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The Adverse Economic Impacts of Cap-and-Trade Regulations

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EXECUTIVE SUMMARY
The Adverse Economic Impacts of Cap-and-Trade Regulations

A cap-and-trade scheme for controlling greenhouse gas emissions (GHGs) would impose significant economic costs on the U.S. economy and, consequently, are an inappropriate policy response to current concerns about global warming. Our analysis of cap-and-trade's economic impacts reveals the following impacts:

- In economic terminology, cap-and-trade operates is a "quantity constraint" as the scheme establishes (or constrains) the GHGs that can be produced. As a quantity constraint, cap-and-trade regulations inherently create more price volatility in the GHG allowance market, as has already been observed in Europe. The Congressional Budget Office has also raised the price volatility issue, concluding that cap-and-trade regulations are not sound policies for addressing global warming.

- Cap-and-trade regulations would likely impose a large cost on the U.S. economy. The U.S. Energy Information Agency (EIA) estimates that overall economic growth could decline by up to 4.2 percent if a cap-and-trade system were implemented to achieve the Kyoto Protocol targets (7% below 1990 GHGs by 2008-2012). The costs to reach the ultimate goal of some GHG control proponents (e.g., reducing GHGs to 80% below 1990 levels by 2050) would be significantly greater. However, these estimates assume that the government will auction off the rights to emit greenhouse gases as opposed to simply giving these rights away, which is the approach often discussed in the U.S. and what has actually been implemented in Europe.

- Fossil fuels (oil, coal and natural gas) provide 86 percent of our current energy needs. It is not currently feasible for the alternative energy sources to significantly expand their energy contribution sufficiently in the near-term to substitute for the demand growth, according to the EIA. Consequently, a GHG cap could effectively become an energy production cap – or an energy supply shock.

- The U.S. economy's past experience with energy supply shocks supports the conclusions of the EIA study. During the previous oil supply shocks (energy supply shocks) of 1974-75, 1979-81 and 1990-91, the economy declined, unemployment rose, and the stock market declined in value.

- Based on the energy efficiency responses to the energy supply shocks of the 1970s, the U.S. economy could be 5.2 percent smaller in 2020 compared to what would otherwise be expected if cap-and-trade regulations are imposed. This equates to a potential income loss of about $10,800 for a family of four for the initial Kyoto GHG reduction target.

- Technical difficulties in measuring and verifying the validity of traded GHG allowances imply that the global market will be inefficient, and subject to manipulation and fraud. Government regulations that fail to delineate future GHG control levels add more uncertainty. These uncertainties raise further questions regarding the efficacy of the cap-and-trade regulations.

When evaluated as a whole, cap-and-trade regulations are likely to impose significant economic costs on the U.S. economy. These costs argue against implementing cap-and-trade regulations as a response to concerns about the potential contribution of GHGs to global warming.

The Adverse Economic Impacts from Cap & Trade Regulations on CO2

Arthur Laffer and Wayne Winegarden

In response to the global warming consensus, political momentum is building to cap greenhouse gas emissions (GHGs), sub-divide the cap into smaller parts (or emissions allowances similar to rationing coupons), and distribute the emissions allowances, either by auction or a no-cost basis to businesses that emit greenhouse gases. Businesses wishing to emit GHGs beyond their specific allowances would be able to purchase rights to do so from owners of surplus emission allowances. GHGs include carbon dioxide from combustion of fossil fuels and methane and nitrous oxide from agriculture and food production activities.

These policies are commonly referred to as "cap-and-trade" regulations. The costs of reducing GHGs through cap-and-trade regulations are not trivial. If implemented, cap-and-trade policies would add significant costs to production and would likely have a severe negative impact on the long-term U.S. growth. We review the economics behind cap-and-trade polices, and illustrate the adverse economic impacts that can be expected from the implementation of cap-and-trade regulations.

Proponents of Cap-and-Trade Misunderstand the Dynamic Marketplace

Already implemented in the European Union through the Kyoto Protocol, advocated by numerous states, and the subject of several legislative proposals in Congress, cap-and-trade is billed as a market-based approach for managing GHGs. Cap-and-trade establishes an aggregate constraint – that is, "the cap" – on GHGs. This constraint is typically benchmarked to the GHGs from a certain year – the Kyoto Protocol, for instance, established a cap that is 7 percent below 1990 levels for the years 2008-2012. Some cap-and-trade proponents advocate GHG cuts of up to 80 percent below 1990 levels by 2050.

The aggregate constraint is sub-divided into emission allowances that are then sold or allocated to businesses that emit greenhouse gases. Businesses constrained by their available allowances face a choice – either comply with their GHG allocations by changing their production levels or production technologies; or purchase more GHG allowances from owners of surplus GHG allowances. *The Economist* (2007) has described the theoretical workings of cap-and-trade by 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.*[1]

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

Advocates claim cap-and-trade is superior to other alternatives for reducing GHGs, such as a so-called "carbon tax," because of its supposed flexibility and "market-based" approach to the problem. Proponents hypothesize that cap-and-trade represents an efficient division of labor – that is, the government establishes emissions levels while the market sorts out who has the right to produce them. Goods and services that are in greater demand will be able to pay a higher price for GHGs associated with their production. Consequently, producers of good and services in high demand will outbid other users for the right to emit greenhouse gases, while the manufacturers of the less-valued products will either have an incentive to sell these rights or will not be able to purchase these rights in the first place. Either way, only the producers of good and services that consumers value the most will end up with GHG allowances. In this manner, the market is allocating the scarce right to emit greenhouse gases based on their most valued use.

