(12)	0.0%	0
Furniture and Fixtures	-0.8%	(4)	-0.8%	(4)	0.0%	0
Stone, Clay, and Glass	-1.4%	(7)	-2.0%	(10)	-0.4%	(2)
Primary Metal Industries	-1.4%	(9)	-2.0%	(13)	-0.5%	(3)
Fabricated Metal Products	-0.9%	(13)	-1.1%	(16)	-0.1%	(2)
Nonelectrical Machinery	-0.2%	(3)	-0.2%	(4)	-0.1%	(2)
Electrical Machinery	-0.8%	(13)	-0.9%	(14)	0.2%	3
Transportation Equipment	-0.1%	(2)	-0.1%	(2)	0.1%	2
Instruments and Parts	-0.1%	(1)	-0.3%	(2)	0.1%	1
Miscellaneous Manufacturing	-2.3%	(9)	-2.3%	(9)	-0.5%	(2)

Source: Economic Policy Institute

Table 3
Employment Change by Industry in 2020
Relative to Base Case

	Grandfathered Permits		Grandfathered Permits, 90% of '90 Emissions		Auction, Deficit Reduction	
	Percent Change	Jobs Lost (thousands)	Percent Change	Jobs Lost (thousands)	Percent Change	Jobs Lost (thousands)
Civilian Employment - HH Survey	-0.4%	(600)	-0.3%	(500)	-0.1%	(100)
Nonagricultural Establishments	-0.3%	(500)	-0.3%	(500)	-0.1%	(100)
Contract Construction	0.3%	20	-0.2%	(10)	1.5%	90
Finance, Insurance & Real Estate	-0.5%	(40)	-0.4%	(30)	0.7%	60
Mining	-22.2%	(100)	-24.4%	(110)	-22.2%	(100)
Transportation and Public Utilities	-5.6%	(350)	-6.4%	(400)	-5.0%	(310)
Total Services	-0.9%	(490)	-0.9%	(480)	-0.5%	(280)
Health Services	-2.2%	(320)	-2.3%	(330)	-2.0%	(290)
Education Services	0.9%	20	1.4%	30	1.4%	30
Other Services	-0.5%	(180)	-0.5%	(190)	-0.1%	(20)
Retail Trade	0.9%	240	1.1%	290	0.9%	250
Wholesale Trade	0.1%	10	-0.2%	(20)	0.8%	70
Federal Government	0.0%	0	0.0%	0	0.0%	0
State and Local Governments	1.7%	390	2.3%	520	-0.8%	(180)
Manufacturing	-1.1%	(170)	-2.1%	(330)	1.5%	240
Nondurables Manufacturing	-2.5%	(180)	-3.1%	(220)	0.4%	30
Food and Products	-1.3%	(20)	-1.1%	(17)	-1.1%	(17)
Tobacco Products	0.0%	0	0.0%	0	9.1%	1
Textiles and Products	-2.5%	(12)	-2.5%	(12)	3.3%	16
Apparel and Products	-8.8%	(49)	-9.1%	(51)	3.9%	22
Paper and Products	-1.3%	(8)	-2.4%	(15)	0.0%	0
Printing and Publishing	-1.0%	(17)	-0.9%	(15)	0.4%	7
Chemicals and Products	-2.4%	(24)	-4.9%	(48)	0.1%	1
Petroleum Products	-20.0%	(20)	-24.0%	(24)	-17.0%	(17)
Rubber and Plastics Products	-1.7%	(20)	-2.6%	(30)	0.9%	10
Leather and Products	-21.6%	(11)	-27.5%	(14)	5.9%	3
Durables Manufacturing	0.0%	0	-1.2%	(110)	2.4%	210
Lumber and Wood Products	0.1%	1	-0.3%	(2)	3.8%	27
Furniture and Fixtures	1.5%	6	1.0%	4	5.9%	24
Stone, Clay, and Glass	-0.9%	(4)	-2.4%	(11)	1.5%	7
Primary Metal Industries	-2.8%	(15)	-5.9%	(32)	-0.2%	(1)
Fabricated Metal Products	-0.2%	(3)	-1.0%	(15)	2.3%	33
Nonelectrical Machinery	2.5%	38	2.2%	33	0.8%	12
Electrical Machinery	-4.0%	(51)	-7.0%	(90)	1.9%	25
Transportation Equipment	3.1%	45	2.3%	34	3.7%	55
Instruments and Parts	1.3%	8	-0.5%	(3)	3.6%	22
Miscellaneous Manufacturing	-5.7%	(22)	-7.3%	(28)	2.1%	8

Source: Economic Policy Institute

Table 4
Employment by Industry in 2020
Change from the Base Case

	Case 1 Grandfathered Permits		Case 2 Grandfathered Permits, 90% of '90 Emissions		Case 3 Auction, Deficit Reduction Grandfathered Permits		Average Hourly Earnings 1995*
	percent	thousands	percent	thousands	percent	thousands	
Total Civilian Employment	-0.4%	(606.3)	-0.3%	(491.0)	-0.1%	(127.3)	
Nonagricultural Establishments	-0.3%	(498.8)	-0.4%	(579.0)	-0.1%	(153.5)	$11.46
Contract Construction	0.4%	23.3	-0.2%	(10.1)	1.4%	88.5	$15.04
Finance, Insurance and Real Estate	-0.5%	(39.6)	-0.3%	(26.9)	0.8%	64.9	$12.88
Mining	-23.4%	(106.2)	-17.5%	(116.6)	-22.0%	(99.8)	$15.32
Transportation and Public Utilities	-5.6%	(346.6)	-6.4%	(395.9)	-4.9%	(305.9)	$14.22
Services	-0.9%	(490.5)	-0.9%	(488.8)	-0.5%	(282.5)	$11.41
Retail Trade	0.9%	236.5	1.1%	287.5	0.9%	248.6	$7.70
Wholesale Trade	0.2%	17.8	-0.2%	(18.6)	0.9%	75.2	$12.40
Federal Government	0.0%	0.0	0.0%	0.0	0.0%	0.0	n.a
State and Local Government	1.7%	394.7	2.3%	527.6	-0.8%	(176.8)	n.a
Nondurables Manufacturing	-2.5%	(181.4)	-3.2%	(226.2)	0.3%	24.3	$11.60
Durables Manufacturing	0.0%	2.2	-1.3%	(110.9)	2.4%	210.1	$12.90

*"Employment and Earnings", March 1996. Average hourly earnings for production and non-supervisory workers in the private sector, from the establishment survey.

Source: Economic Policy Institute

Table 5
Industrial Winners and Losers
Sectors Experiencing Gains or Losses of More than 5% in Output in 2020 with Grandfathered Permits

	Change in Output from Base Case	
Losses Exceeding 5%	**2010**	**2020**
086 Rubber & Plastics Footwear	-54.3%	-55.9%
012 Coal Mining	-45.9%	-45.3%
091 Other Leather Goods	-24.0%	-33.7%
207 Electric Utilities	-19.7%	-29.6%
014 Natural Gas	-13.7%	-28.1%
208 Gas Utilities	-13.4%	-27.3%
160 Household Audio & Video Equip.	-12.5%	-22.4%
081 Petroleum Refining Ex. Fuel Oil	-11.7%	-19.0%
090 Leather Footwear	-15.9%	-16.0%
203 Pipelines, Ex N. Gas	-10.1%	-13.7%
082 Fuel Oil	-11.3%	-13.0%
096 Kitchen Pottery Products	-11.9%	-12.5%
190 Watches & Clocks	-8.9%	-12.4%
013 Crude Petroleum	-5.2%	-8.7%
042 Apparel From Purchased Mat'l	-8.8%	-8.3%
195 Toys & Sporting Goods	-7.2%	-7.6%
016 Chemical & Fertilizer Mining	-5.7%	-6.6%
089 Leather Tanning & Finishing	-7.7%	-6.5%
011 Misc. Nonferrous Ores	-4.4%	-6.4%
010 Copper Ore Mining	-5.0%	-6.0%
108 Nonferrous Metals NEC	-4.3%	-5.8%
009 Iron & Ferroalloy Ores	-6.0%	-5.6%
083 Lubricating Oils and Greases	-5.4%	-5.0%
Gains Exceeding 5%		
017 New Construction	0.0%	5.0%
130 Elevators & Mat'ls Handling Eq.	1.8%	5.2%
174 Motor Vehicles	1.5%	5.4%
146 Other Service Industry Machinery	2.1%	5.4%
141 Packaging Machinery	2.7%	5.8%
052 Partitions & Fixtures	1.9%	6.0%
127 Lawn & Garden Equipment	2.4%	6.1%
148 Computer Peripheral Equipment	2.4%	6.6%
172 Truck & Bus Bodies	3.2%	7.0%
173 Truck Trailers	3.6%	7.1%

