LAFFER ASSOCIATES
Supply-Side Investment Research
July 13, 2007

GLOBAL WARMING: MINIMIZING THE ECONOMIC IMPACT FROM CARBON TAXES

By Arthur B. Laffer and Wayne Winegarden

Summary

- If one accepts the notions that i.) the earth would not be harmed if the burning of fossil fuels were reduced and ii.) altering human behavior can influence the future trajectory of global warming, it would seem prudent to take action to reduce global carbon emissions. However, the costs and consequences of such action cannot be ignored.
- Global warming may well be serious, but so would be the consequences from combating global warming. A higher overall tax rate on carbon emissions per se would have a devastatingly negative impact on the long-term growth of America and the world. Poverty, despair, and suffering would expand exponentially.
- Of the two primary policies being proposed to address global warming—the capping and trading of emissions and the taxation of emissions—we favor the taxation of emissions. We suggest that a pro-active environmental policy should include an appropriate carbon tax fully offset by a static dollar-for-dollar across-the-board reduction in marginal income tax rates. If implemented with taxpayer protections, this policy would mitigate many if not all of the adverse economic costs from reducing carbon emissions.
- Pollution of the earth is global. The efficacy of environmental policies is increasingly dependent on the degree to which they are applied universally. If only one-half of the earth implements pollution reducing environmental policies, total pollution emitted would decline but by far less than one-half of the decline had the whole earth implemented the same pollution-reducing environmental policies.

Political and scientific consensus appears to be coalescing on two closely related hypotheses. The first hypothesis is that planet earth is facing a global warming crisis the environmental consequences of which will be disastrous. The second hypothesis is that man is a primary cause of global warming.

The earth did quite well for billions of years prior to man's burning of fossil fuels; although there were moments ranging from massive errant asteroid collisions, volcanic eruptions, floods, earthquakes, pestilence and the like that were pretty upsetting. At least we and our progenitors survived.

In order to justify taking action, one does not have to bite into the apple that we are in fact facing a crisis, or that man has caused that crisis. Today, all one needs to assume is that burning less fossil fuels, and burning what we do burn more efficiently, would not hurt the planet. It is also not necessary to assume that man is the primary cause of this global warming crisis, but only that man can influence the future trajectory of global warming. The current scientific consensus contends that economizing on our fossil fuel use could have a positive impact on the environment and, in fact, may even avert a global crisis. Based on this current scientific consensus and the potential environmental benefits from reducing carbon emissions, it would surely seem prudent to do what we can to reduce global carbon emissions.

Where we have concerns is what the secondary impacts on the economy would be from policies enacted to reduce carbon emissions. The costs of reducing carbon emissions are by no means trivial; therefore, it's not enough to simply press forward in the name of global warming and ignore the consequences of the various plans. Global warming may well be serious, but so would be the consequences from combating global warming. What we can say with a high degree of certainty is that a higher overall tax rate on carbon emissions per se would have a devastatingly negative impact on the long term growth of America and the world. Poverty, despair, and suffering would expand exponentially.

There are two primary policies being proposed to address global warming. One is to mandate that total emissions be capped at some as-of-yet undefined level. Those industries that wish to emit carbon beyond their current allocations would be able to purchase the right to do so from someone else who owns the right to emit carbon but is not exercising that right. The second policy would impose a tax on carbon emissions. Ideally, the size of the carbon tax would determine how much energy users would economize on fossil fuels.

We suggest that a pro-active environmental policy should include an appropriate carbon tax fully offset by a static dollar-for-dollar across-the-board reduction in marginal income tax rates. If implemented with taxpayer protections that ensure the

marginal tax rate reductions are not later reversed, this policy would mitigate many if not all of the adverse economic costs from reducing carbon emissions.

And, it is here that we have been quite impressed by Al Gore's proposal of reducing the payroll tax to accompany his proposed increase in the carbon tax:

> *For the last fourteen years, I have advocated the elimination of all payroll taxes—including those for social security and unemployment compensation—and the replacement of that revenue in the form of pollution taxes—principally on CO2. The overall level of taxation would remain exactly the same. It would be, in other words, a revenue neutral tax swap. But, instead of discouraging businesses from hiring more employees, it would discourage business from producing more pollution.*[1]

Our slight disagreement with Gore is that we would prefer an across-the-board income tax reduction because income taxes tax all factors of production, including capital, while payroll taxes only apply to labor and even in the case of labor income, exclude the high end. But, Gore's proposal is nonetheless very good.

In the pages that follow we illustrate the problems with the environmental policies as they are commonly described, and then discuss the benefits from our proposed carbon emissions tax swap. But first, a little background.

Scientific Consensuses Have Been Known to Change

There has always been pressure on scientists to agree on the pressing issues of the day, and the scientific community is never in doubt that "the consensus" is correct. For example, during the 1970s there was a general scientific consensus that global cooling was a significant threat to life on our planet that had to be addressed, and fast! In 1974, *Time Magazine* noted that:

> *As they review the bizarre and unpredictable weather pattern of the past several years, a growing number of scientists are beginning to suspect that many seemingly contradictory meteorological fluctuations are actually part of a global climatic upheaval…when meteorologists take an average of temperatures around the globe they find that the atmosphere has been growing gradually cooler for the past three decades. The trend shows no indication of reversing. Climatological Cassandras are becoming increasingly apprehensive, for the weather aberrations they are studying may be the harbinger of another ice age.*[2]

To ward off the impending doom, some of the best scientific minds suggested burning more unfiltered hydrocarbons and spreading soot on the polar ice caps—all in an effort to retain more heat within the Earth's atmosphere.

Even before Galileo's time, however, scientific consensus did not preclude a future re-examination. Now, fast forward 33 years to 2007, and the consensus of the 1970s has been reversed 180 degrees. Go figure! Now there is a general scientific consensus that the earth is warming, not cooling. According to the new consensus, global warming is as much a significant threat to our planet as was global cooling and that global warming will create horrific problems if not promptly addressed. In his recent Congressional testimony, Gore portrayed the current scientific consensus as:

> *…the scientific community, in its strongest statement to date, confirmed that the evidence of warming is "unequivocal." Global warming is real and human activity is the main cause. The consequences are mainly negative and headed toward catastrophic, unless we act.*[3]

But, just because scientists have changed their collective minds 180 degrees on global warming in the past 33 years does not mean that the current consensus on global warming is not correct. And, it also certainly does not mean that the global warming threat is not serious. However, there are still a number of analysts who claim that the consensus on global warming is not the nightmarish scenario portrayed by Gore in his recent Congressional testimony or Oscar-winning film "An Inconvenient Truth."

"Exposed: A Climate of Fear," hosted by Glen Beck on CNN May 2, 2007, claimed that the scientific consensus as portrayed by Gore "is fraudulent." Beck interviewed many scientists and climatologists who disagree with the current scientific consensus. Instead of being engaged in a reasoned scientific debate, these scientists are intimidated by what Beck describes as "the global warming hysteria." Also disagreeing with the portrayal of the current scientific consensus, Iain Murray (2005), a Sr. Fellow at the Competitive Enterprise Institute specializing in global climate change, wrote:

> *Scientists do agree that: (1) global average temperature is about 0.6°Celsius—or just over 1°Fahrenheit—higher than it was a century ago; (2) atmospheric levels of carbon (CO2) have risen by about 30 percent over the past 200 years; and (3) carbon, like water vapor, is a greenhouse gas whose increase is likely to warm the Earth's atmosphere.*[4]

However, Murray continued on to say:

> *…that the world has warmed and that man is at least partly responsible for the warming—though there is no consensus on the precise extent of man's effect on the climate. There is ongoing scientific debate over the parameters used by the computer models that project future climatic conditions. We cannot be certain whether the world will warm significantly and we do not know how damaging—if at all—even significant warming will be.*[5]

Patrick Michaels (2007), a senior fellow at the Cato Institute and a research professor of environmental sciences at the University of Virginia, argues that forecasts of dramatic and disastrous global warming are simply wrong.[6] Discussing the recent United Nations Intergovernmental Panel on Climate Change report, Michaels illustrates that the findings show:

> *…that the rate of global warming has been remarkably constant—about 0.18°C per decade—since 1975. So, any news report that "UN panel says the planet is warming at an increasing rate" (and there will be many) will be dead wrong… More interesting, and, again, less newsy, is that the communal behavior of the dozens of computer models for future climate also predicts a constant (rather than an increasing) rate of warming.*
>
> *That means that unless the collective conclusions of all of the models is [sic] wrong, we can confidently estimate a warming of about 1.8°C from 2000 to 2100. That's very near the low end of the range of projections released on Friday. The fact that the most logical distillation of observed and predicted warming yields such a modest heating should be reassuring, rather than alarming.*[7]

Striking a similar tone, Bjorn Lomborg (2001), author of the best-selling book, "The Skeptical Environmentalist," shows that many of the environmental doomsday scenarios are grossly exaggerated. Perhaps more importantly, Lomborg wrote that the costs carbon restricting policies entail are not worth the benefits gained in reduced greenhouse gasses; especially in light of other pressing global alternatives such as poverty reduction or eradicating diseases such as malaria.[8]

The Global Warming Debate

The debate over the current environmental consensus boils down to three general positions: (1) Those who believe the earth is warming and man-made greenhouse gas emissions are the primary cause; (2) Those who believe the earth is warming and other phenomena are the primary cause; and, (3) Those who do not believe there is any credible evidence that the earth is warming.

For those who believe the earth is warming and man-made greenhouse gas emissions are the primary cause, global warming policies must be implemented and efforts to minimize the significant economic damage these policies can create must be made. Only by addressing the deleterious consequences of these policies on the economy could an electoral consensus be guaranteed.