Cap-and-trade advocates are correct only in a static world where market supply-and-demand curves are known with certainty. Appendix I illustrates the theoretical benefits from a cap-and-trade policy, or what is known as a quantity constraint in economics, under these hypothetical and unrealistic conditions.

Markets are dynamic, and people change their actions in response to the changing dynamics of the marketplace. Appendix II illustrates this economic logic in a realistic scenario where the supply-and-demand curves vary compared to levels expected by the government after establishment of a GHG cap. Once market dynamics are incorporated, the efficacy of the cap-and-trade solution disappears.

Significant price volatility emerges in the market because the supply-and-demand curves are not known to policymakers when initial cap-and-trade policies are established. Furthermore, the supply-and-demand curves will shift over time, and oftentimes in unpredictable ways. By definition of the cap-and-trade quantity constraint, the quantity of the GHGs allowances cannot change and may become substantially stricter in subsequent years. Changes in supply-and-demand, then, can only be accommodated through changes in prices (*see* Appendix II). This process may lead to extreme price volatility in the emissions allowance market and the markets for good and services produced under emissions caps.

The European experience with cap-and-trade exemplifies these fundamental flaws. The value of the GHG allowances in Europe nose-dived in April 2006 due to a mismatch between the allowances granted and actual market demand. While some observers try to explain these variations as a result of poor planning on the part of governments, such extreme price volatility is a natural consequence of policies that arbitrarily cap quantities. As shown in Appendix II, this price volatility is what should have been predicted prior to Europe's implementation of cap-and-trade. The European experience supports the contention that cap-and-trade is not the appropriate policy response for addressing the issues related to GHG emissions.

A recent Congressional Budget Office analysis echoes these precise concerns:

> *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.*[2]

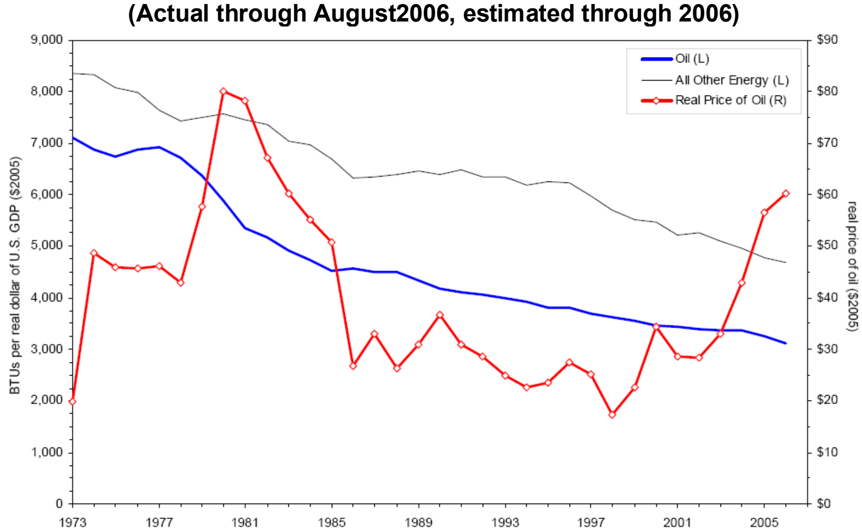
The results are the exact opposite of what cap-and-trade proponents argue – cap-and-trade regulations create overly restrictive policies that increase price uncertainty in the marketplace. The market loses efficiency because of cap-and-trade regulations.

Carbon Restrictions Impact Economic Growth

Energy use creates externalities – that is costs (or benefits) imposed on others who are neither the seller nor the purchaser of the products and services in question. Pollution emitted from energy use is a negative externality. Economic growth, wealth creation, and poverty reduction created from using energy are positive externalities.

Global warming policies geared toward economizing our use of fossil fuels impose tremendous economic costs, especially when the positive externalities of economic growth and poverty reduction are not given appropriate consideration. Economic growth and pollution are intertwined in complex ways. As countries become wealthier, heavy industries develop creating industrial wastes that increase pollution. However, there is ample evidence from recent history that greater economic growth, at least past a certain threshold, actually reduces the pollution a society creates. The U.S., for example, has been consistently using less energy per dollar of economic output in times of both rising and falling oil prices (*see* Figure 1).

Figure 1
U.S. Physical Consumption of Oil and Non-Oil Energy and the Real Price of Oil
(Actual through August2006, estimated through 2006)



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 per cent during the mid seventies to mid eighties.[3]

Appropriately incorporating 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.