Source: Economic Policy Institute

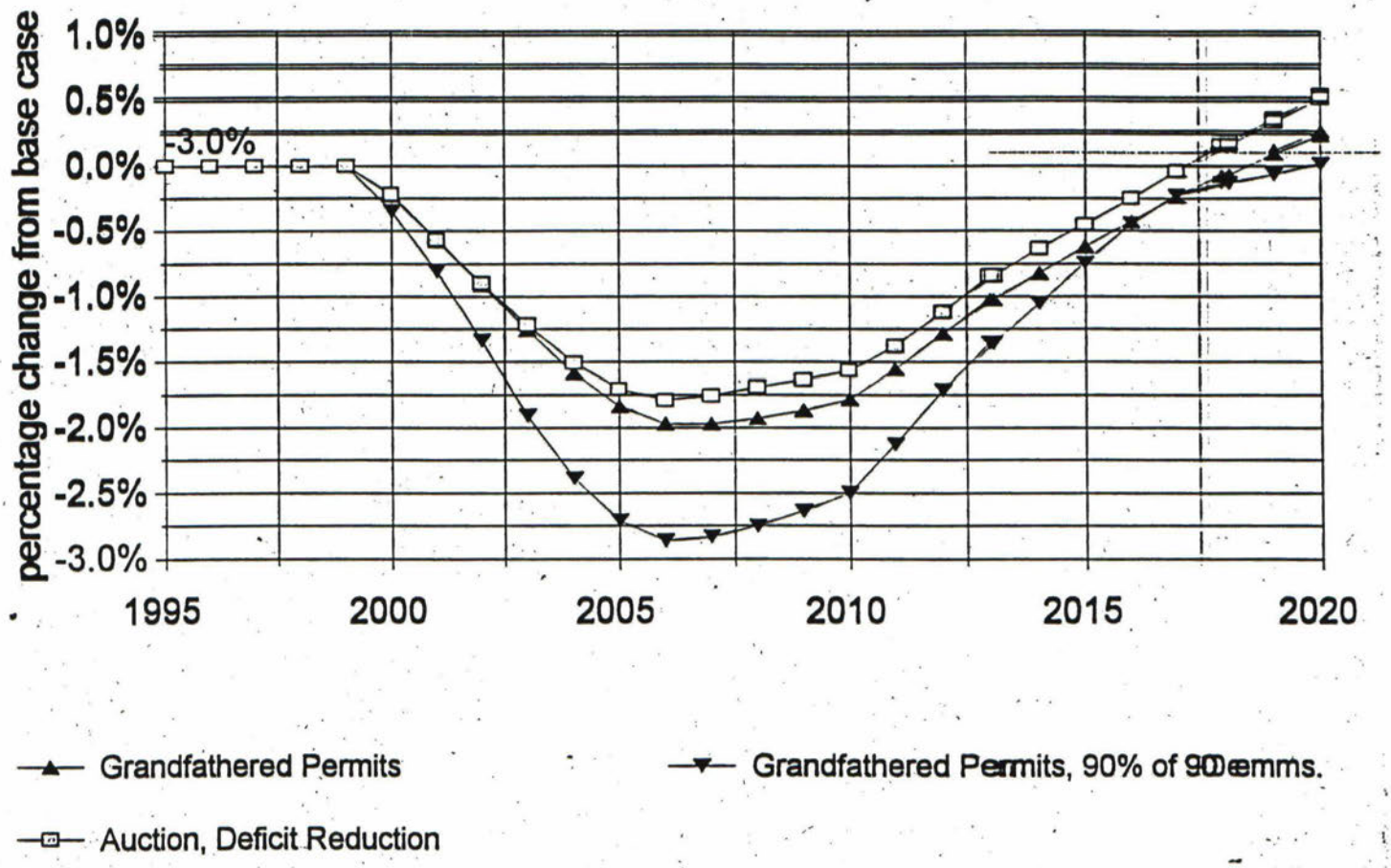
Table 6
Regional Gains and Losses
Changes in Population and Employment in 2020
(Grandfathered Permits, Percent Change from Base)

Region	Resident Population	Civilian Employment (HH Survey)	Contract Construction	Mining		Total Services	Retail Trade	Manufacturing
				total	Coal			
New England	0.3%	0.1%	0.4%	-3.7%	-51.2%	-3.0%	1.1%	-1.7%
Middle Atlantic	0.0%	-0.3%	6.7%	-23.3%	-41.5%	-0.8%	0.7%	-1.9%
South Atlantic	-0.3%	-0.8%	-0.5%	-28.3%	-40.3%	-1.3%	0.3%	-1.6%
East North Central	0.3%	-0.1%	0.5%	-19.8%	-39.5%	-0.7%	1.2%	-0.5%
East South Central	-1.1%	-2.0%	-1.4%	-33.1%	-39.8%	-3.5%	-0.5%	-2.1%
West North Central	0.5%	0.2%	1.5%	-10.1%	-43.5%	-0.9%	2.1%	-0.4%
West South Central	-0.6%	-1.1%	-0.9%	-20.3%	-65.5%	-1.8%	-0.3%	-1.1%
Pacific Northwest	1.7%	1.6%	1.4%	-20.9%	-47.5%	1.2%	4.5%	1.5%
Pacific Southwest	0.1%	-0.3%	-0.2%	-14.3%	-36.1%	-0.5%	1.0%	-1.5%