For those who believe the earth is warming and other phenomena are the primary cause, the ultimate cause of global warming is not so important, but whether man can do things to reduce carbon from the air is important. Again, to achieve an electoral consensus, it is critical that the global warming pact include steps to minimize harm to the economy.

Additionally, for those who question man-made global warming or the phenomenon of global warming at all, the appropriate questions are:

(1) Is there a risk that global warming is happening? and, if so,
(2) Does a less risky solution exist that can address the potential risk while safeguarding against the potential adverse consequences from global warming policies?

While the authors of this paper are not environmental scientists, there is a risk that man-made global warming is real. There are some basic economic truths which, if followed, would ensure that our responses to the risk of global warming do minimal harm to the world's economy. Swapping a tax on carbon with an across-the-board marginal income tax rate cut meets this criteria. From our standpoint, even if there were no global warming, we still might opt for an across-the-board income tax rate swap due to beneficial economic reasons, as we'll discuss.

A Comment on Universality

The efficacy of environmental policies is increasingly dependent on the degree to which they are applied universally. If only one-half of the earth implements pollution reducing environmental policies, total pollution emitted would decline but by far less than one-half of the decline had the whole earth implemented the same pollution-reducing environmental policies. Pollution of the environment is truly as global as the earth's stratosphere. Chinese pollution affects global warming from Santiago, Chile, to Vladivostok, Russia, from polar ice cap to polar ice cap. An environmental policy imposed only on one specific location will simply push polluting industries out of that location and into other locations that are more tolerant of polluting. Under this scenario, while the earth's atmosphere may be little impacted, production in the specific location may

well be devastated. From our perspective, policies such as those adopted recently in California will not be very effective in controlling global warming but could be quite harmful to the local area's economy.[9] The point here is simply that failure to achieve universality in a global warming policy will greatly reduce its effectiveness and yet will not significantly reduce its costs.

Here's another view of these dynamic effects: If the U.S. were to increase its gasoline tax, gasoline consumption in the U.S. would decline, for sure. But, simultaneously, gasoline and other oil products would become cheaper and more plentiful to other nations such as China, India and Brazil. For instance, Greg Mankiw, in his advocacy for a carbon tax, stated explicitly: "…as a higher gas tax discouraged oil consumption, the price of oil would fall in world markets."[10] The net effect of a U.S. gas tax would be in part a relocation of carbon emissions that could ironically increase overall carbon emissions because China, India and Brazil are gallon-for-gallon far more serious polluters of the world's environment.

What is true for California is true for the U.S., Europe or any individual country or region. Without universal commitment to a carbon reduction regime, people will have the incentive to move businesses that emit carbon from the countries or regions with restrictive carbon policies to the countries or regions without restrictive carbon policies. Due to these responses, the net impact on carbon reduction will be diminished, while the net economic impacts can be potentially quite large. Clearly, universality is a key precondition for an effective carbon emissions reduction regime.

Global Warming, Taxes and Deficits: A Net Tax Increase Is Not Justified

All too often, the budgetary gains from a carbon tax are seen as a fiscal windfall for everyone's pet projects—especially those geared toward alternative energy sources. Total 2006 federal tax revenues were $2.4 trillion, or slightly above the long-run average of 18.3% of total economic activity in the country; such a hefty take makes it hard to justify a tax increase of any sort because "the government does not have enough money" (Figure 1). And, state and local governments need a tax increase even less—today, their coffers, as a whole, are overflowing. In FY2006, aggregate ending balances for state budgets were a positive $59 billion, or 9.8% of total state expenditures. Goodness knows how large local government surpluses are.

As for the federal budget deficit, it is not a problem, either. As a percentage of national income, the federal budget deficit has been falling dramatically: Between calendar years 2005 and 2006, the deficit declined by nearly half, from $361 billion, or 2.9% of GDP, to $197 billion, or just 1.5% of GDP (Figure 2). As of this writing, the federal budget deficit stands at 1% of GDP and is projected to fall to 0.6% as of 2008. Of the 36 years from 1970 through 2005, there have only been nine years in which the federal deficit as a percent of GDP has been smaller than the current deficit, and 27 years in which it has been larger! Including current state and local government surpluses, total government budget deficits are even lower. Including what we know of these surpluses, total government deficits are far lower than 1% of GDP today.

Figure 1
Federal Expenditures and Receipts as a % of GDP
(through 1Q2007)

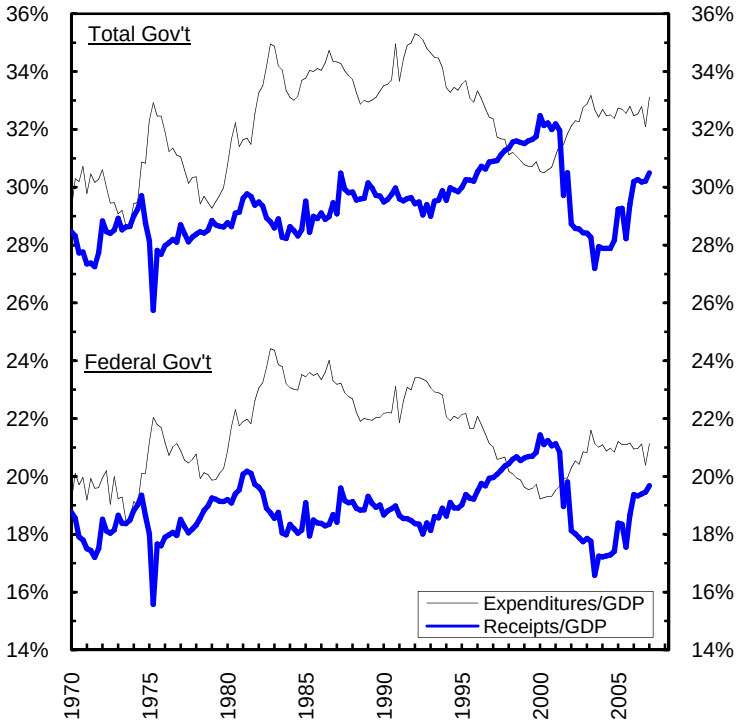
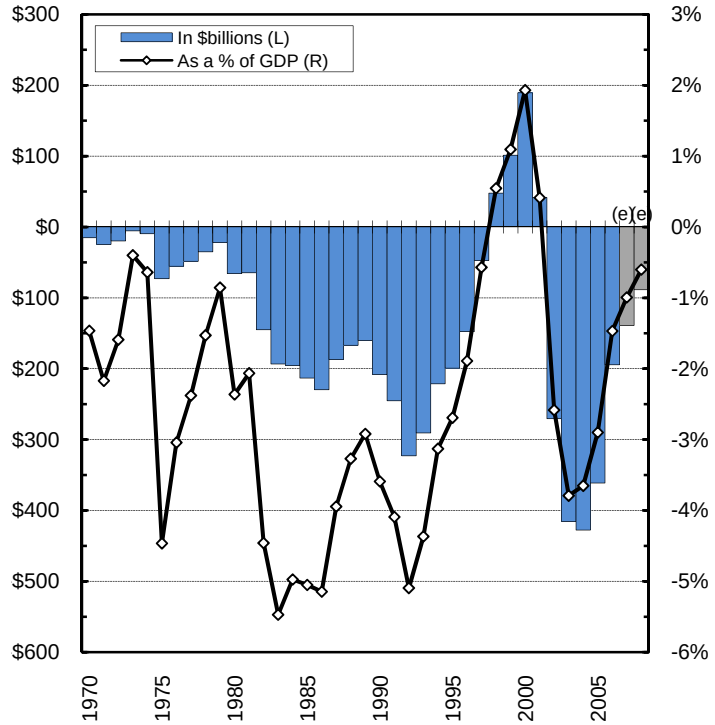


Figure 2
Federal Budget Surplus(+)/Deficit(-) as a % of GDP
(through 2006; 2007-2008 are authors' estimates)



The vast majority of the decline in the federal deficit in recent years has been due to soaring tax receipts, not reduced government spending. That's what pro-growth tax policy, rapid economic growth and an appreciating stock market will do. Any net tax increase, including an add-on carbon tax, is simply not warranted and could result in a significant downturn in the U.S. economy.

Lesson #1: Substitution Effects and British Wartime Shortages

It is our contention that if there is a major reduction in hydrocarbon usage in the U.S. as a result of the implementation of correct policies, the impact on the U.S. could be vanishingly small.

Energy is a key input for economic growth, as is food. Olson (1963) reviewed the economic impact from food shortages in Great Britain during three major wars: the Napoleonic Wars, World War I, and World War II.[11] Traditionally Great Britain has imported a large portion of its food supply. As a direct consequence, in all three wars Great Britain's enemies believed that the island nation could be starved into submission.