Carbon-based energy – i.e., coal, natural gas and oil – supplies the vast majority of global energy needs. Restricting energy options by significantly capping the amount of GHGs the U.S. emits will raise the country's energy costs, at least in the short-run. Artificial reductions in the supply of energy – akin to a "supply shock" – impose significant economic costs on the U.S. economy. 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.[4] 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:[5]

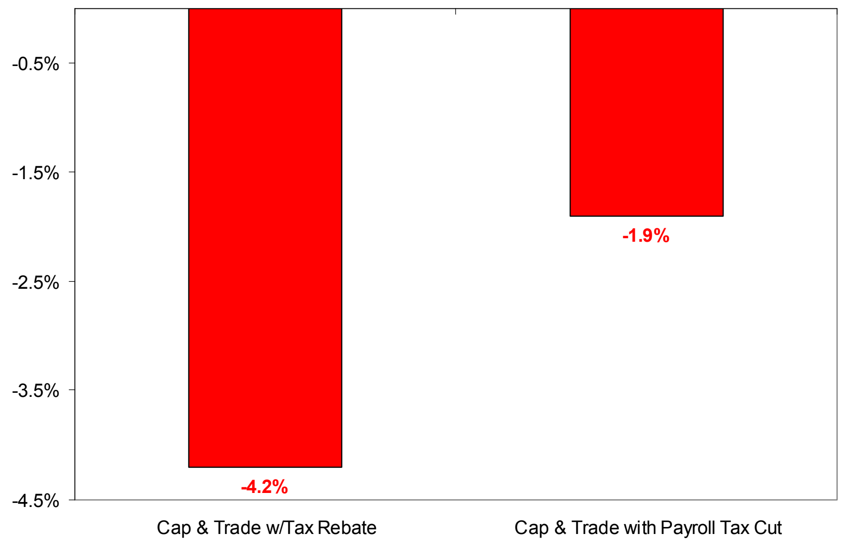
…first, returning collected revenues to consumers through a personal income tax lump sum rebate and, second, lowering social security tax rates as they apply to both employers and employees. The two policies are meant only to be representative of a set of possible fiscal policies that might accompany an initial carbon mitigation policy.

The EIA study forecasted that implementing cap-and-trade regulations with a tax offset via a personal income tax rebate would reduce economic growth by 4.2 percent, or $565 billion of 2006 QIV GDP (*see* Figure 2). Implementing the cap-and-trade proposal with a payroll tax rebate would reduce economic growth by 1.9 percent, which is $256 billion of 2006 QIV GDP.

There are a few important caveats regarding the EIA's economic impact estimates. The EIA study examined the potential economic impacts from reducing GHGs to a level that is 7 percent below 1990 levels. Current discussions regarding the target for GHGs have become more aggressive – some as high as 80 percent. Since such carbon reductions are many times more restrictive than the scenario's considered by the EIA, it is not unreasonable to assume that the potential economic impacts could be significantly greater. Consequently, the economic impacts discussed above may significantly under-estimate the potential economic impacts from the significantly more restrictive GHG policies currently under consideration.

The economic impacts may also be higher because, although the EIA assumed that the initial distribution of GHG allowances was achieved through a government auction, this allocation mechanism has not been generally used.

Figure 2
EIA Forecasted Impact on GDP Growth from Kyoto Protocol
Forecast Growth Compared to Baseline Growth
Assumes Carbon Levels 7 percent Below 1990 Levels



As implemented in Europe, and now under consideration in the U.S., the initial GHG allowances would be freely allocated to different private entities. Under this "grandfathering" system, the initial the right to emit GHGs are given away to certain emitters free-of-charge based on some formula involving current emissions and designated emissions goals. Another way to describe the cap-and-trade system is that the government arbitrarily designates winners and losers – a process that would most likely devolve into competition between lobbyists.

In order to effectively limit GHGs, the regulatory cap must reduce GHGs below current market levels. But 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. A recent *Financial Times* article documented this impact in the United Kingdom:

> *…profits are created because of the way the emissions trading scheme works, rather than because of sharp practice by the companies. Electricity prices are higher as a result of the scheme. But generators' costs do not rise to the same extent, as they are given most of their permits for free.*
>
> *In phase two of the scheme, which runs from 2008 to 2012, the price of permits is about €23 a tonne of carbon dioxide, and UK electricity companies have been allocated permits for 104m tonnes of carbon dioxide a year. In the first phase of the scheme, 2005-07, it is thought the total windfall profit for the generators was about £2bn.*[6]

The adverse impacts on consumers are not equitably distributed either. Energy taxes, such as gasoline taxes, are generally viewed to be regressive because the dollar value of the tax imposes a larger burden on people of lesser means compared to wealthier individuals. The same holds true for cap-and-trade regulations. Energy price increases operate as an additional "tax" on lower income people. As a consequence, it is likely that the costs of the cap-and-trade regulations will be felt most acutely by those least able to afford these costs.

The Congressional Budget Office raised these equity concerns as a significant problem with most cap-and-trade regulations.[7] Additionally, a cap-and-trade system implemented with a grandfathering distribution of emission allowances limits the government's options to offset the impact on the economy from the carbon reduction policy. Consequently, the adverse economic impact from cap-and-trade regulations are amplified when the right to emit carbon is given away as opposed to auctioned off to its most valued purchaser.

Lessons from previous Supply-shocks

Fossil fuels, the energy sources that produce the most GHGs, currently account for 86 percent of total energy consumption.[8] Alternative low GHG sources currently account for only 6.1 percent of total energy consumption. Importantly, renewable fuels are not in a position to replace the lost energy output from fossil fuels.