Source: Economic Policy Institute

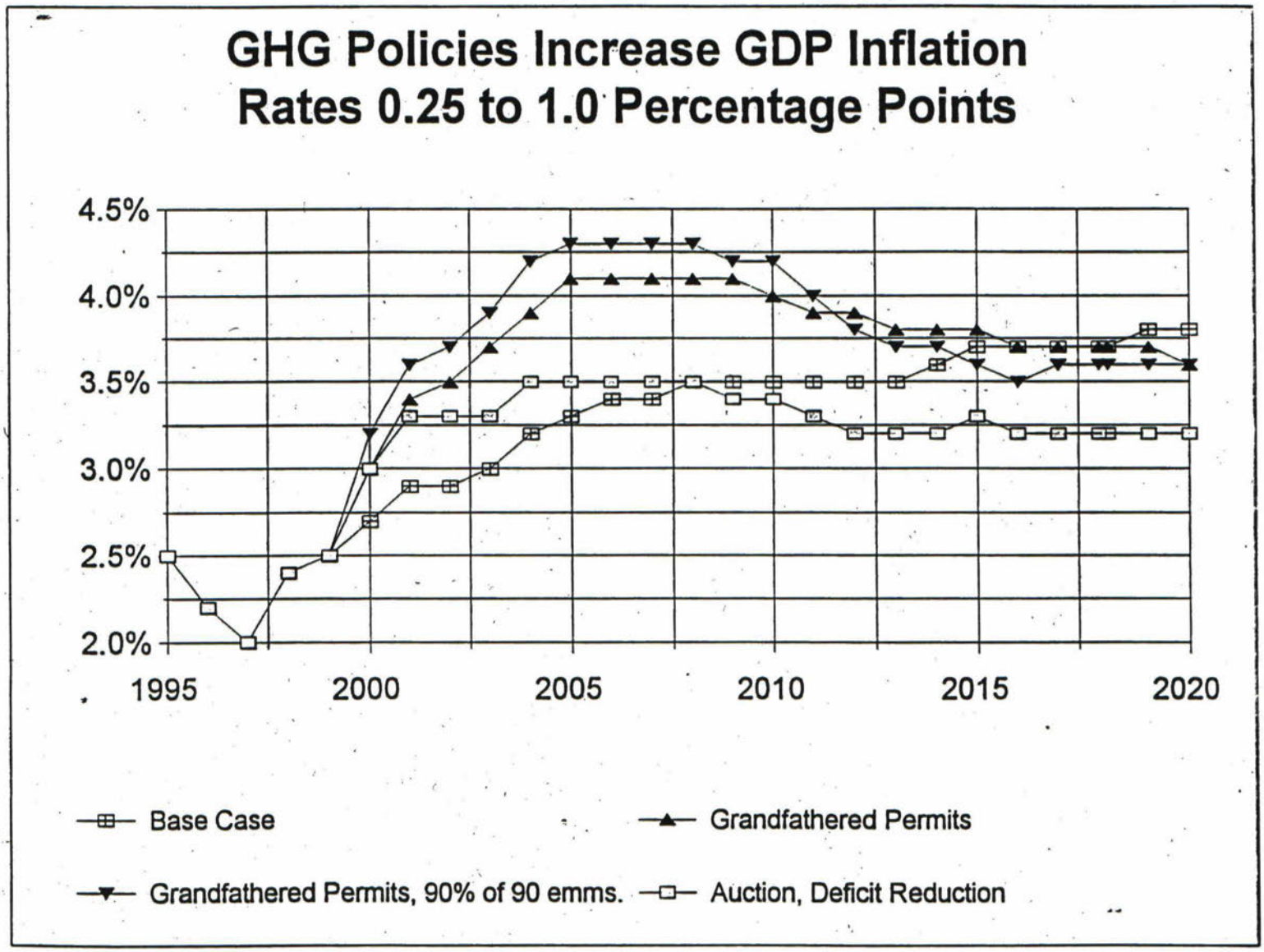
Figure 1

Green House Gas Limits Will Reduce GDP 1.8 to 2.9 Percent During Phase-in



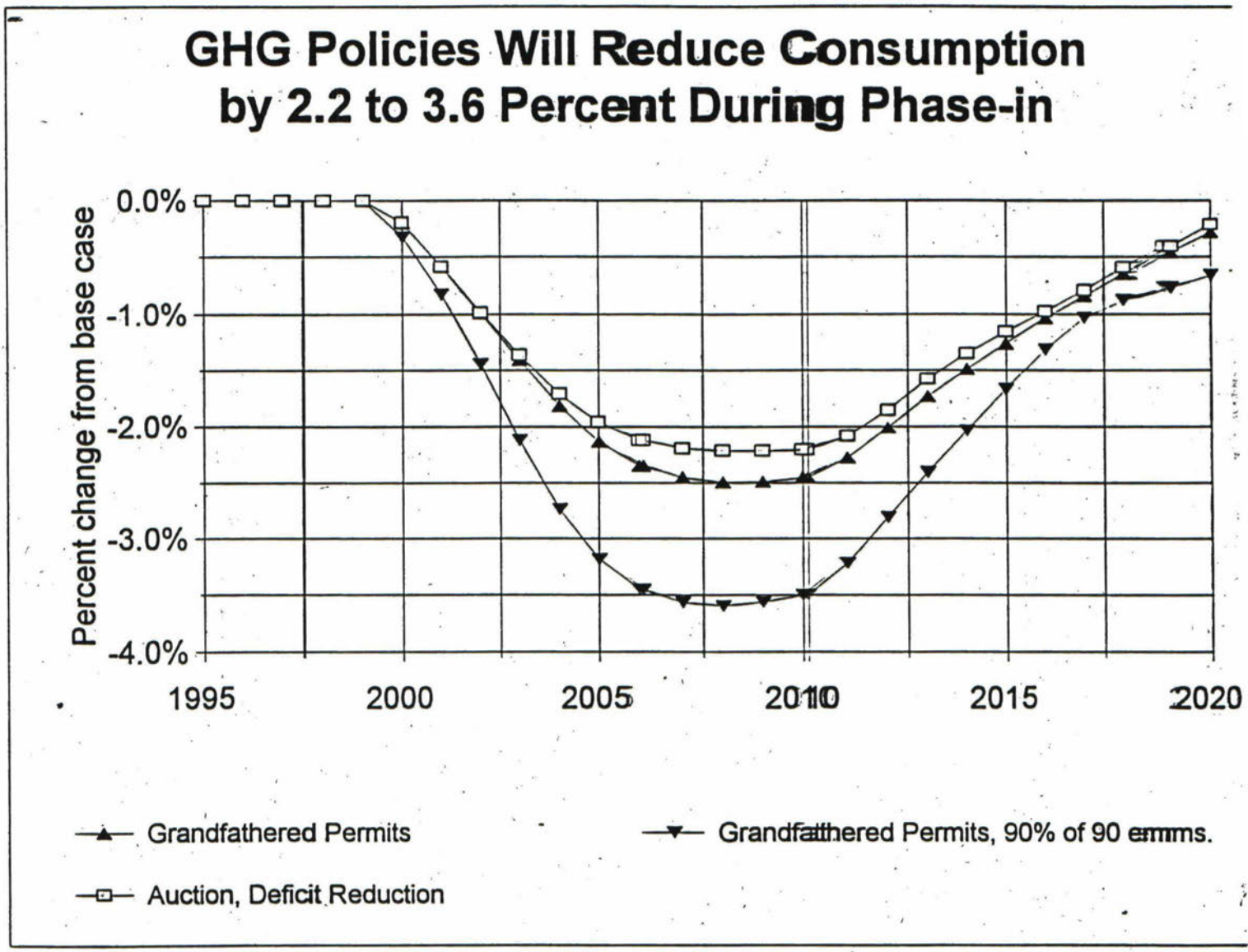
Source: Economic Policy Institute

Figure 2



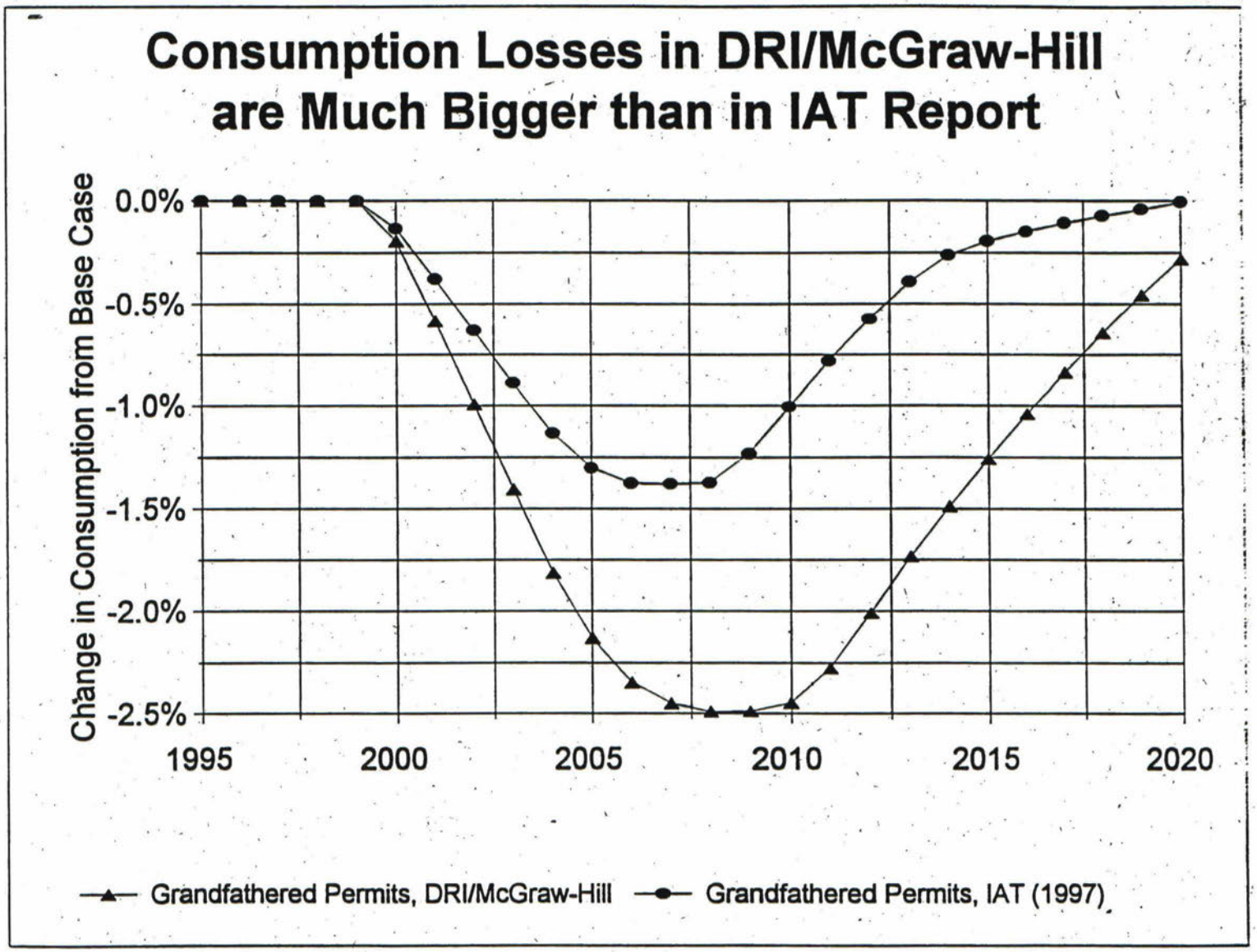
Source: Economic Policy Institute

Figure 3



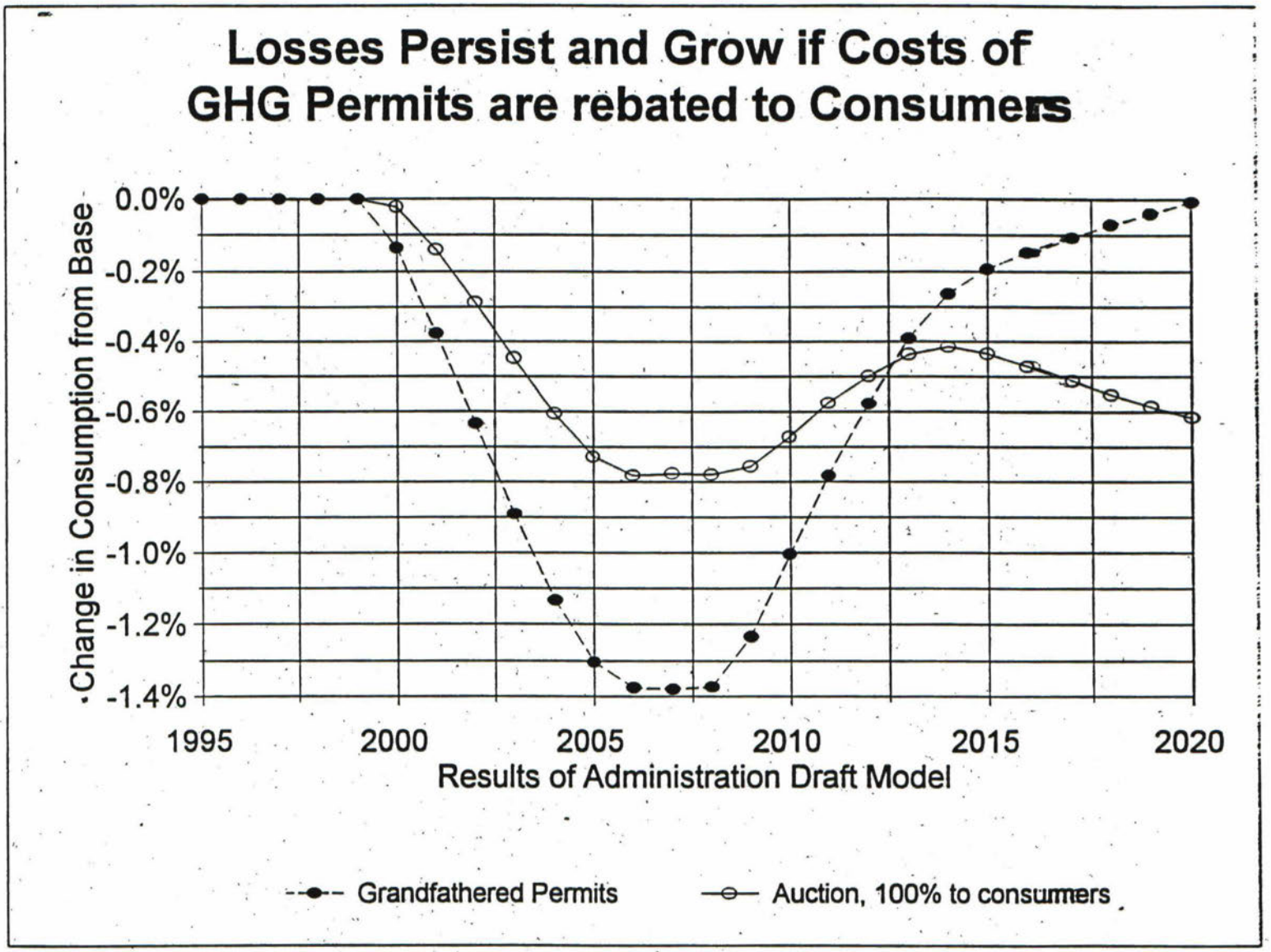
Source: Economic Policy Institute

Figure 4