As it turns out, the presumption that Great Britain could be starved into submission was the epitome of static thinking in a world that is in fact dynamic. The embargoes and blockades used against Great Britain did not lead to mass starvation or endemic malnutrition as her enemies had wished. Instead, the British people responded to the changed prices of food by changing their food production methods and consumption habits. The British government also changed its policies, furthering the goal of working around the shortages created by Britain's enemies. As Olson documents, the world is dynamic, and free market economies are especially good at overcoming shortages:

> *Because of the possibilities for substitution, advanced industrial economies are not as inflexible in the face of shortages as might be supposed. They have a considerable capacity to substitute for anything in short supply…This substitution is not only—not even mainly—of the obvious kind, where something ersatz, something that is obviously a "substitute," takes the place of what is in short supply. People may often readjust their patterns of production and consumption in ways such that no one thing, but rather many different things, take the place of what is scarce.*[12]

Napoleon's military campaigns met with great success in the early 1800s, and by 1805 France occupied many of the countries that supplied Great Britain with its food. France prohibited any country within its "sphere of influence" from trading with Great Britain, thereby cutting off a large portion of Great Britain's food supplies. Making matters worse for the British, the American's were reticent to trade with either France or Great Britain due to each combatant's attempts to disrupt American trade with the enemy; and the British agricultural sector suffered several bad harvests between 1795 and 1814. Despite these hardships:

> *The most significant fact about the British food situation in the Napoleonic War, then, is that, while difficult, it was never disastrous, and that by preventing wasteful consumption, encouraging agriculture and subsidizing importation, the British adjusted fairly successfully to the challenge of an abnormally large number of years with bad weather, coinciding with diplomatic and military predicaments that drastically limited food imports.*[13]

The Germans took a more pro-active approach toward starving the British during World War I. Their strategy was predicated on statistical logic and static thinking. In light of the volume of shipping Britain was receiving as of 1917, the estimated consumption levels necessary to sustain the military, and the poor harvests Great Britain and the United States were experiencing, the German navy calculated that if they destroyed 600,000 tons of shipping a month that the British would be forced into surrendering within six months. The German navy was successful at achieving that goal. Between February 1917 and July 1917 the German navy sunk an average of 642,833 tons of shipping per month. And yet, the British never surrendered. Why?

> *The answer, briefly, is that the British, sometimes in conjunction with their American allies and sometimes alone, undertook a series of economic countermeasures that enabled them to get along very well without the merchant tonnage lost to the German submarines. By making a series of substitutions or adjustments in shipping and import policies, in food consumption patterns, and in agricultural production it was possible to compensate for the destructiveness of the submarines. The shipping shortage could be overcome only at very great expense, but there was no question, because of the economic countermeasures, that it could be overcome.*[14]

The German strategy for starving Great Britain did not change much between World War I and World War II—sink enough shipping tonnage to starve Great Britain into submission. The strategy, not surprisingly at this point, did not lead to starvation in Great Britain:

> *The essence of the British food situation in World War II, then, is that, though before the war British agriculture had declined to the point where the nation imported most of its food, and though the German submarine blockade during the war was to a considerable extent effective, Britain still was able to completely maintain the health and efficiency of its people while at the same time releasing a large amount of shipping for military purposes. This was due partly to a number of adjustments and substitutions in agricultural production, which led to a greatly increased output of food nutrients, and to a series of limitations and substitutions in import and consumption patterns, which led to important additional economies in cargo space, and brought complete success in counteracting the submarine campaign to blockade Britain into starvation and submission.*[15]

Whether it was the Napoleonic Wars, World War I, or World War II, economizing behavior on the part of the British citizens, coupled with sound policies on the part of the British government, were successful in counteracting a significant food supply shock.

The British experience with wartime food shortages has important lessons for our current debates on global warming. If handled expeditiously and with careful forethought, market forces can be employed to overcome—perhaps not with ease but certainly without undue consequences—a major reduction in carbon emissions.

Lesson #2: Tax Increases and the Early 1990s California Experience

A higher carbon tax with no offsetting tax cut, combined with the all-too-common static revenue analysis and forecasts, would definitely cause government to believe that revenues will be higher in the future, thus encouraging more spending. A higher carbon tax would also have a lot of unintended consequences: lower output, employment and profits and commensurately lower tax receipts in other categories, higher welfare expenditures and—if given enough time to do enough damage—perhaps even larger deficits. California's experience after Proposition 111, passed in June 1990 with its sharply higher gasoline tax, exemplifies what could happen at a national level.

Proposition 111 was a 9¢ per gallon gas tax increase (plus the sales tax charged on that increase), a doubling of the truck weight tax, and a gutting of the Gann spending limits. California paid a large economic toll from the combination of higher taxes and the removal of government spending limits:

- Unemployment in California went from slightly below the national average to significantly above it (Figure 4);
- California personal income growth went from exceeding the national average to lagging the national average (Figure 5); and,
- California's fiscal solvency worsened as tax revenues per capita, adjusted for legislative tax changes, declined (Figure 6).

Figure 4
Unemployment Rates: CA and U.S.
(January 1976 – May 2007)

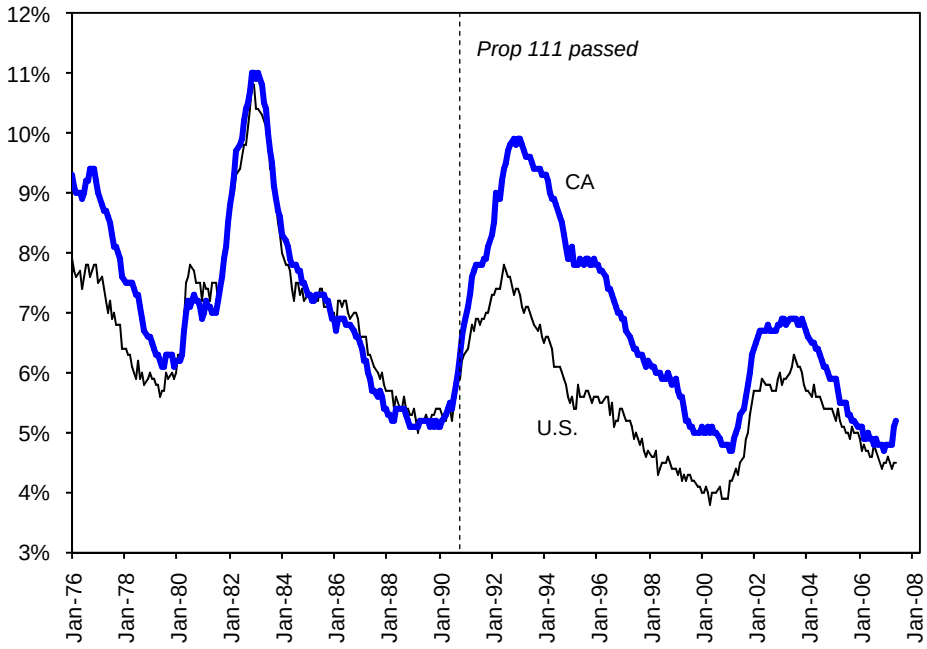


Figure 5
Personal Income Growth: CA and U.S.
(yr/yr, 1Q1976 – 1Q2007)

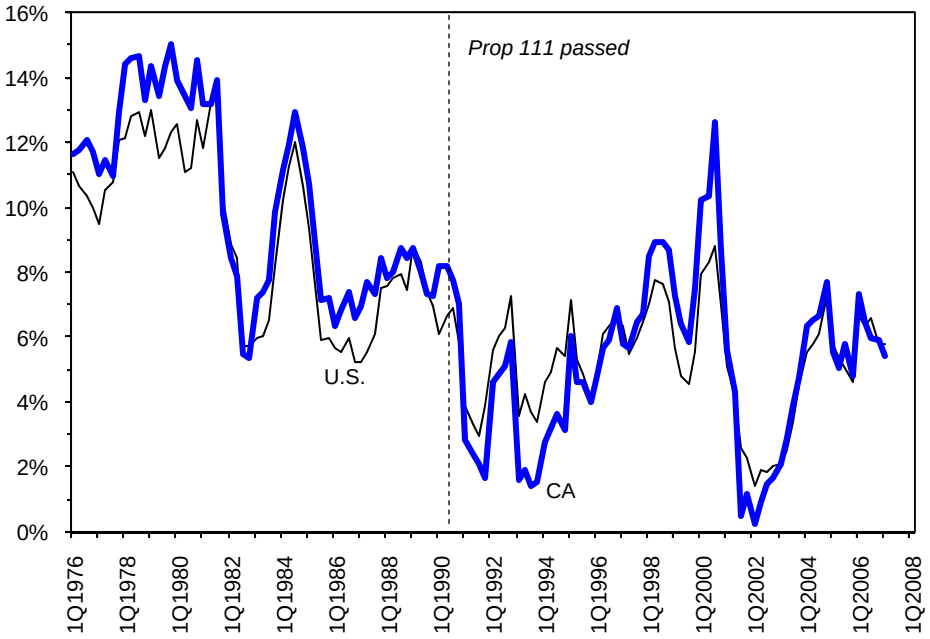
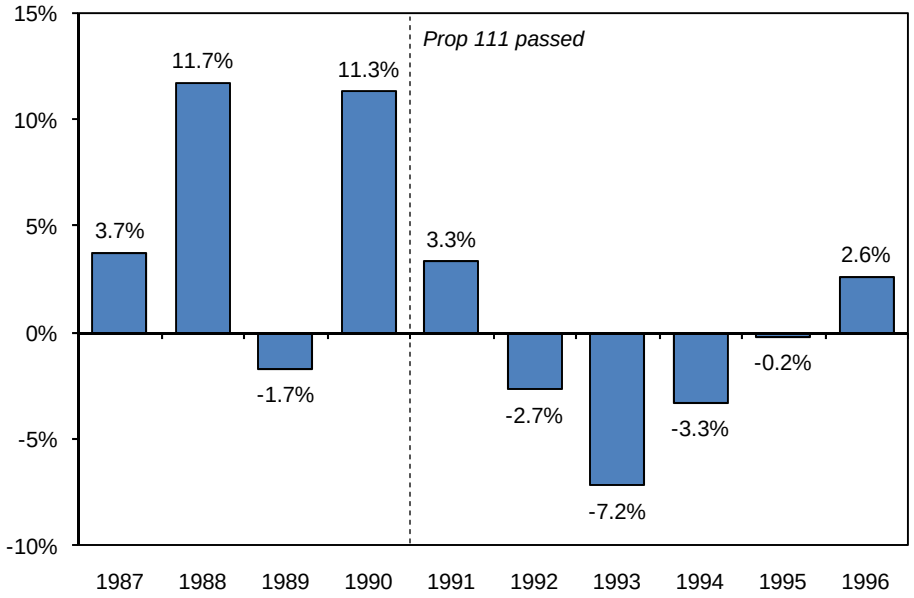