According to the EIA,[9]

> *[solar power]…is still in the early stages of development, with relatively high costs and uncertain performance, and inadequate solar conditions east of the Mississippi River limit its potential market [while] wind resources are often far from electricity customers, and if the wind is not blowing the resources may not be available during peak daily or seasonal loads.*

Wind power has other problems. Wind farms can only be placed in certain locations and these locations often interfere with the migratory paths of birds. They are also unsightly and localities resist their construction. These barriers limit the viability of wind power in the near term. Similar barriers exist for other renewable energy sources. Due to these constraints, limiting GHGs emissions in the short-term can only be achieved by limiting the supply of energy produced. Disrupting the country's energy supplies, whether by domestic regulation or foreign oil embargo, is an energy supply shock.

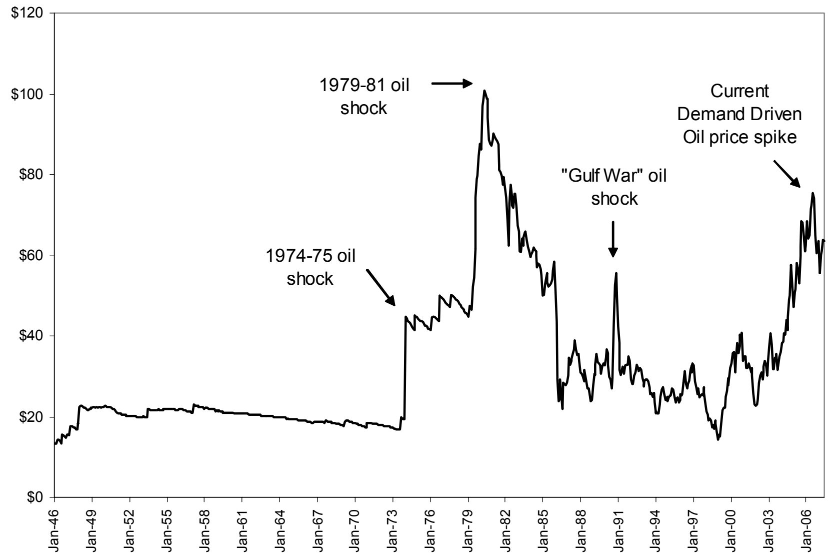
It is not necessary to forecast impacts on the U.S. economy from a significant energy supply shock. The U.S. economy has endured several supply-induced energy crises over the last 40 years. These real world examples clearly illustrate the adverse economic impacts in the short-run from supply-induced energy shocks. Figure 3 traces the spot commodity prices of oil on a monthly basis from January 1946 through April 2007. Figure 3 shows four significant oil price spikes:

- 1974 – 75;
- 1979 – 81;
- 1990 – 91; and
- 2005-present.

The first three oil price spikes resulted from an "energy shock" or supply-disruption. The current price spike, in contrast, has resulted from increased demand.

Currently, the supply of oil has never been greater. World daily crude production averaged over 73 million barrels in early 2006, averaged 63+ million in 1996, and averaged about 56 million back in 1986. Moreover, known reserves are also in abundant supply. Proved crude oil reserves, estimated at 51 billion barrels in 1944, grew to 1.3 trillion barrels by the end of 2003.[10]

Figure 3
West Texas Intermediate Spot Oil Price
January 1946 – April 2007



The cause of the current price spike is a global economic boom of unbelievable breadth and depth. Even with huge augmented supplies of oil pouring on the world economy, demand growth has led to a price spike. Without this spike in the price of oil, the world economy would be in precarious shape. The rise in the price of oil is doing just what it is supposed to do—allocating a scarce commodity amongst alternative users. Today's rise in the price of oil is a direct consequence of the efficient positive functioning of global markets whereas earlier spikes in the price of oil were a consequence of hostile anti-growth interventions in the oil market. Consequently, it is the first three price spikes that are of interest with respect to the economic effects of a supply-side energy shock.

Oil prices increased dramatically during 1974-75 as a direct result of an interdiction in the oil supply initiated by OPEC countries. The period of 1974-75 is best 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 declined precipitously.

The 1979-81 price shock reflected another Mid-East-related interdiction in supply, U.S. wellhead price controls, excess profits taxes on oil companies, and gas rationing – all 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 contributed.

When Iraq invaded Kuwait in 1990, the U.S. responded with "Desert Storm." Again, oil supplies were greatly reduced, shifting the supply curve for oil leftward once 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. 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.

Figures 4 – 6 detail the results. Figure 4 reviews the impact on real GDP growth following each of the three energy supply shocks. In each episode, the U.S. economy entered a recession, the severity of which was linked to the severity of the supply shock, see Table 1.