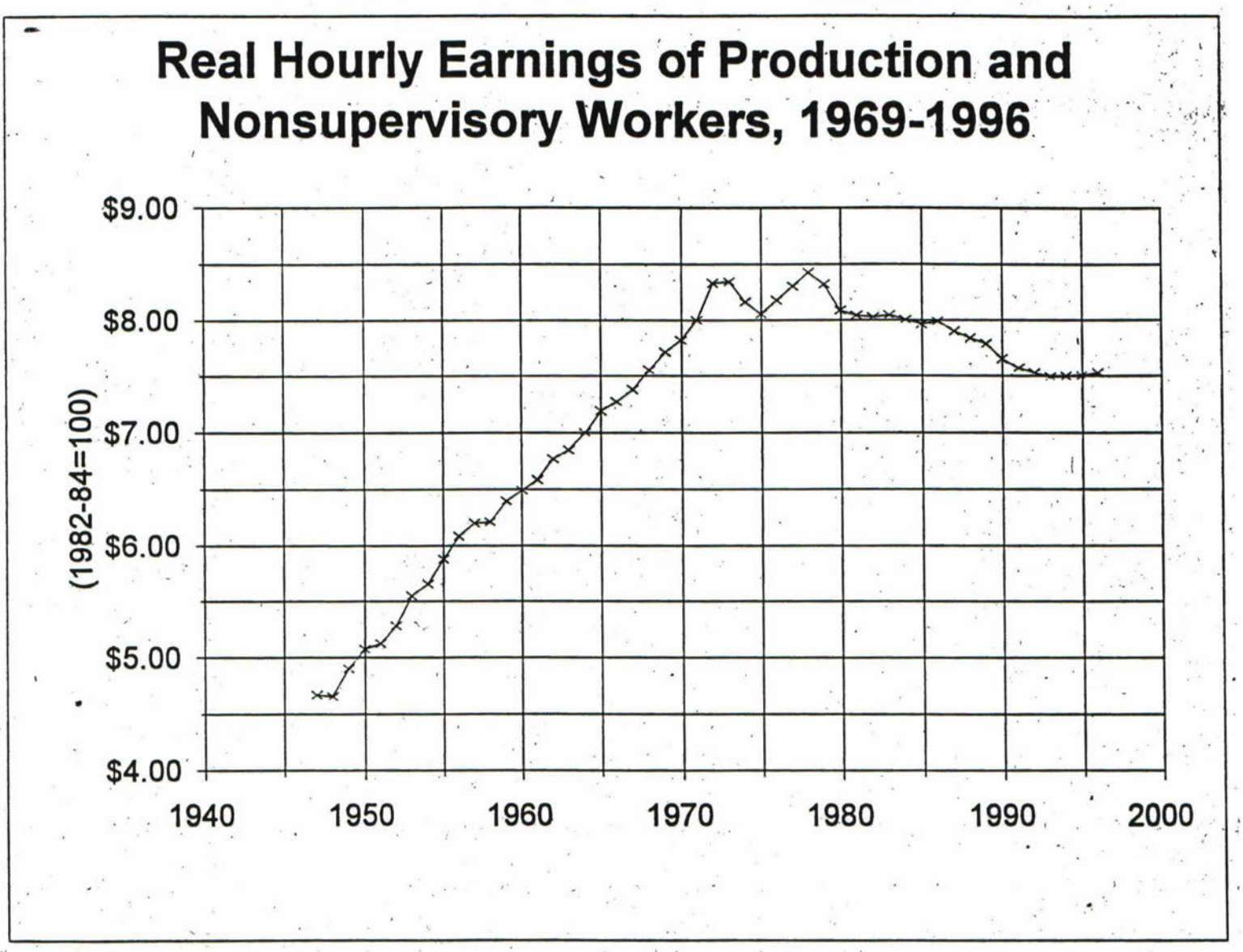
Source: Economic Policy Institute

Figure 5



Source: Economic Policy Institute

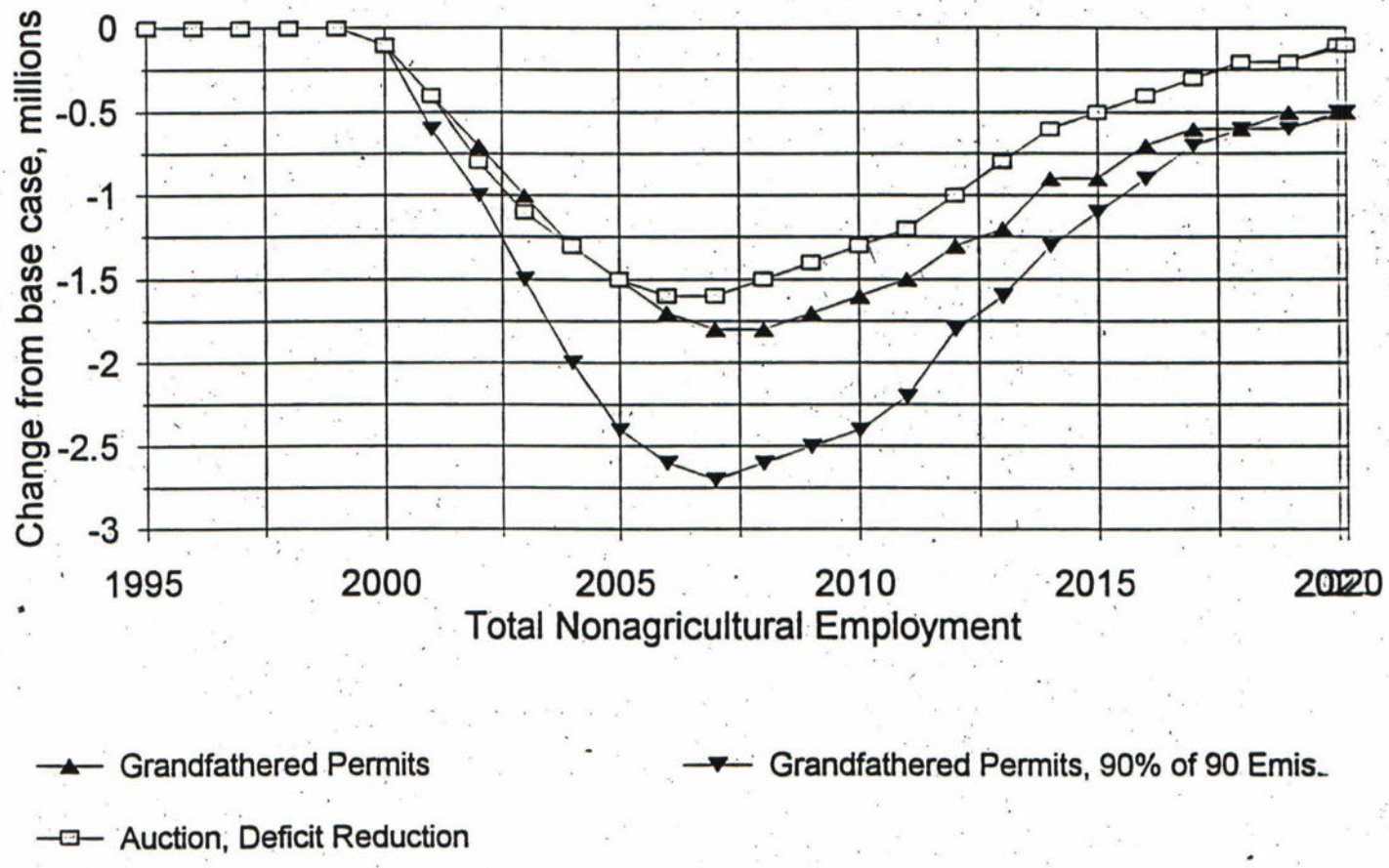
Figure 6



Source: Economic Policy Institute

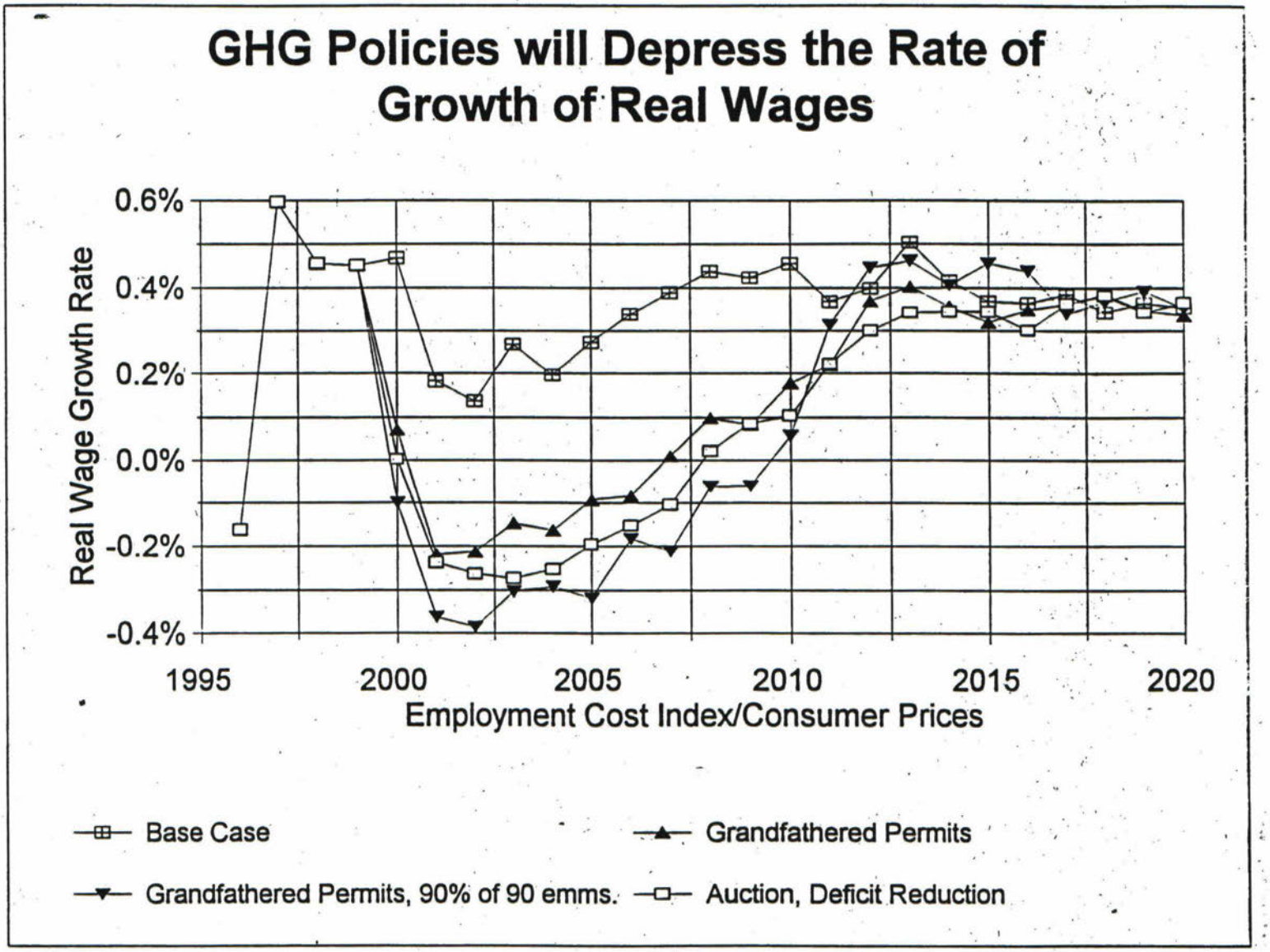
Figure 7

GHG Policies will Reduce Employment Growth by as much as 2.7 Millions Jobs



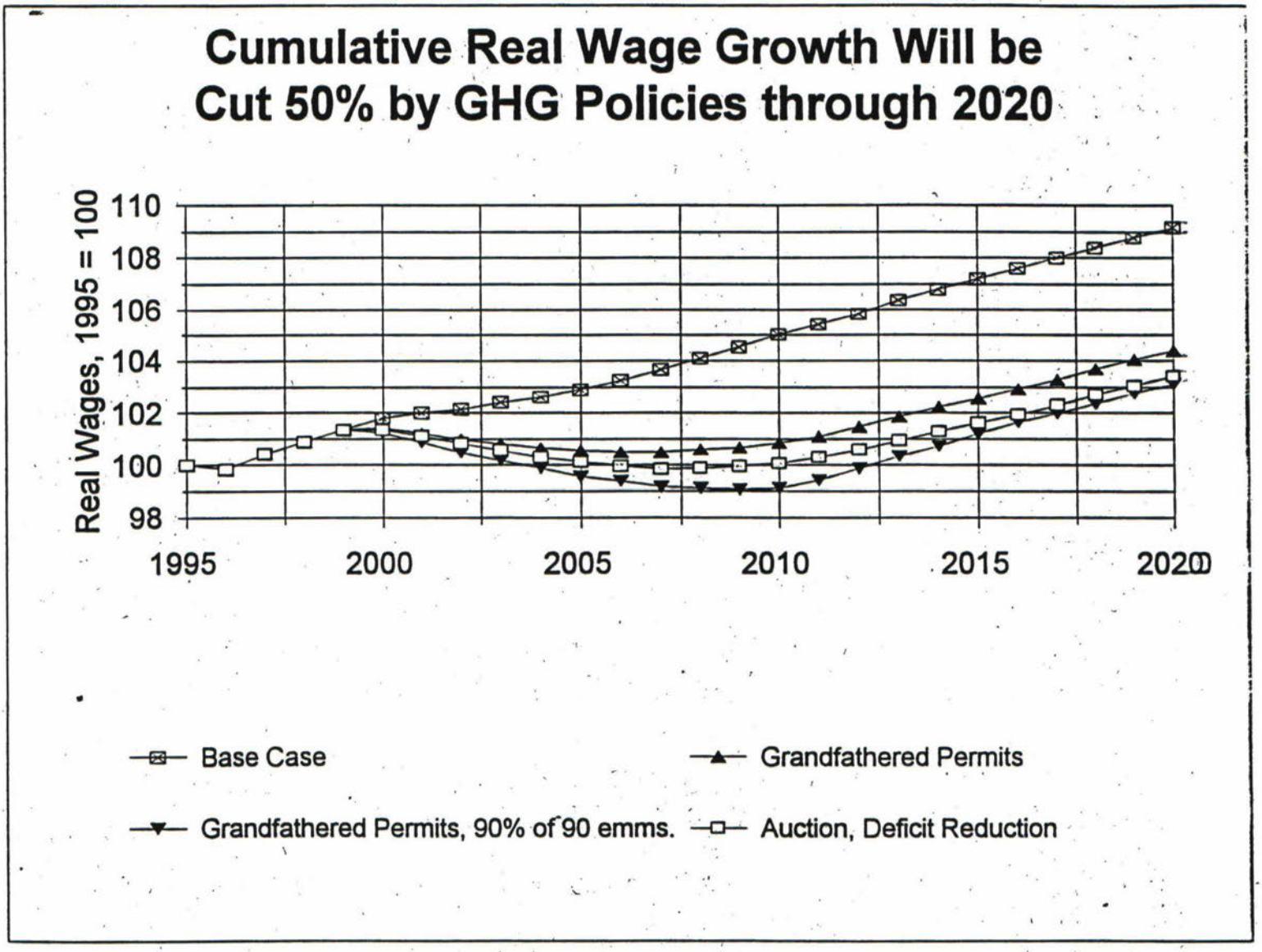
Source: Economic Policy Institute

Figure 8