Figure 6
Growth in California Tax Revenues Per Capita
(yr/yr, adjusted for static revenue legislated tax changes)



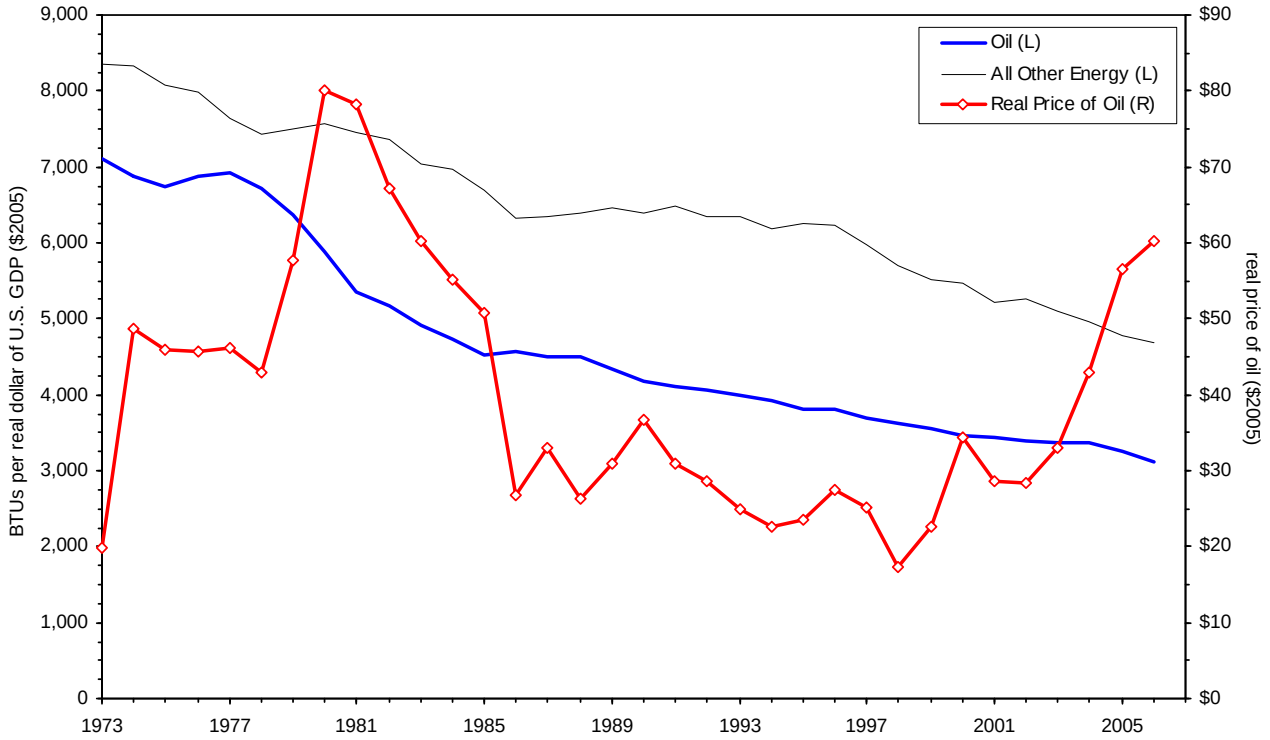
Carbon Restrictions Impact Economic Growth

As learned from the British wartime food shortages, the market process finds the appropriate response to shortages—whether the shortages are created by enemy shipping blockades or global warming policies—if the correct market incentives and government policies are implemented. Global warming policies geared toward economizing our usage of fossil fuels could create tremendous economic costs with few economic benefits. However, if we counter balance those costs with other equally-as-powerful positive policies, then we can overcome the costs without significant hardships.

The use of energy brings with it major externalities. An externality is defined as a cost (or benefit) that is imposed on somebody who is neither the seller nor the purchaser of the product or service in question. The pollution and greenhouse gases emitted from energy use are negative externalities. However, economic growth, wealth creation, and poverty reduction resulting from energy use are positive externalities. Economic growth and pollution are also intertwined in complex

ways. As countries become wealthier, heavy industries develop, creating industrial wastes that increase the amount of pollution. However, there is ample evidence from recent history that greater economic growth, at least past a certain threshold, actually reduces the amount of pollution a society creates. In the U.S., for example, we have been consistently using less and less energy per dollar of economic output in times of both rising and falling oil prices (Figure 7).

Figure 7
U.S. Physical Consumption of Oil and Non-Oil Energy and the Real Price of Oil
(annual, estimated through 2006 based on actual data through Aug-06)



At a February 2003 Harvard Business School Conference on Asia Business, the Executive Secretary of the United Nations Economic and Social Commission for Asia and the Pacific concurred with these sentiments, stating:

> *Deterioration of environment could turn to improvement as economic development progresses and income increases to a certain level. Sustained high economic growth for a long period is a pre-condition for this to happen. In this regard, both Japan and the Republic of Korea have performed extremely well in the decades of 70's, 80's and most part of 90's in the last century. Per capita income of Japan increased from US$4,481 in 1975 to US$37,600 in 2000. For the Republic of Korea, the increase has been from US$599 in 1975 to US$9,762 in 2000. Poverty in the absolute sense is virtually non existent in Japan and very low in the Republic of Korea. Improvements in environmental conditions are equally impressive. They have excelled in improving energy efficiency and resource conservation and were successful in reducing pollution. For example, Japan was able to reduce SO2 emission by 40 percent during the mid seventies to mid eighties.*[16]

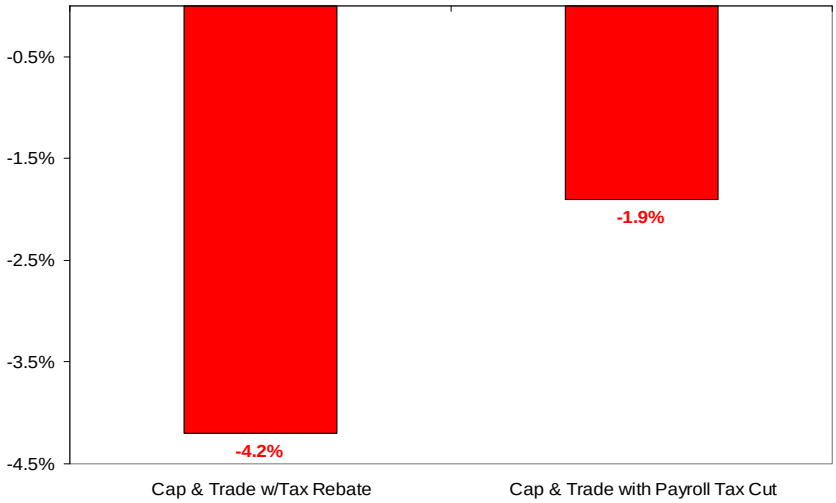
Appropriately incorporating the externalities into a coherent comprehensive global plan is no simple affair. Rigid requirements to force nations and companies to focus exclusively on reducing negative externalities, while politically popular, may cause more harm than necessary if the positive externalities of carbon use are not given due consideration.

Carbon-based energy supplies the vast majority of global energy needs. Restricting energy options by meaningfully capping the amount of carbon the U.S. emits will raise the country's energy costs, at least in the short-run. According to the Federal Energy Information Agency (EIA), imposing the restrictions mandated by the United Nation's Kyoto Global Warming Treaty would reduce total U.S. economic growth significantly.[17] The actual forecast varied depending upon what the government was assumed to do with any windfall revenues it would raise. The EIA assumed that the government would raise revenues through an initial sale of the right to emit carbon into the air. Depending upon the assumptions and amount of carbon restrictions imposed, these revenues are estimated to be between $128 billion and $585 billion.

The EIA considered two scenarios regarding the revenues raised: "…first, returning collected revenues to consumers through a personal income tax lump sum rebate and, second, lowering social security tax rates as they apply to both

employers and employees. The two policies are meant only to be representative of a set of possible fiscal policies that might accompany an initial carbon mitigation policy."[18] The EIA study forecasted that implementing the cap and trade proposal with a tax offset via a personal income tax rebate would reduce economic growth by 4.2%, which is $565 billion of 4Q2006 GDP (Figure 8). Implementing the cap and trade proposal with a payroll tax rebate would reduce economic growth by 1.9%, which is $256 billion of 4Q2006 GDP.

Figure 8
EIA Forecasted Impact on GDP Growth from Kyoto Protocol
Forecast Growth Compared to Baseline Growth
Assumes Carbon Levels 7% Below 1990 Levels



Unfortunately, econometric models often fail to account for all of the potential dynamic impacts from income tax cuts. The dollar-for-dollar payroll tax cut analyzed by the EIA would lower the marginal income tax rate for most workers and firms in the U.S. This policy change would simultaneously increase workers' after-tax income and decrease total employment costs to firms. This change creates important pro-growth incentives for the economy that are not accounted for in the EIA study. Consequently, we believe that the adverse economic impacts in the payroll tax scenario are overstated.