Figure 4
Percent Change in Real GDP
1970 QI – 2007 QI

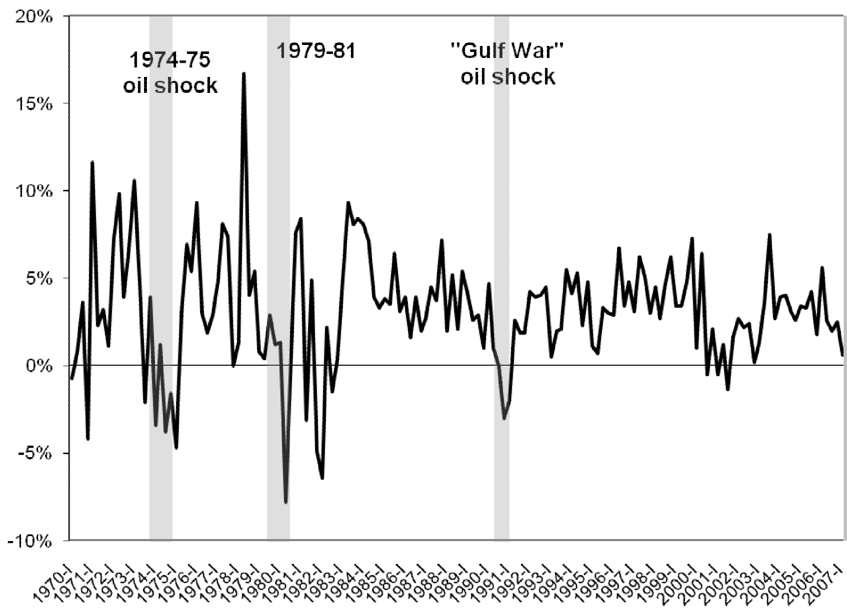


Table 1
Percent Change in Real GDP

	1974 - 75	1979 - 81	1990 - 91
Percent Increase in Oil Price*	+134.1%	+117.2%	+88.3%
Percent Change GDP (peak to trough)	-2.70%	-2.18%	-1.26%

* Measured as peak price to price prior to price spike

Consistent with a recession, the unemployment rate surged following each oil supply shock (*see* Figure 5). The oil supply shocks with the largest percentage increase in oil prices were also associated with those periods with the largest increase in the nation's unemployment rate (*see* Table 2).

As a final measure of the adverse economic impacts caused by energy supply shocks, Figure 6 compares changes in inflation adjusted stock prices and inflation adjusted oil prices; it shows that when inflation adjusted oil prices rise, inflation adjusted stock prices fall.

Taken together, the previous energy supply shocks all tell the same story – an energy supply interdiction causes the U.S. economy to slow, unemployment to rise, and the value of the stock market to fall.

Figure 5
U.S. Unemployment Rate
January 1970 – May 2007

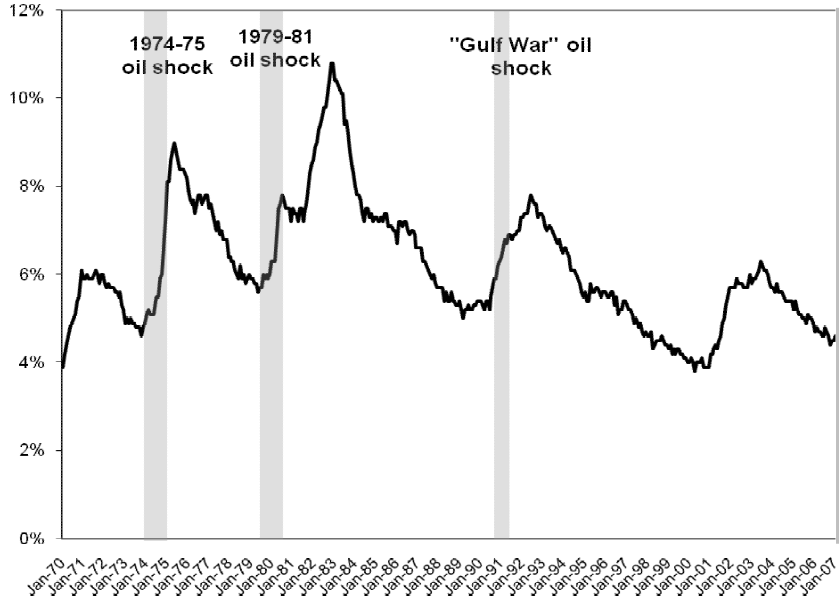


Table 2
Increase in National Unemployment Rate

	1974 – 75	1979 - 81	1990 - 91
Percent Increase in Oil Price*	+134.10%	+117.21%	+88.26%
Increase in Unemployment Rate	+3.90 p.p.	+2.20 p.p.	+1.70 p.p.

* Measured as peak price to price prior to price spike
p.p. denotes percentage point

Figure 6
Inflation Adjusted Oil Prices vs. Inflation Adjusted Stock Prices
1970 QI – 2007 QI

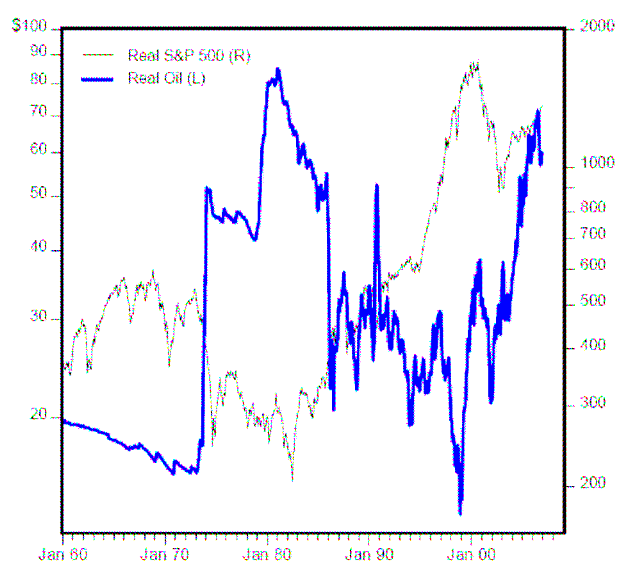


Table 3
Summary of GDP and Employment Effects from Previous Oil Supply Shocks

	Average Change
Percent Increase in Oil Price*	+113.2%
Percent Change GDP (peak to trough)	-2.1%
Increase in Unemployment Rate	+2.6 percentage points