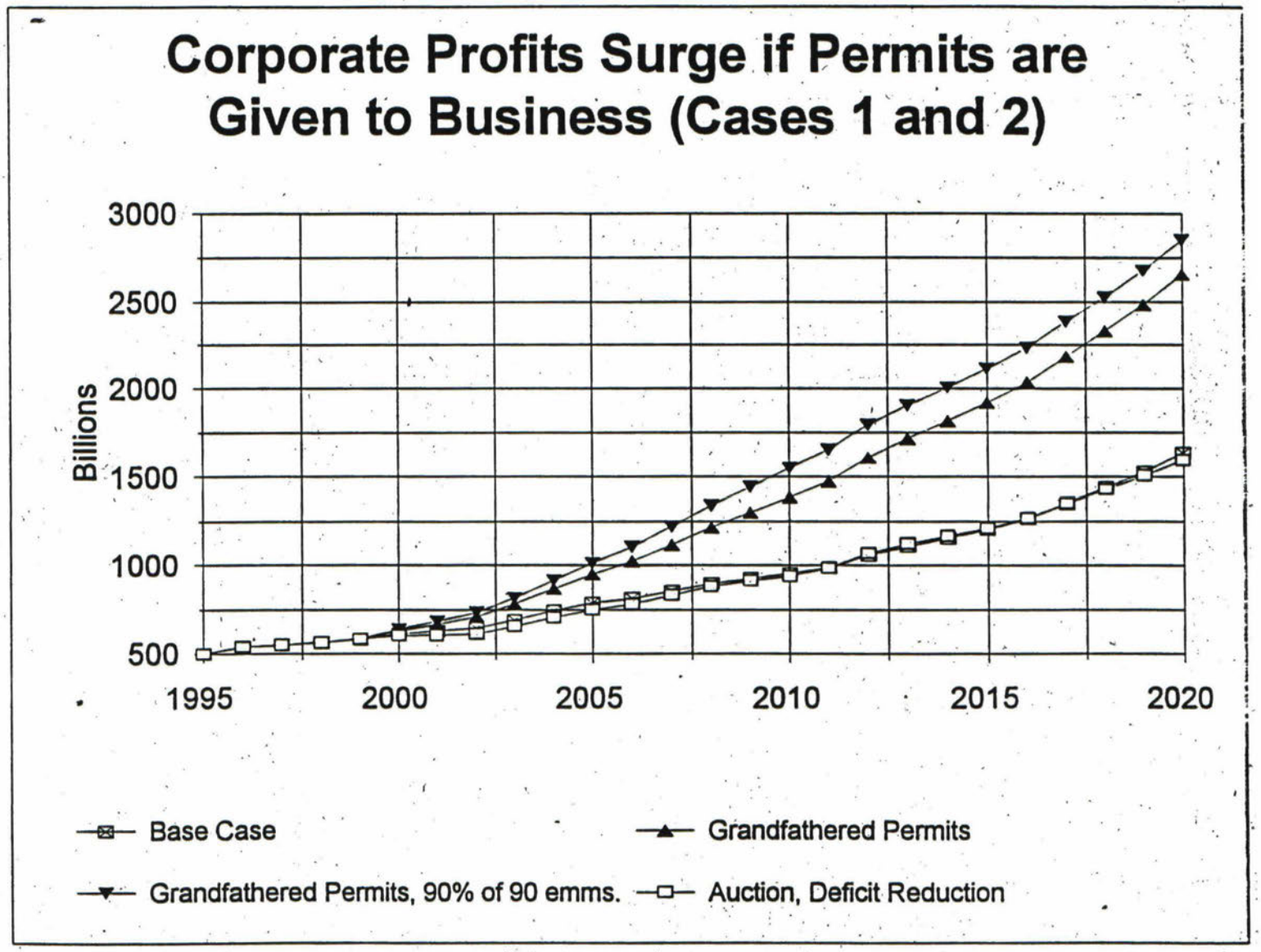
Source: Economic Policy Institute

Figure 9



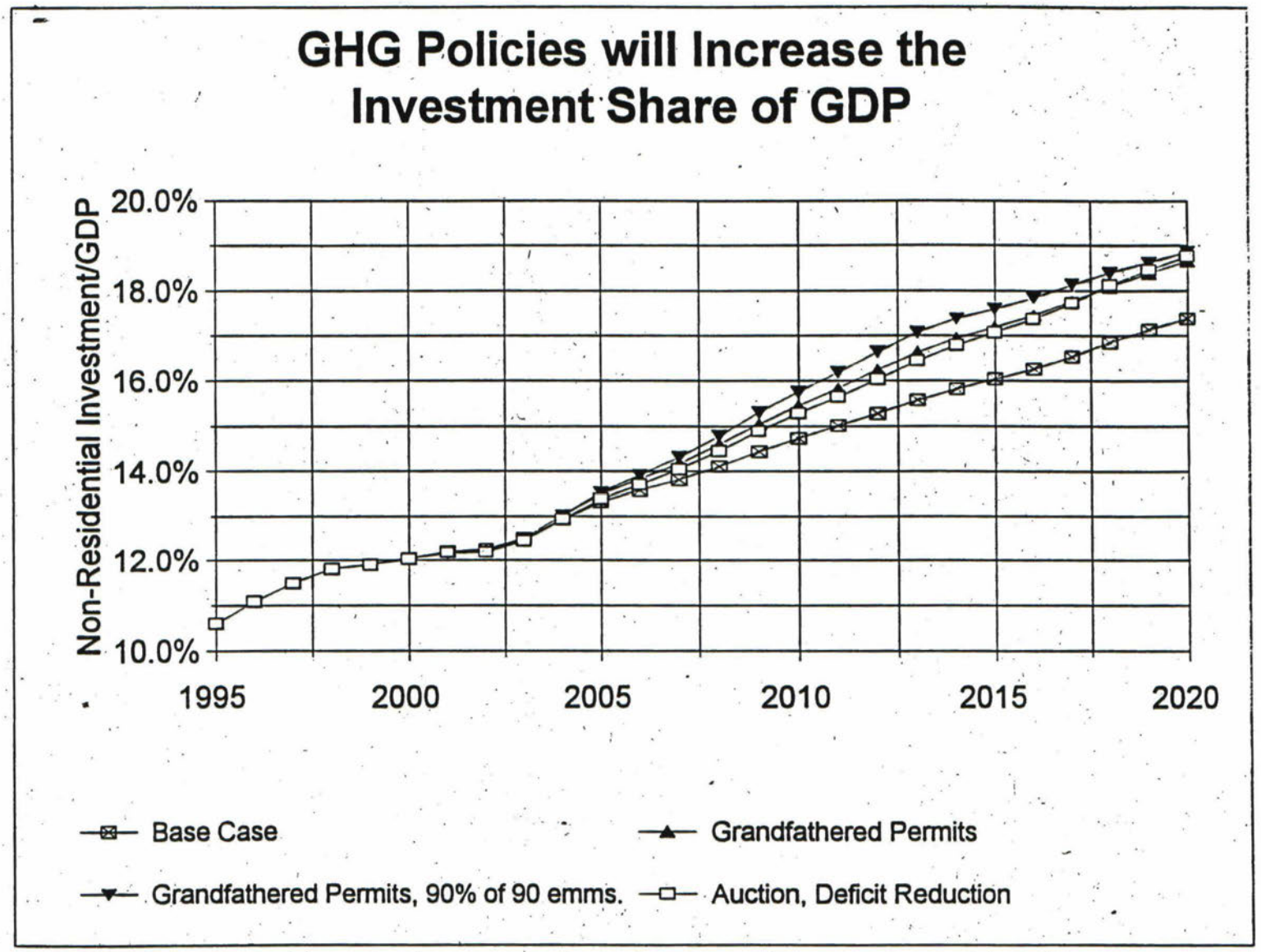
Source: Economic Policy Institute

Figure 10



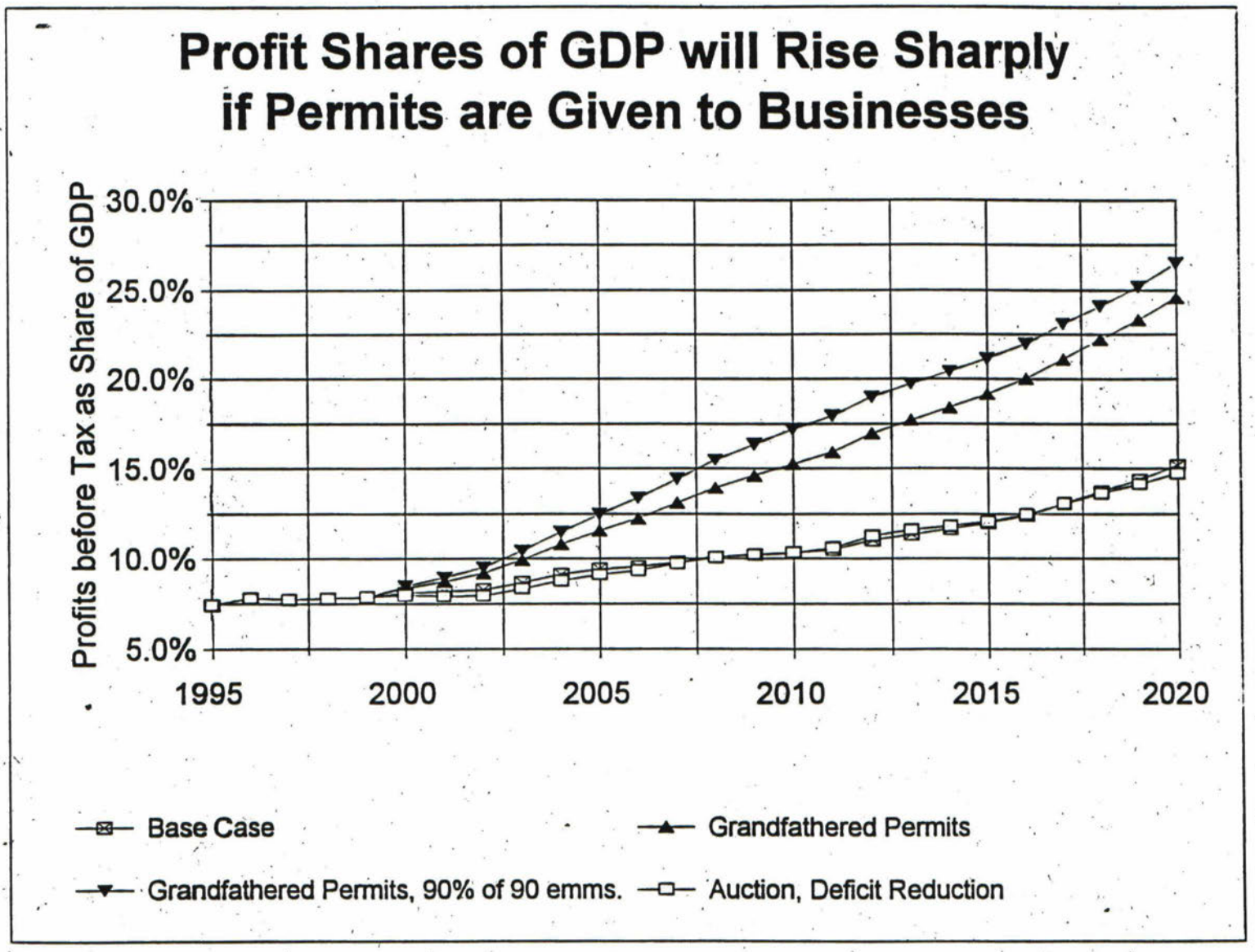
Source: Economic Policy Institute

Figure 11



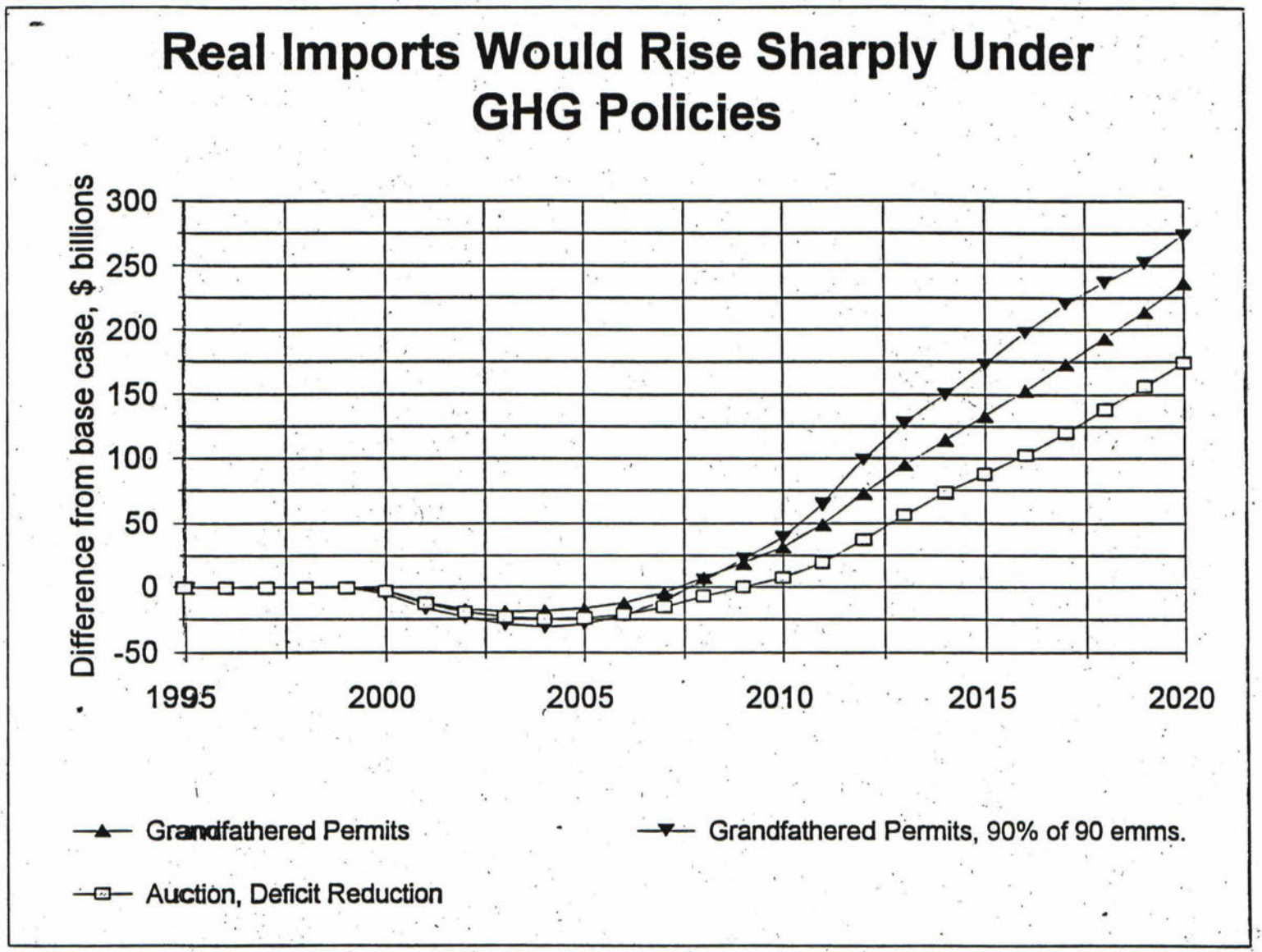
Source: Economic Policy Institute

Figure 12



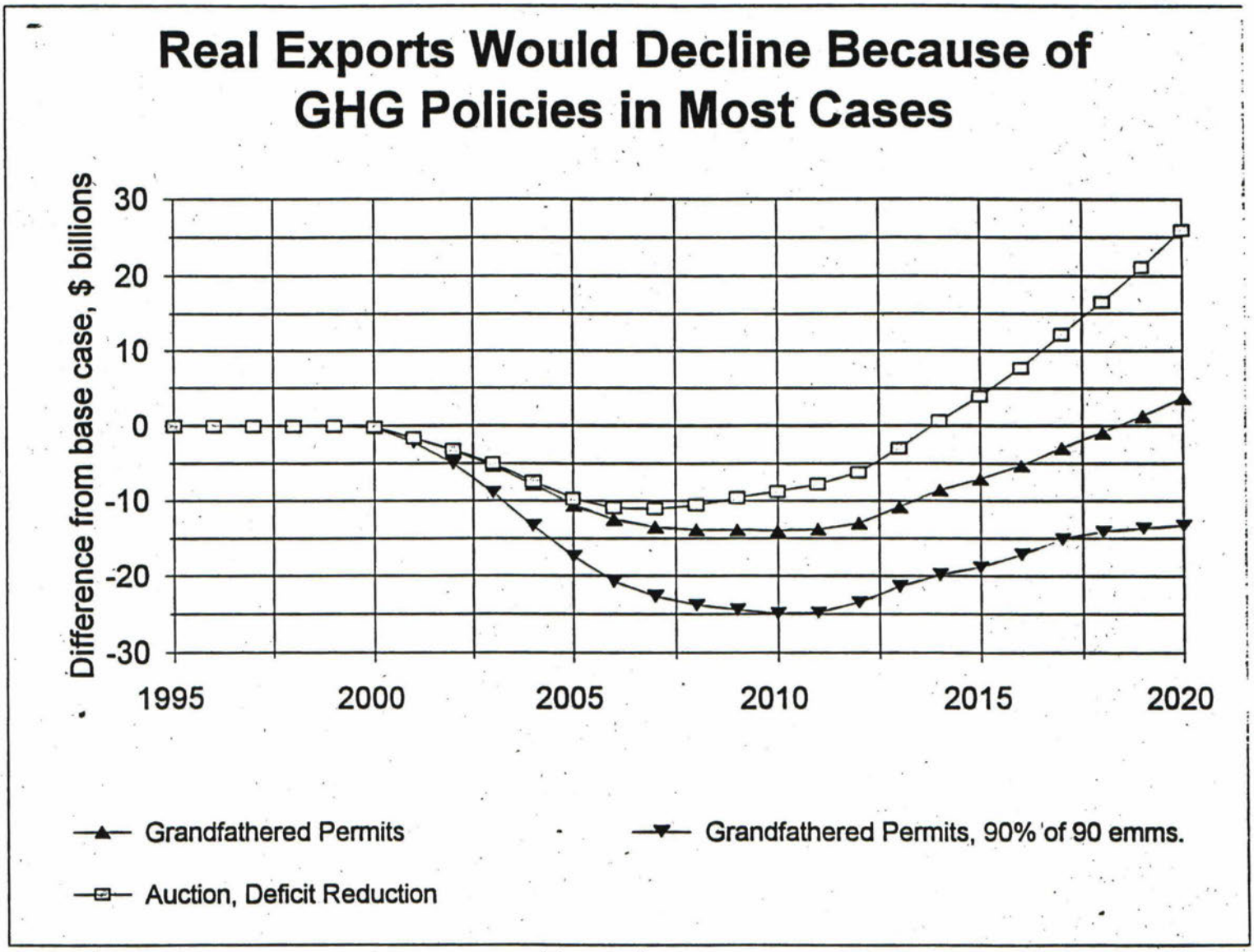
Source: Economic Policy Institute