The supply-induced energy crises of the last 40 years provide real world examples that clearly illustrate the adverse short-run impacts from supply-induced short-run price increases. Oil prices dramatically increased in 1974-75 as a direct result of an interdiction in the supply of oil initiated by OPEC countries as a response to the U.S. support for Israel in the Yom Kippur War. As such, the 1974-75 period can best be described as a leftward shift in the supply curve for oil. The price of oil rose as a result of the deprivation of oil supply. The U.S. economy and stock market tanked in a big hurry. The interdiction of supply was a major contributor to the high price of oil and the subsequent collapse of the U.S. stock market and economy. It was not a pleasant episode.

The 1979-81 period also reflected an interdiction in supply surrounding the Iranian hostage crisis, U.S. wellhead price controls, excess profits taxes on oil companies, and gas rationing—causing another leftward shift in the supply curve for oil. The price of oil again rose, the stock market weakened and the economy faltered. While by no means the sole cause of the U.S. recession of 1981-82, the high price of oil surely didn't help matters.

In 1990-91, Saddam Hussein invaded Kuwait and the world responded with "Desert Storm." Again, oil supplies were greatly reduced, shifting the supply curve for oil leftward once again. Again, oil prices rose and the world experienced an economic slowdown, albeit not entirely due to rising energy prices. The culprit was yet another Middle East-induced interdiction of supply.

Along with the EIA study, the prior episodes of drastic oil reduction illustrate the type of economic consequences that could occur in the U.S. if economic considerations are not carefully incorporated into a prudent plan to reduce carbon emissions. The devastating economic consequences of oil shortages as witnessed in the 1970s, 1980 and the 1990s are not preordained but will occur if politics as usual supplants economic reasoning.

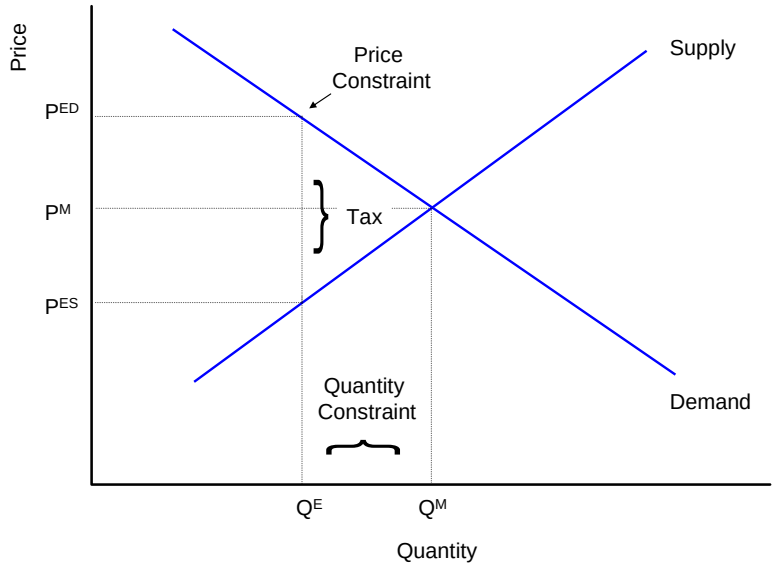
Taxes, Quantity Constraints, and Price Constraints: A Chalkboard Example

Government policies can affect a market by impacting the price of the product, setting the quantity of the product, or setting the price of the product. A tax increase, such as a carbon tax, impacts the price of a product, or is a "price add-on" policy. Regulations, such as cap and trade, constrain the quantity of the product. A price constraint establishes a minimum price

that must be paid for the product. Economic theory illustrates that in a static environment with full information, there is no difference between any of these policies.

Figure 9 details the chalkboard illustration of a market whose production creates an externality such as excessive carbon emissions. In this market, supply represents the production of the good that emits carbon during its production process. Demand represents consumer desire for this product. Given the production costs of the product and consumer desires, the market will naturally establish an output level of Q^M and a market price of P^M—basic market supply and demand analysis.

Figure 9
Chalkboard Example
Tax, Quantity Constraint and Price Constraint Equivalency



However, by assumption, the market-determined level of output is not the correct level. We have established that production of this good emits carbon, a greenhouse gas, which we will assume is causing global warming. The costs of global warming are real, but neither the producers nor the consumers are incorporating these costs into their current decision making processes. Because the market determined output level is not incorporating the costs of carbon emissions on the environment into the price of the product, too much consumption of this product is occurring.

The government's optimal policy response is to ensure that the market properly considers the "full" costs of the product, thereby ensuring that the correct production level is established. For the chalkboard illustration, we assume that with the full costs of greenhouse gasses included, the optimal amount of output is reduced from Q^M to Q^E. At output level Q^E, consumers must pay a price of P^{ED} and producers receive a price of P^{ES}. This outcome is efficient because the full costs (including the cost of carbon emissions on global warming) are now being incorporated by both the producers and consumers in the market.

In the chalkboard example we are empowered with a great deal of knowledge in this market. We know: the exact supply curve; the exact demand curve; and, the efficient level of output or alternatively the efficient level of carbon emissions. With such knowledge, Figure 9 illustrates that it does not matter whether the government uses a carbon tax equal to the distance $P^{ED} - P^{ES}$, a quantity constraint at Q^E, or a price constraint at P^{ED}.

If the government wanted to impose a carbon tax, it would know that the correct tax is equal to P^{ED} minus P^{ES}. Similarly, if the government were to impose a quantity constraint, the quantity of carbon emissions created with a production level of Q^E is the correct quantity constraint. Lastly, if the government were to impose a price constraint, the price of the product should be established at P^{ED}. Given what we know about this market, all three policies create identical outcomes. Total output is reduced to the efficient level and carbon emissions are now optimal.

Policymakers do not have the knowledge contained in the chalkboard example, however. As a consequence, the three government policies—price constraint, quantity constraint, and tax—are not equivalent once the market stochastic considerations are incorporated. Due to these uncertainties, a carbon tax provides more economic stability compared to the quantity and price constraint policies.

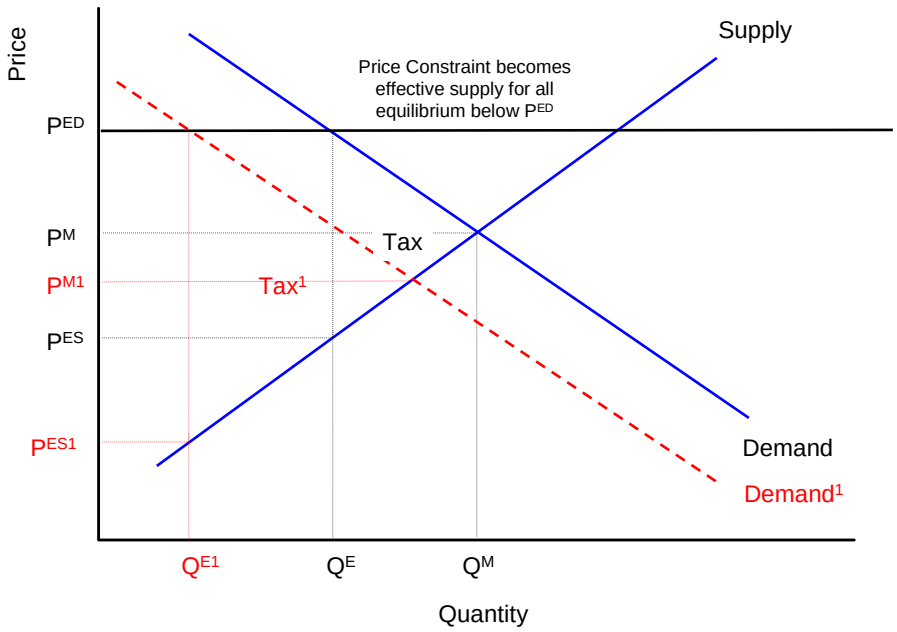
Price Constraints: Setting the Price of Oil

George Shultz has advocated a price constraint that would establish a minimum price of $60 per barrel of oil. Figure 10 walks through the market dynamics that would result from George Shultz's proposed policy. Figure 10 begins with a reproduction of Figure 9, emphasizing the price constraint scenario. The price constraint is represented by the solid black line at P^{ED} in Figure 10. Figure 10 also incorporates the stochastic considerations that demand changes. While the $60 minimum price of oil was predicated on the solid demand curve in Figure 10, the actual market demand curve is now represented by the dashed line denoted Demand[1].

Demand[1] represents a smaller amount of demand than the original equilibrium. Consequently, the market clearing price, if the price control policy were not effective, would fall from P^{M} to P^{M1}. By definition of the price policy, however, the market price cannot change. As a result, the market wedge, or tax impact, from the minimum pricing policy increases from Tax to Tax[1] or from $P^{ED} - P^{ES}$ to $P^{ED} - P^{ES1}$. Suppliers subsequently receive an even lower price for oil (P^{ES1}), and the quantity of oil provided falls further from Q^{E} (the efficient quantity) to Q^{E1}. The total quantity of oil consumed is, consequently, below the optimal level when demand falls. The reverse holds when demand increases. The market wedge, or tax impact, decreases, and the total quantity of oil is above the optimal level. It really makes no sense that the effective tax on oil should increase as demand declines and fall as demand increases.

The example illustrated in Figure 10 demonstrates several key attributes of price constraints. The "tax" or market wedge associated with price control policies changes as supply and demand changes; and all market variability is reflected in changes in the quantity, which can be extreme depending upon the size of the market changes. Extreme quantity variability creates additional uncertainties and production constraints that impose a larger than necessary economic impact.

Figure 10
Supply and Demand Effects of Price Constraints



Quantity Constraints: Cap and Trade

Associated with the Kyoto Protocol, as well as advocated by Governor Arnold Schwarzenegger of California and several Northeastern states, the cap and trade system is billed as a market-based approach to managing carbon emissions. "Cap and trade" regulations establish an aggregate constraint "cap" on the amount of carbon that can be legally emitted. Typically this constraint is benchmarked to the carbon emissions from a certain year—for instance, the Kyoto Protocol establishes a carbon emissions cap that is 7% below 1990 levels.