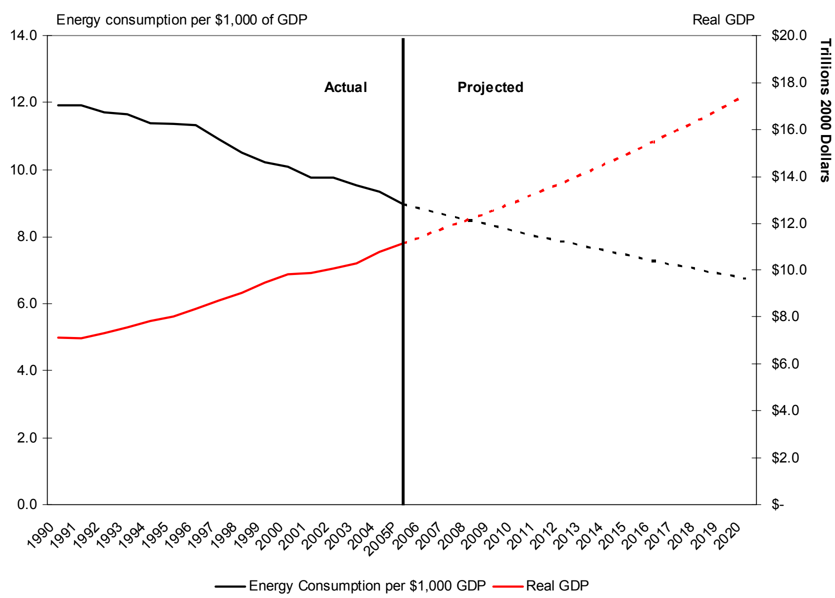
Because current technological constraints limit the viability of alternative energy sources, a GHG cap will have the effect of lowering the amount of fossil fuel-derived energy that can be used; while it is unclear how the lost energy output will be replaced. Additionally, GHGs are not simply carbon emissions. For instance methane emissions from dairy farms and nitrous oxide emissions from fertilizers are also GHGs. A comprehensive GHG cap will, consequently, impact agricultural production GHGs as well. The economic impact from a full GHG cap could be larger than the values estimated below as these impacts are driven primarily by constraints on fossil fuel use.

As of 2005, each dollar of GDP is generated by 8,970 British Thermal Units (BTUs) of energy, or a total of 99.9 quadrillion BTUs.[11] The U.S. Department of Energy EIA study has estimated that a GHG emissions cap consistent with the Kyoto Protocol would require total energy output to be reduced to 98.8 quadrillion BTUs.[12]

On average, the U.S. economy becomes more energy efficient each year, where increased energy efficiency is defined as the ability to produce the same level of economic output (or GDP) with less energy input (BTUs). Since 1949 energy efficiency has improved by about 1.4 percent per year. Since 1990, the pace of energy efficiency has increased to 1.9 percent per year. Based on the rate of energy efficiency growth since 1990, and average total GDP growth since 1990, by 2020 each dollar of GDP will be generated by 6,756 BTUs, and total real economic output will be $17.4 trillion. These values imply total energy usage of 117.8 quadrillion BTUs.

Figure 7

Real GDP Compared to Energy Consumption per $1 of GDP
1990 – 2005 (actual)
2006 – 2020 (projected)



Compliance with the Kyoto Protocol would require an actual reduction of total energy usage to 98.8 quadrillion BTUs. If energy efficiency did not improve compared to this baseline, such a disruption in energy supply would lead to total economic activity being 16.1 percent lower in 2020 than the baseline scenario.

The actual economic impact will likely be less than the 16.1 percent figure as growth in energy efficiency will likely accelerate and partially offset the impact of the lower energy usage on GDP. During the period around the energy supply shocks of the 1970's, the rate of growth in energy efficiency accelerated to 2.7 percent per year. Such economizing behavior is a natural response of individuals to higher energy prices, and results from changing driving habits, car purchase choices, home temperature settings and other energy efficiency activities.

Assuming that consumers respond to the higher energy costs from cap-and-trade regulations so that our energy efficiency growth accelerates to an average of 2.7 percent per year, total economic activity would be 5.2 percent lower in 2020 than the baseline scenario.

The implications of such a discrepancy are significant. Due to the reduction in economic growth, by 2020 every man, woman, and child would be about $2,700 poorer than the baseline scenario – or about $10,800 for a family of 4.[13] Furthermore, the lack of current technological alternatives limits the ability to offset these impacts. To the extent that GHG emissions constraints are more binding, the overall adverse economic impact could be slightly larger. This analysis, along with the EIA study, and the prior episodes of drastic oil reduction illustrate the types of economic consequences that would likely occur in the U.S. from ill-conceived cap-and-trade policies.

Cap & Trade Fraud

Financial instruments representing GHG emissions allowances are not like future or spot market contracts for traditional commodities such as agricultural, energy or mining products – all of which contemplate that their underlying physical commodities be delivered to a specific place at a precise time and in pre-determined quantities of sufficient quality.