Figure 13



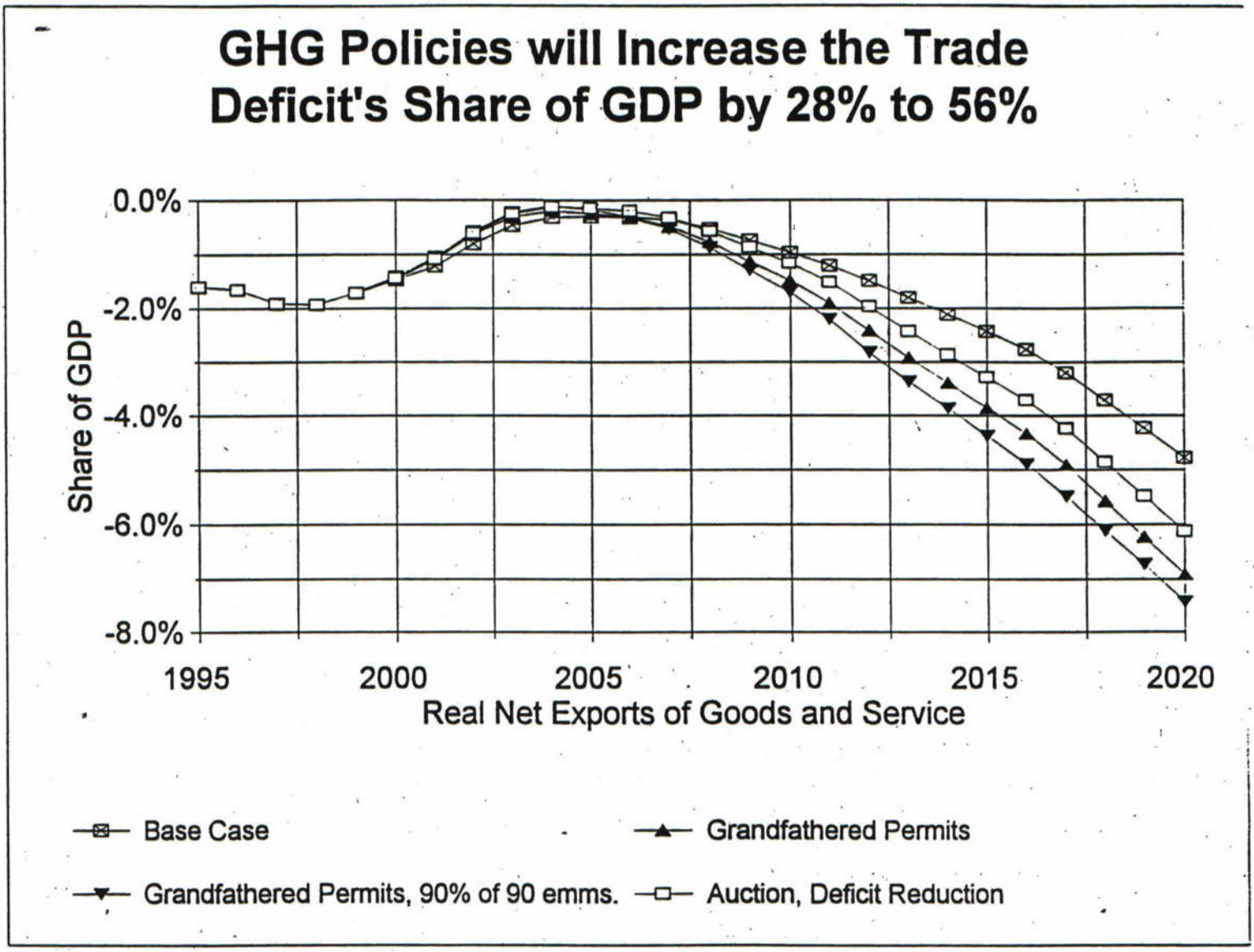
Source: Economic Policy Institute

Figure 14



Source: Economic Policy Institute

Figure 15



Source: Economic Policy Institute

Economic Analysis

DRAFT Talking Points on the EPI Climate Change Study
September 17, 1997

Background: The Economic Policy Institute released today a study purporting to reflect the economic ramifications of a policy designed to reduce U.S. greenhouse gas emissions to 1990 levels by the year 2010. The study predicts largely negative consequences, including between 1.5 and 2.7 million lost jobs, reduced consumer spending, and a substantial decrease in GDP. The study is likely to be used by organized labor (particularly the coal sector) to argue against U.S. acceptance of binding emissions targets and timetables at the climate change conference in Kyoto this December.