The aggregate constraint is then sub-divided into emission allowances that are allocated to manufacturers. Constrained by the overall cap, all manufacturers face a choice—comply with their emissions allocation by changing their production levels or production technologies; or purchase (trade) more emission allowances from other emission allowance holders. *The Economist* magazine has described the theoretical workings of the cap and trade, stating:

> *The basic idea is that power plants and manufacturers will be allowed to emit a certain number of tons of carbon. If they exceed that amount, they must buy 'credits' from companies that pollute less than their allowance. One day the price of a ton of carbon may be as widely quoted as that of a barrel of oil."*[19]

Several proposals for a cap and trade scheme also incorporate a means to store or "bank" current carbon emission allowances for later use, allowing for an inter-temporal transfer of carbon emissions.

Advocates of the cap and trade system claim this approach is superior to a carbon tax because of its flexibility and market-based approach to the problem. As the theory goes, there is an efficient division of labor: the government establishes how much carbon may be emitted while the market sorts out who earns the right to produce the carbon emissions. The products that are in greater demand will be able to pay a higher price for the right to emit carbon. As a consequence, the manufacturers of the products in high demand will outbid other users for the right to emit carbon; while the manufacturers of the less valued products will either have an incentive to sell these rights to the manufacturers of the products in high demand or will not be able to purchase these rights in the first place. Either way, only the products that consumers value the most will end up with the right to emit carbon. In this manner, the market is allocating the scarce right to emit carbon based on its most valued use.

A quantity constraint impacts the price of the product: the greater the quantity restriction, the larger the regulation's impact on price. With quantity fixed, prices will adjust to ensure that the market clears, which can create significant price variability.

Because quantity constraints have a varied impact on price, these regulations create significant price volatility in the marketplace. With respect to the cap and trade regulations, the cap sets the quantity of carbon emissions allowances in the market. Depending upon the quantity level set, the price of the carbon emissions allowance could be cheap or expensive. If the quantity cap creates a significant production constraint, then the price for a carbon emissions allowance will skyrocket. On the other hand, if the cap is a minor constraint, prices will plummet.

Significant price volatility also emerges in the market because, despite the chalkboard examples, the supply and demand curves are not known to policymakers when they establish the initial cap and trade policies. The Congressional Budget Office raised these precise concerns in a recent paper:

> *When costs and benefits are uncertain, as they are in the case of climate change, a system that raises the price of emissions—for example, a tax or a permit system with a set permit price—can have significant advantages over one that establishes an emissions quota. Tightening restrictions on emissions is likely to raise the incremental cost of mitigation much more quickly than it lowers the incremental benefit. As a result, the cost of guessing wrong and imposing an overly restrictive quota could be relatively high. In contrast, the cost of guessing wrong about the appropriate tax level—and perhaps failing to reduce emissions enough in any given year—will probably be relatively low.*[20]

These effects can be clearly seen in Figures 11. Figure 11 also begins with a reproduction of Figure 9, focusing on the quantity constraint scenario. The solid black line at Q^E represents the quantity constraint that is determined based on the assumed supply and demand curve. By definition of the cap, this is the maximum amount of carbon emissions that can be created. In Figure 11 demand curves fluctuate or otherwise differ from the demand curve assumed by the government to exist when the cap and trade policy was established (although we have chosen to focus on the demand curve, the same analysis would hold for the supply curve). As Figure 11 illustrates, the actual prices in the market (P^{ED1} and P^{ED2}) will fluctuate significantly from the expected price (P^{ED}); especially in comparison to the price fluctuations that would occur under a carbon tax, see Figure 12. The price fluctuations represent the implicit tax on oil production imposed via the quantity constraint.

The demand curves in Figure 12 are precisely the same as the demand curves from Figure 11. Following the implementation of the tax, the suppliers and demanders in the market establish new equilibrium quantities and prices that incorporate the impact of the tax increase on the market price. With a price add-on, both the quantity and price exhibit variability. This flexibility reduces the price variations compared to the cap and trade approach. It also reduces the quantity variability compared to a price cap approach. Because cap and trade regulations significantly increase price volatility, the market incentives are stronger under a carbon tax policy not with a cap and trade regulatory scheme; contradicting what the proponents of cap and trade claim. A carbon tax also eliminates the inefficiencies that arise under both the quantity and price constraint regulations due to the variable market wedge or the implicit "taxes" imposed by the price constraint and quantity constraint regulations.

Figure 11
Quantity Constraint, Price Volatility

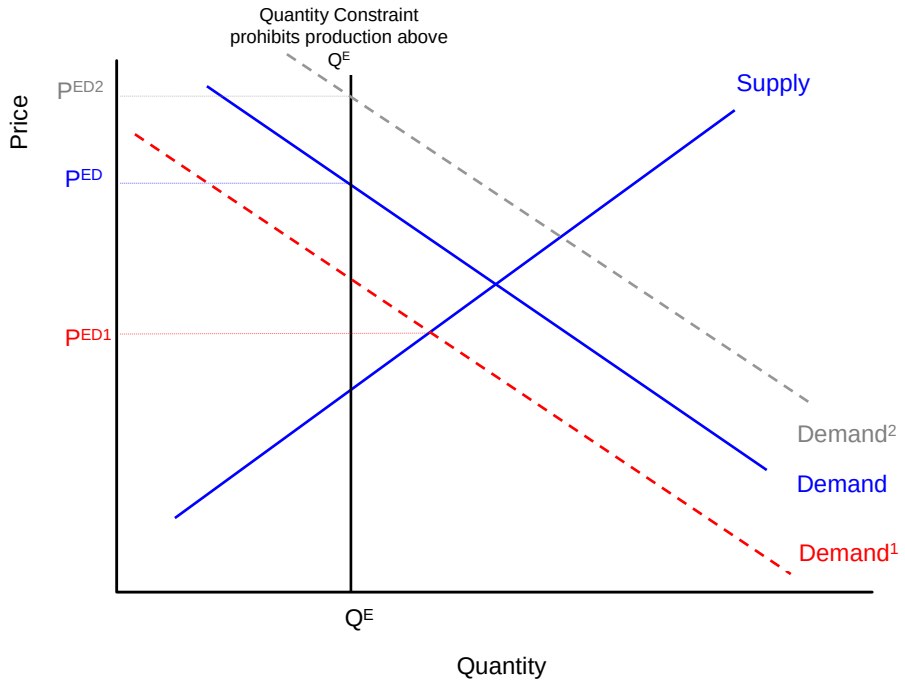
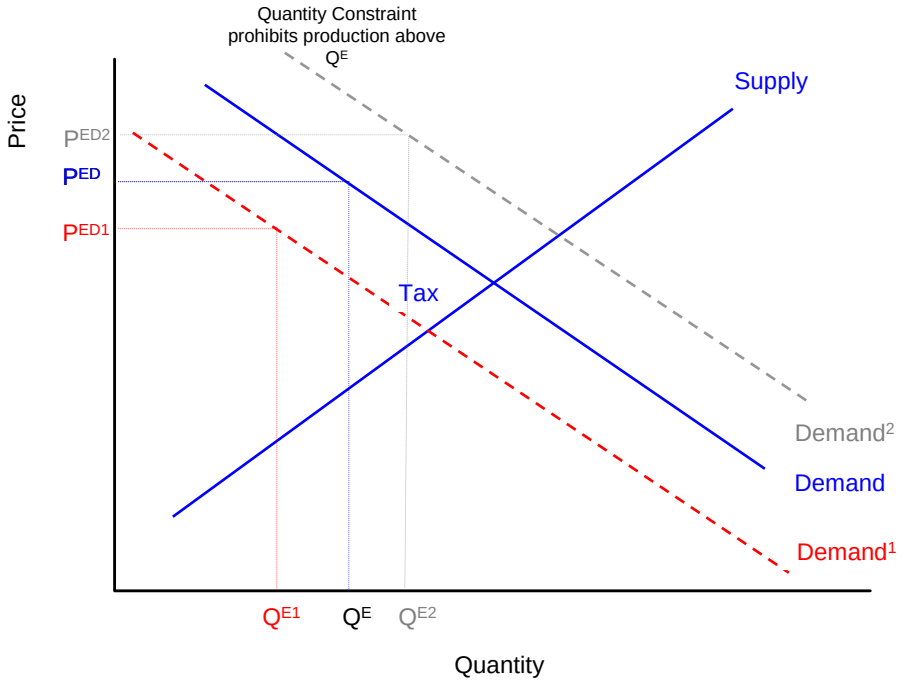


Figure 12
Carbon Tax Imposes Lower Price Volatility



Other Inefficiencies with Cap & Trade

All markets face uncertainty: will consumers want the product; is production (especially agricultural production) sufficient; will any new competitors or competitive products enter the market; not to mention the myriad of transportation and distribution issues that must be managed. Creating a market for carbon emissions adds an extra layer of uncertainty on top of the typical uncertainty inherent in all markets. Under the cap and trade system the government must continually set the number of carbon emission allowances (the level of the cap) into the future. Many assumptions must be made in order to establish the correct quantity cap due to environmental and economic uncertainties. Just a few of these uncertainties include the

expected environmental impact from the emissions constraint (will the quantity constraint actually impact global warming); the expected cost for firms to effectively replace their current carbon-emitting technology; and the expected costs that the emissions constraints will impose on the economy. Errors in any of these calculations will cause the actual emissions caps to vary (perhaps significantly) from the efficient carbon emissions level.