GHG emissions are invisible, are not easily measurable, and there is currently no uniform or standard way to measure GHG emissions. Additionally, because GHG emissions are global in scope, there is no single regulatory or enforcement organization responsible for measurement of all GHG emissions. Because of these concerns, the financial instruments based on GHG emissions will be subject to fraud and manipulation that will be difficult, if not impossible, to detect or guard against.

Schmalensee (1996) has previously described some of the issues associated with international treaty compliance:

> *It is first argued that widespread noncompliance with the reporting requirements of the Montreal Protocol have arisen not from bad intentions, "but rather because [countries] did not have the resources and technical know-how needed to carry out their obligations." As even non-economists know, "I don't have the money," almost always means, "I have better things to do with the money." If half the signatories to the Montreal Protocol are willing to claim in public that they couldn't afford to meet the Protocol's reporting requirements, it does not take much imagination or cynicism to predict near-universal non-compliance with a climate protocol involving costs that are orders of magnitude larger. A history of partial compliance with low-cost environmental treaty*

obligations argues that compliance with any burdensome future climate-related agreements is likely to be very spotty indeed.

Second, it is noted that noncompliance with certain oil pollution treaties was solved when an equipment standard was adopted that made monitoring easy, and it is asserted in passing that "monitoring of international agreements may be the more important problem." This assertion is hard to dispute; one can only wish its implications had been explored. Most international environmental agreements rely on self-reporting, and almost none are well-monitored. And, as I noted above, it is at least arguable that for technical reasons only CO2 emissions from fossil fuels can be reliably monitored today.[14]

The argument developed by Schmalensee raise important concerns regarding carbon emissions trading. Based on experience with the Montreal Protocol and the experiences of many countries that are currently trying to comply with the Kyoto Protocol, it is likely that industries in many countries will not be complying with the emissions cap. Furthermore, a global carbon emission cap-and-trade system requires that all allowances, including the allowances from countries with less stringent controls, to be tradable in the global marketplace.

As a result, the carbon emissions allowance marketplace will be subject to game-playing by emitters from countries where strict enforcement may not be pursued; and uncertainty due to lack of compliance in many countries. These uncertainties will make it difficult for a company that purchased a carbon emissions allowance from the global trading system to verify that the person or company who sold the allowance has not either used the allowance or sold the same allowance to another company. Because the person selling an allowance does not need to be the original allowance holder, uncertainty will exist regarding the true validity of any emissions allowance purchased on the market. While uncertainty is inherent in all financial markets, uncertainty regarding the validity of ownership (or the property right over the good or service purchased) is not. History has shown that when property rights are not well enforced, market participants lose confidence and in the extreme causes all market transactions to cease.

Other Inefficiencies with Cap & Trade

All markets face uncertainties. Will consumers want the product? Is production, especially agricultural, sufficient? Will new competitors or competitive products enter the market? What about the myriad transportation and distribution issues that must be managed? Creating a market for trading GHG allowances adds an extra layer of uncertainty to the typical uncertainty inherent in all markets.

Under cap-and-trade, the government must continually set the number of GHG 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 cost for businesses to effectively replace their current GHG-emitting technology; and,
- The costs that 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 GHG level. Additionally, current Kyoto Protocol GHG caps are not set past 2012, thereby creating an arbitrary endpoint that disrupts business planning and that impacts the ability to properly price the value of the caps.

Urban experiences with taxi cab medallions exemplify the difficulties of the cap-and-trade regulations. Many cities 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.[15] Ultimately, taxi services are compromised as the taxi medallions reduce the taxi market’s efficiency.

What holds true for taxi medallions will likely hold true for cap- and-trade regulations on GHG emissions. By imposing a quantity constraint, cap-and-trade regulations could create price volatility with respect to emission allowances and increase overall uncertainty in the market. As implemented, cap-and-trade regimes may also limit the government’s options for implementing policies that can offset the adverse economic impacts caused by creating an energy shortage.

The U.S. experience with implementing an income tax is also illustrative. The current U.S. income tax was implemented in 1913. The income tax was applied only to those people earning $500,000 or more a year, which was the top 1 percent of income earners. Within 10 years, the top marginal tax rate went from 7 percent to 73 percent, and the number of people responsible for paying income taxes exploded. The adverse economic impact from income tax uncertainty has been well documented since. Imposing a new government regulation can be expected to create new uncertainties with respect to corporate planning and investment.

Some have tried to liken the EPA’s acid-rain-emissions-trading program to GHG cap-and-trade. The two programs are not comparable on any level. Importantly, the transactions costs with respect to the acid rain program were significantly lower. In terms of scale, the acid rain program involved hundreds of emitters within the U.S., whereas GHG cap-and-trade would involve millions of emitters (if not hundreds of millions) around the world. The technical feasibility of measuring and reducing acid rain-related emissions (sulphur dioxide and nitrogen oxide) from power plant smokestacks is technically much simpler and cheaper than measuring and reducing GHG emissions from a much wider variety of sources. Finally, no one has comprehensively studied the costs and benefits of the EPA’s acid rain program in great detail, so it is premature to conclude that it can serve as a model for GHG cap-and-trade. However, the use of quantity constraints implies that the costs with respect to the amount of sulphur dioxide and nitrogen oxide reduction may have been higher than necessary.

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 if 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 on one specific location will only push polluting industries out of that location and into other locations more polluting tolerant. While the earth's atmosphere could be little impacted, production in the specific location could 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 California's economy. The failure to achieve universality in a global warming policy will greatly reduce its effectiveness and yet will not significantly reduce its costs.