- **The President has not decided on a specific target and timetable for greenhouse gas emission reductions nor on the specific policies that might be implemented to achieve such reductions.**

- **This Administration is working to develop the right policies that enable us to achieve needed environmental gains without sacrificing continued economic prosperity.**

- **We look forward to working with organized labor, industry, and others to this end.**

- **It is important to note that the study itself uses assumptions that would tend to pruduce the more extreme estimates of negative economic costs.**

- **It fails to account for the role of international emissions trading and other mechanisms widely regarded as having the potential to significantly reduce the costs of emissions reductions.**

- **Furthermore, the economic model EPI has relied on (the DRI model) is not well-suited to making projections over timeframes much longer than a year or two -- making its estimates of economic effects in 2005, 2010, or 2020 unreliable.**

DRAFT Statement
Release of the EPI Report on Climate Change
September 17, 1997

I have reviewed the study released today from the Economic Policy Institute entitled, "Accelerating Globalization? The Economic Effects of Climate Change Policies on U.S. Workers." This study purports to reflect the economic ramifications of a policy designed to reduce greenhouse gas emissions to 1990 levels by the year 2010. There are two points I would like to make.

The President has not decided on a specific target and timetable for greenhouse gas emission reductions nor on specific policies that might be implemented to achieve such reductions.

The Administration is working to develop the right policies that enable us to achieve the needed environmental gains without sacrificing economic prosperity. We look forward to continuing to work with organized labor, industry, and others to this end.

Second, it is important to note that the study itself uses assumptions that would tend to pruduce the more extreme estimates of negative economic costs. It fails to account for the role of international emissions trading and other mechanisms widely regarded as having the potential to significantly reduce the costs of emissions reductions. Furthermore, the economic model EPI has relied on (the DRI model) is not well-suited to making projections over timeframes much longer than a year or two -- making its estimates of economic effects in 2005, 2010, or 2020 unreliable.

~~Econ Analysis~~
Econ Analysis

MEMORANDUM

TO: Todd Stern, WH
Jeff Hunker, DOC

FROM: Judi Greenwald, WHCCTF

RE: Soon to be released climate change economic analysis

BACKGROUND

I understand that, sometime the week of September 15, The Economic Policy Institute (EPI) will release an analysis of the economic impacts of stabilizing U.S. emissions at 1990 levels in the year 2010. EPI is an independent think tank who is heavily funded by, and sympathetic to, the labor movement.

The analysis was funded by the United Mineworkers and the National Mining Association. The analysis was performed by DRI, Inc. using the DRI macroeconomic model. I believe that EPI's role was to technically and financially manage the contract with DRI.

The Administration's Interagency Analysis Team (IAT) used three models, including the DRI model, for its analysis. The strengths of the DRI model are that it is particularly well suited to looking at short-term transition issues, and it has a lot of rich detail on the important economic and energy sectors. Its weakness is that it does a relatively poor job of examining the very long timeframes that are relevant to climate change policy. The IAT was criticized by several of its peer reviewers for relying too heavily on the DRI model; somel of the reviewers thought that the model should not be used at all for this purpose.

I understand that the assumptions used in the EPI/DRI analysis are somewhat different from the assumptions used by the IAT when it ran the DRI model. For example, the Administration assumed a more optimistic level of energy efficiency innovation than was assumed in the EPI analysis. However, several peer reviewers criticized the IAT for its optimism on this point.

I also understand that the analysis assumes no international emissions trading or joint implementation. (The DRI analysis contained in the June 1997 IAT report did the same thing. The DRI analysis we did assuming trading has never been released. However, we did analyze trading using other models in that report.) I understand that the estimated costs of the EPI analysis are about twice as great as the DRI cost estimate that appeared in that June IAT report (i.e., a 2% peak year loss in GDP vs. a 1% GDP loss; and job losses of 1.5 to 2.6 million vs. 900,000 in the IAT report).

As I learn more, I will provide updates for you.

SUGGESTED TALKING POINTS ON THE EPI/DRI REPORT

--It was funded by the United Mineworkers of America and the National Mining Association.

--It did not model U.S. policy. The U.S. has not settled on a specific policy. However, the U.S. is committed to international emission trading and joint implementation. These policies dramatically reduce costs, yet were not incorporated into the cost analysis.

--Several of the expert peer reviewers of the Administration's staff climate change analysis said that the DRI model is inappropriate for this sort of long-term analysis.

--The DRI model tends to exaggerate the short-term economic impacts and does not adequately simulate the long term resiliency of the U.S. economy, and the ability of businesses to innovate.

Economic Analysis

White House Climate Change Task Force

734 Jackson Place, N.W. - Washington, DC 20503

FAX

To: Jonathan Fr Todd

Organization/Title:

Fax: **Phone:**

Pages (including cover): 4 **Date:** Sept 11

From: Judi Greenwald

Phone: 343 1060

Message:

Jonathan - My home phone # is 301 279 5425 in case you need me tonight or tomorrow.

Note to Todd:

--The labor analysis is still supposed to come out on Wednesday, September 17. I expect to have the final version on Monday.
--I won't know until Monday what the final version actually looks like, although it shouldn't be very different from the draft (except where I had indicated in marginal notes in your copy).
--I put together some background info and initial talking points earlier this week (extra copy attached).
--I gave you a copy of a draft of the study (extra cover note attached).
--I have given the draft to a couple of people to review. I should have a final set of talking points, incorporating their input, on Monday.
--As I mentioned in my cover note, we need to decide whether we should interpret the study as an invitation to talk with the AFL-CIO about transition issues and border adjustment policy options. (I would like to, but these are difficult policy questions.) We could, for example say something like:
"The study indicates that border adjustment and transition policies could mitigate any impacts on workers and communities. We plan to engage in a dialogue with labor representatives about these policies."
Or
"We appreciate the concerns that labor has regarding the potential impacts of climate policies on working Americans. That is why we are working hard to ensure that the policy we ultimately adopt will minimize the impacts on workers. We already are committed to market-based approaches, including emissions trading and joint implementation, that will minimize the impacts. We will also consider, as the study suggests, border adjustments and transition programs."
--Another issue we need to address is whether it might be better for the Labor Department to respond than the White House. They could say something like,
"The Labor Department is actively involved in the Administration's policy development process, and ensuring that the climate treaty is a good deal for American workers is a major aspect of the deliberations."
(I have given the draft to the Labor Department's Chief Economist, Ed Montgomery. He knows it is to be closely held. I should get feedback from him by Monday.)
--I recommend that we either talk about this at Monday morning's staff meeting. (I won't be there tomorrow) or that we set up a separate meeting and invite someone from the Labor Department to attend.
--I will check in with Jonathan tomorrow and see if you need me to do anything else.

Extra "1 0 1
for my memo
from Judi

MEMORANDUM

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Jeff Hunker, DOC

FROM: Judi Greenwald, WHCCTF

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--The DRI model tends to exaggerate the short-term economic impacts and does not adequately simulate the long term resiliency of the U.S. economy, and the ability of businesses to innovate.

Extra copy of -

Note to Todd--

This is a draft of the labor analysis which will be released next week. It is still in internal revi among Labor and EPI, and it could change.

It would not be good if they knew we have it. It is being fairly closely held, and someone co get in trouble for giving it to us.

The principal author is Robert Scott, who was one of the IAT peer reviewers.

There are a number of places in the existing text where context is provided that is relatively helpful to us (e.g., comparing the costs to other larger costs). My source tells me that this context may be deleted or modified, which would be unfortunate. I indicated in marginal not the now-helpful text that may be deleted or modified.

They spend a fair amount of time comparing their analysis to the draft IAT analysis. We need decide whether we want to defend the draft IAT analysis against their criticisms. I think we could, but we have not done that thus far. For example, they say that the demand elasticity in version of the DRI model we used is too high. We could explain that we incorporated project for the success of the voluntary CCAP programs, which business generally supports.

The overall message is that the treaty is going to be very bad for working people. They think i going to increase income equality (by increasing investment income and decreasing wage incor depress wages for non-college educated Americans, eliminate high paying jobs, send investmer overseas, etc. EPI says that we could mitigate these costs somewhat through border adjustme policies and real transition programs. One option for responding is to engage in substantive dialogue with them over border adjustment policies and transition programs. As I'm sure you know, both of these are fraught with difficulty. As I understand it, there has been some limited internal discussion of these issues as part of the interagency policy process. The free traders d like border adjustments, and past transition programs have not worked very well. Although th are difficult policy issues, I think if we really are serious about getting labor support, we're goi to have to discuss this seriously and in great detail. I also think such a discussion, despite its difficulties, is likely to be much more fruitful than arguing about the costs.

Econ Analysis
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Note to Todd
from Judi Greenwald

Sept. 17

The DRI analysis and EPI study will be released on Wednesday morning at 8:30 a.m. at a press breakfast at the Washington Court Hotel. It is being released jointly by the coal companies and the coal miners, through an organization funded by the mineworkers out of their hourly wages. The organization is called something like the Labor Management Positive Change Committee. It was set up as a way for the workers and the companies to work together on issues of mutual importance. This organization and the funding mechanism was something Trumka negotiated when he headed UMW. The company side is the Bituminous Coal Operators Association (BCOA) which is the organization which negotiates contracts with the UMW. This effort is independent of the ad campaign.

cc: Dirk Forrister
Paul Risley