Because the quantity of the emission allowances cannot change under an emissions quantity constraint, price volatility in the market for emissions caps will result. As a real-world example, the value of the carbon emission allowances in Europe nose dived in April 2006 due to a mismatch between the allowances granted (the quantity cap) and actual market demand. Such extreme price volatility is a natural consequence of a policy that caps quantity. Furthering the uncertainty problems, currently carbon caps associated with the Kyoto Protocol are not set past 2012. Creating an arbitrary endpoint disrupts corporate planning impacting the ability to properly price the value of the caps.

The cap and trade system also requires an initial distribution of carbon emission allowances. One possibility is for the government to auction off the emission allowances. However, as implemented in Europe and under consideration in the U.S., the initial carbon emissions allowances are simply allocated to different private individuals and companies—often referred to as "grandfathering." Under the grandfathering system, the initial right to emit carbon is given away to current carbon emitting plants free of charge based on some formula of current carbon emissions as well as the designated carbon emissions goal.

In order to be effective in limiting carbon emissions, the regulatory cap must set a carbon emissions level below current market levels. Reducing the quantity of carbon emissions raises the price of energy. Because the companies received the rights to pollute without paying for them, the revenues from the higher prices are transferred from the consumer to the producer—which may be an undesirable outcome from an equity perspective. Additionally, a cap and trade system implemented with a grandfathering distribution of carbon emission allowances limits the government's options to offset the impact on the economy from the carbon reduction policy.

Urban experiences with taxi cab medallions exemplify many of the aforementioned difficulties of quantity constraints in general, and the cap and trade system in particular. Many cities, most famously New York City, constrain the number of taxis by requiring all taxi drivers to acquire a "taxi medallion." The supply of taxi medallions are constrained with the purpose of capping the total number of taxis operating within the city. The constrained quantity leads to higher prices; supply shortages during peak usage times (especially during rush hour or rainstorms); and, inflated and volatile values for taxi medallions depending upon the changing market dynamics and the regulatory response.[21] Ultimately, taxi services are compromised as the taxi medallions reduce the taxi market's efficiency.

What holds true for taxi medallions will hold true for cap and trade regulations on carbon emissions. By imposing a quantity constraint, cap and trade regulations create price volatility with respect to carbon emission allowances and increase overall uncertainty in the market. As implemented, cap and trade regimes also limits the government's options for implementing policies that can offset the adverse economic impacts from creating a carbon emissions shortage. As a consequence, a carbon tax is a more direct and effective policy instrument to reduce overall carbon emissions.

And, as we all know, it is far easier to get forgiveness than to get permission.

Taxes: Imposing a Carbon Tax

A carbon tax is levied on the burning of fossil fuels based on each fuel's specific carbon content. As opposed to a cap and trade system, a carbon tax directly raises the price of the goods linked to man-made global warming. As such, a carbon tax avoids many of the uncertainties associated with the cap and trade system. A recent example of a carbon tax was advocated by George W. Bush's former Chairman of the Council of Economic Advisors, Gregory Mankiw, who has advocated a $1-per-gallon increase in the federal gasoline tax, perhaps as part of a larger carbon tax, to be phased in over 10 years.[22] However, there are downsides to imposing a carbon tax, and many of the typical justifications advocates claim will arise from a carbon tax ring hollow.

The whole purpose of the carbon tax is to encourage the use of low emission technologies and discourage the use of high emission technologies. It logically follows that carbon taxes should be applied in a manner that encourages individuals to use low emission technology and simultaneously discourages the use of high emission technologies. For example, a gasoline tax is applied equally to each gallon of gas, thereby encouraging more fuel efficient cars—obviously a desirable outcome. However, carbon emissions can also be reduced through technologies that reduce carbon emissions but have minimal or no impact on gasoline mileage. A simple gasoline tax discriminates against technologies that reduce emissions but do not impact fuel efficiency. Such considerations must be fully incorporated into any carbon tax policy. And yet, adding such complexities creates opportunities for people to game the system either through the marketplace or through political influence.

In addition to environmental concerns, carbon taxes are often advocated for national security reasons as an added bonus, or sometimes as a full fledged objective. The Princeton Project, George Shultz being one of the honorary co-chairs, has advocated a gasoline tax for this precise reason:

> *Massive U.S. consumption of oil threatens American security by transferring an enormous amount of wealth from Americans to autocratic regimes and by contributing to climate change and degradation of the environment. The only solution to these problems is to decrease our dependence on oil and provide incentives for investments in energy alternatives. Toward this end the United States should adopt a national gasoline tax that would start at fifty cents per gallon and increase by twenty cents per year for each of the next ten years.*[23]

The concept of energy independence, also advocated by Alan Greenspan and Gregory Mankiw among others, makes no economic sense and makes even less national security sense. A number of foreign countries produce oil less expensively than we do and we use oil more efficiently than they do. It's silly to deprive ourselves of cheap oil, just because we don't like the seller. A $1-per gallon additional gasoline tax would be a self-imposed burden on the U.S. economy. To impose on ourselves the same oil deprivation that foreigners would impose on us through an embargo in order to avoid reliance on foreigners does not make sense.

A carbon tax for the sake of national security also suffers from a confusion of objectives—more on this in the next section.

Rather than endure a self-launched pre-emptive strike on the U.S. economy, it is a better strategy to trust the free market to deal with anticipated interruptions in supply. Sudden spikes in demand do not leave consumers without turkeys on Thanksgiving or fireworks on the Fourth of July. As described in Olson (1963), Great Britain was able to effectively deal with the interruption in its food supply following war-time embargos possibly because it embraced free market policies that strengthened its economy and industrial expertise prior to the economic disruption. On the other hand, Germany, which imposed high taxes on imported food in order to achieve food self sufficiency, was much less effective in dealing with the interruption in its food supply during World War I.

Gasoline taxes are also promoted as a means to reduce road congestion. Yogi Berra's adage about a restaurant that has become so crowded no one goes there anymore comes to mind here. If reduced congestion is so wonderful an attribute, keep in mind that any nascent price sensitivity for motoring will be almost completely offset by motorists' congestion sensitivity; thus, with a higher tax in place the roads will be left almost as congested as they would have been without the tax and gasoline usage would be little affected. More to the point, advocates of reducing gasoline consumption should love, love, love congestion and its deterrent effect on driving. In fact, to be consistent it should be proposed to close roads during rush hour in the major metropolitan areas. Now that would really reduce gasoline consumption! Moreover, taxing gasoline to reduce road congestion is a bit like taxing forks to reduce obesity.

Another point often raised is the old cliché (true that it is) that the U.S. gasoline tax could be increased by $1.00 per gallon and would still be less than half the level in Great Britain, which is still a democracy. Does making the same mistake as Britain, France, Germany or whoever, make that mistake any less of a mistake? It is well possible that a higher gasoline tax could be part of a beneficial comprehensive tax reform, but not without a thorough understanding of the primary economic impacts from a carbon tax.

The Optimal Tax Directly Addresses the Policy Problem

There is one common, but serious, mistake made when designing global warming policies. With respect to a carbon tax, proponents, especially proponents for a tax on gasoline, often argue that the tax incidence impacts both the consumers (U.S. drivers) and the producers of oil (Saudi Arabia and Venezuela are often mentioned). Consequently, Saudi Arabia, Venezuela and other oil suppliers would "in effect be paying" part of the gasoline tax. You can almost hear the crowds yelling "yippee!" However, if the source of the oil is the problem, not the carbon emissions, then the proper policy is not a carbon emissions tax.

In a classic article, Bhagwati and Ramaswami (1963) illustrated that a policy that directly addresses a market problem at its source is the most efficient way to remedy a market distortion.[24] Consequently, the Bhagwati theorem states a trade distortion should be addressed with appropriate trade policies; a production distortion should be addressed with appropriate tax or incomes policies on production; and a consumption distortion should be addressed with appropriate tax or incomes policies on consumption. If we want to discourage oil imports from select countries—a trade problem—then the proper policy is to impose an import duty on oil imports from those countries.

In the case of carbon emissions, there is a consumption problem. When consumers use energy or products created from energy, the prices do not reflect the costs from the carbon emissions on the environment; consequently, consumption is higher than optimal once the full costs of the product are taken into account. The appropriate policy response is a tax on

consumption—the source of the market distortion—but not on trade or production. We elaborate on the importance of taxing carbon consumption in the following sections.

Mitigating a Carbon Tax's Consequences

Oil, coal, and natural gas are economic goods no different than any other product or service. Issues of supply and demand dictate the quantity and price of current energy sources as well as the incentive for suppliers to create viable energy alternatives.

Whether we focus on the 1974-75 spike in oil prices or those of 1980-81 or 1990-91, we found the culprit was an interdiction of supply. In each case, the stock market tanked and the economy faltered. Attempts to artificially reduce our energy supply through global warming policies raise our energy prices, creating a supply shock similar to those of 1974-75, 1980-81, and 1990-91. Given how the economy and stock market responded to major supply price shocks in the past, there is no reason to believe a self inflicted supply shock initiated in a vacuum would not have a similar impact today.

Applying a carbon tax with appropriate tax rate reductions could well mitigate many, if not all, of the adverse economic affects of a stand alone carbon tax. In fact, it is more than just a remote possibility that with the correct tax swap, a carbon tax could actually benefit the economy. We, for two, would be delighted to swap a carbon tax dollar for dollar on a static basis with an across-the-board income tax cut. Along with the environmental benefits, such a tax swap creates economic benefits that would be a welcome bonus.

Using Tax Revenues to Reduce Marginal Income Tax Rates

The theory of incentives provides the basis for designing a carbon tax that minimizes its adverse economic impacts. Incentives can be either positive or negative. They are alternately described as carrots and sticks or pleasure and pain. Whatever their form, people seek positive incentives and avoid negative incentives. The principle is simple enough: If an activity should be shunned, a negative incentive is appropriate and vice versa.

In the realm of economics, taxes are negative incentives and government subsidies are positive incentives, subject to all the subtleties and intricacies of the general theory of incentives. People attempt to avoid taxed activities—the higher the tax, the greater their attempt to avoid. As with all negative incentives, no one can be sure how the avoidance will be carried out. With respect to the carbon tax, by increasing the relative price of carbon producing activities, the carbon tax discourages its use—which is consistent with the environmentalists' goals. However, what about the damage to the economy? The key answer to this question depends upon what the government does with the money.

The carbon tax has imposed a giant negative incentive on the economy. This tax is borne by producers and consumers through the higher costs the tax creates. If the government were to spend this revenue windfall, then the amount of inefficiencies in the economy would likely increase.

The correct carbon tax recognizes the real adverse economic impacts the proposal can create and appropriately adjusts for these impacts. If a carbon tax is going to be levied, it can be levied such that it changes the production incentives, trade incentives, and consumption incentives. In his recent Congressional testimony, Al Gore discussed the need to counteract the negative economic impacts of the carbon tax with lower taxes on production. He is right, and his proposal is commendable.

The adverse economic impacts arise due to the carbon tax's impact on production and trade incentives, while the supposed environmental benefits arise due to the impacts on the consumption incentives. However, a carbon tax burdens both consumption and production. Production is burdened with higher taxes that raise the costs of doing business. As a result, either profits will fall, wages will fall, consumer prices will increase, or some combination of all three will occur.

Consumers will feel both an income effect and a substitution effect from the new carbon tax. The income effect arises because the higher carbon tax reduces people's after-tax income. A lower after-tax income decreases people's ability to spend and save. The substitution effect arises because the price of products that either emit carbon or require carbon emissions in their production will rise relative to the price of all other products and services. The higher relative price discourages consumers from purchasing "carbon emitting" products. In a properly designed policy, the carbon tax is trying to encourage this substitution effect without imposing undue production and income effects.

A payroll tax reduction offsets the adverse production and income effects, but for labor only. With a payroll tax offset, production is still burdened with higher carbon taxes, however, it simultaneously benefits from reduced labor taxes. Similarly, the income effect for consumers from a higher carbon tax is offset by the higher take-home pay from a payroll tax reduction. The payroll tax reduction does not impact the negative economic incentives from the carbon tax on capital, however. Under a payroll tax reduction, the carbon tax still discourages income from capital, and consequently still imposes a negative economic impact on the economy. These negative impacts can be offset from an across the board reduction in marginal income tax rates dollar for dollar with the expected carbon tax revenues on a static basis.

Calculating the revenue offset on a static basis is crucial. In the dynamic world, the carbon tax will discourage the products and technologies that emit carbon. The reduced tax base lowers the government's tax revenues. Nevertheless, the costs from the new carbon tax still exist. For example, imagine that the carbon tax were set at such a high level that there would be a very strong incentive for all carbon emissions to cease. The economic impact from such a sudden shift away from carbon-based energy would be tremendous; however, the actual carbon revenues would be zero. In order to offset the adverse economic impacts, the correct marginal tax rate reductions would not be zero. For this reason, the dollar value of the marginal tax rate reductions should be based on the static revenue estimates from the carbon tax—the carbon tax rate multiplied by the current level of carbon emissions. Another benefit from such a formula is that the necessary tax revenue offsets provide policymakers with a shorthand reminder of the costs that a stand alone carbon tax would impose.

Our current tax system with high marginal tax rates and complex compliance structures is a major obstacle to economic growth. By using the carbon tax revenues to reduce marginal tax rates, the distortions that exist in our current tax system will be reduced. Changes to marginal tax rates are critical for growth because they change incentives to demand, and to supply, work effort and capital. Firms base their decisions to employ workers, in part, on the workers' total cost to the firm. Holding all else equal, the greater the cost to the firm of employing each additional worker, the fewer workers the firm will employ. Conversely, the lower the marginal cost per worker, the more workers the firm will hire. For the firm, the decision to employ is based upon gross wages paid, a concept which encompasses all costs borne by the firm.

Workers, on the other hand, care little about the cost to the firm employing them. Of concern from a worker's standpoint is how much the worker receives for providing work effort, net of all deductions and taxes. Workers concentrate on net wages received. The greater net wages received, the more willing a worker is to work. If wages received fall, workers find work effort less attractive and they will do less of it. The difference between what it costs a firm to employ a worker and what that worker receives net is the tax wedge.

A marginal tax rate cut—ideally to a flat rate—has two types of effects. Because the decrease in marginal tax rates lowers the cost to the employer in the form of lower wages paid, firms will employ more workers. On the supply side, a reduction in marginal tax rates raises net wages received. Again, more work effort will be supplied. Therefore, tax cuts increase the demand for, and the supply of, factors of production. In dynamic formulations, as tax rates fall, output growth increases and vice versa.

The rewards for incremental work by labor, the employment of additional capital and the more efficient combination of the two will all be higher. As a result, more employment, output and production is expected. Economic growth rates will accelerate until these effects are fully incorporated into the workings of the economy.

All of the aforementioned positive incentive effects help offset the impact of the carbon tax on production. The reduced marginal tax rates do not impact the reduced incentive to consume carbon emissions as the relative price of carbon emissions has still been increased. This is the activity the policy is designed to impact. Currently, demanders of carbon-based energy over-consume (have an excessive demand for) energy because the full costs of the carbon emissions consumption has not been incorporated into their purchasing decision. In this way, the policy imposes a tax on what we want to actually reduce—carbon consumption—while minimizing what we do not want to reduce—economic activity.

Conclusion

Man-made global warming may be happening and is associated with potential risks to our environment and ultimately overall welfare. Based on this scientific consensus and the potential environmental benefits from reducing carbon emissions, it seems prudent and risk averse to do what we can to reduce global carbon emissions. Still, action at all costs is not the answer. Government policies that restrict carbon emissions, without any offsetting policy change, impose significant economic costs on the U.S. economy.

However, there is room for a pro-active government policy that reduces the amount of carbon emissions; the key is to simultaneously implement the correct policy to accompany the implementation of a carbon tax. Lowering marginal income tax rates dollar for dollar with the implementation of a carbon tax holds great promise. The combination of a higher carbon tax coupled with lower marginal income tax rates would simultaneously reduce overall carbon emissions while mitigating the potential adverse economic impacts from the proposed carbon tax increase by increasing the incentives in the economy to work, invest and innovate. As a result, the tax impacts consumption decisions—the source of the carbon emission distortions—and not production.

In order to prevent future marginal tax rate increases that reverse the carbon tax's "economic offset", these rate reductions should also be implemented with taxpayer protections that preserve the reduced marginal tax rates. The pro-growth incentives from a marginal tax rate reduction are an integral part of an environmental policy that addresses a real potential risk while safeguarding our current economic progress. It provides a reasonable solution that balances the needs of the economy today and the environment tomorrow.

ENDNOTES

[1] Gore Al (2006) Speech at New York University Law School. September 16.

[2] "Another Ice Age?" (1974) *Time Magazine Archive Article: Science.* June 24th.

[3] Gore, Al (2007) Testimony of the Honorable Al Gore before the United States Senate Environment & Public Works Committee. March 21.

[4] Murray Iain (2005) What Every European Should Know About Global Warming. *Competitive Enterprise Institute: On Point*. July 20.

[5] Ibid.

[6] Michaels Patrick J. (1998) Long Hot Year: Latest Science Debunks Global Warming Hysteria. *Cato Institute*. December 31.

[7] Michaels Patrick J. (2007) New Climate for Global Energy Policy. *The Cato Institute.* February 6.

[8] Lomborg Bjorn (2001) *the Skeptical environmentalist*. Cambridge University Press.

[9] Governor Schwarzenegger and the state legislature have committed California to reducing state carbon emissions to 1990 levels by 2020. The details about how these goals will be reached are still being worked out as of this writing.

[10] N. Gregory Mankiw, "Raise the Gas Tax," The Wall Street Journal, October 20, 2006.

[11] Olson, Mancur (1963) Economics of the Wartime Shortage. Duke University Press.

[12] Ibid.

[13] Ibid.

[14] Ibid.

[15] Ibid.

[16] Kim, Hak-su (2003) Poverty and sustainable development in Asia Pacific region: Issues and policy options. *Harvard Business School 2003 Asia Business Conference* 14-15 February.

[17] (1998) Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity. *Energy Information Administration* October (SR/OIAF/98-03).

[18] Ibid.

[19] "How an American carbon-trading system should work". (2007) Economist.com, Jan 22nd.

[20] (2003) Addressing the Uncertain Prospect of Climate Change. *Congressional Budget Office: Economic and Budget Issue Brief* April 25.

[21] See for instance, Cervero Robert (1985) "Deregulating Urban Transportation" *The Cato Journal* Vol. 5, No. 1 (Spring/Summer).

[22] N. Gregory Mankiw, "Raise the Gas Tax," The Wall Street Journal, October 20, 2006.

[23] Ikenberry G. John and Slaughter Anne-Marie (2006) Forging A World Of Liberty Under Law: U.S. National Security In The 21st Century. *The Princeton Project* (September 27).

[24] Bhagwati Jagdish, Ramaswami V. K. (1963) Domestic Distortions, Tariffs and the Theory of Optimum Subsidy *The Journal of Political Economy*. Vol. 71, No. 1 (February), pp. 44-50.