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. In advocating a carbon tax, economist Greg Mankiw observed, "…as a higher gas tax discouraged oil consumption, the price of oil would fall in world markets."[16] The net effect from the gas tax is 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 and the U.S. is true for Europe, Japan 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. The net impact on carbon reduction will be diminished, while the net economic impacts can be potentially quite large. Universality is a key precondition for an effective carbon emissions reduction regime.

Conclusion

As currently conceived, cap-and-trade regulations are an economically harmful and ineffective policy for addressing global warming concerns. Because the regulations would constrain GHG emissions, significant price volatility for emissions allowances, such as the volatility that has been evident in the European Union's emissions market, are a natural consequence. Citing the price volatility issue, the Congressional Budget Office has concluded that cap-and-trade regulations are not a sound policy for addressing global warming issues.

Cap-and-trade regulations would likely impose large economic costs on the U.S. economy. The EIA estimates that overall economic growth could decline by as much as 4.2 percent for just the initial cap of 7%. These estimates assume, however, that the government will auction off the rights to emit GHGs as opposed to simply giving them away at no cost – the approach most commonly discussed in the U.S. and the approach actually implemented in Europe. When coupled with the lack of feasible technological alternatives, the economic impact from a cap-and-trade regulation could be even larger.

The EIA's forecasted economic impacts are substantiated by the real world impacts from previous energy supply shocks. Over the past 40 years, the three supply shocks on the oil market, one of the primary energy sources for the U.S. economy, were all followed by a significant downturn in the economy, an increase in unemployment, and a decline in the stock market.

Technical difficulties in measuring and verifying the validity of traded GHG emissions allowances imply that the global market for GHG emissions will likely be inefficient. Government regulations that fail to define the precise levels of GHG emissions far into the future add another layer of uncertainty, disrupting the ability of businesses to effectively plan and grow their businesses in the future. These uncertainties raise further questions regarding the efficacy of the cap-and-trade regulations.

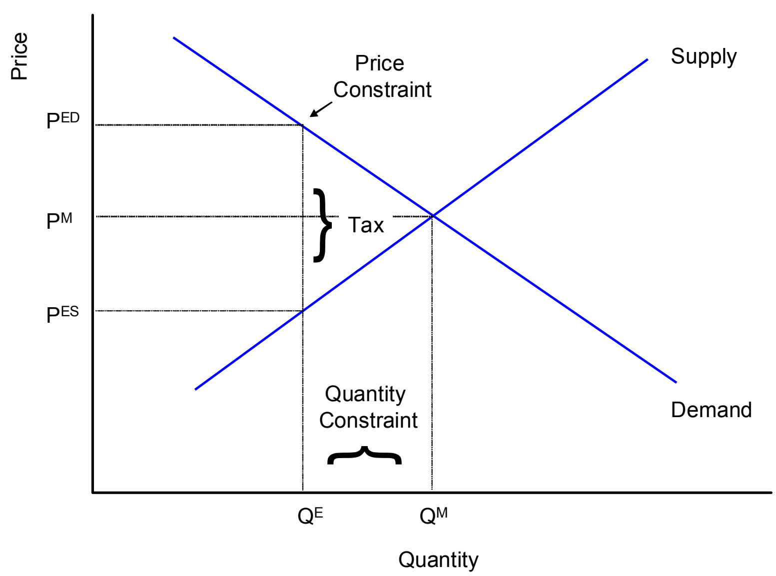
When evaluated as a whole, cap-and-trade regulations would likely impose significant economic impacts on the U.S. economy. These costs argue against implementing cap-and-trade regulations as a response to current concerns over global warming.

APPENDIX I: Cap-and-trade Regulations, 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 with full information, there is no difference between any of these policies.

Figure A1 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 GHGs during its production process. Demand represents the consumers' desires 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 A1
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 GHGs, 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 GHG 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 GHG 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 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 GHG emissions. With such knowledge, Figure A1 illustrates that it does not matter whether the government uses a carbon tax, a quantity constraint, or a price constraint.

If the government wanted to impose a carbon tax, it would know for sure 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 the exact same outcome. 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, inefficiencies arise, especially with respect to the quantity constraint policies such as cap-and-trade – see Appendix II.

APPENDIX II: The Inefficiency of Cap-and-trade, a Supply and Demand Analysis

"Cap-and-trade" regulations are an example of what economists call a quantity constraint. A quantity constraint establishes a fixed quantity of the product that can be produced or consumed. With quantity fixed, all market variations can only impact the price of the product: the greater the quantity restriction, the larger the regulation's impact on price. The greater the amount of variation in market supply and demand, the greater price variability will be evident in the marketplace.

With respect to the cap-and-trade regulations, the cap sets the quantity of GHG emissions allowances in the market. Depending upon the quantity level set, the price of the GHG emissions allowance could be cheap or expensive. If the quantity cap creates a significant production constraint, then the price for a GHG emissions allowance will skyrocket. On the other hand, if the cap is a minor constraint, prices will plummet.

These effects can be clearly seen in Figures A2. Figure A2 details the supply and demand curves for GHG emissions – or more precisely the products whose production and consumption emits GHGs.

Figure A2
The Economics of Cap & Trade

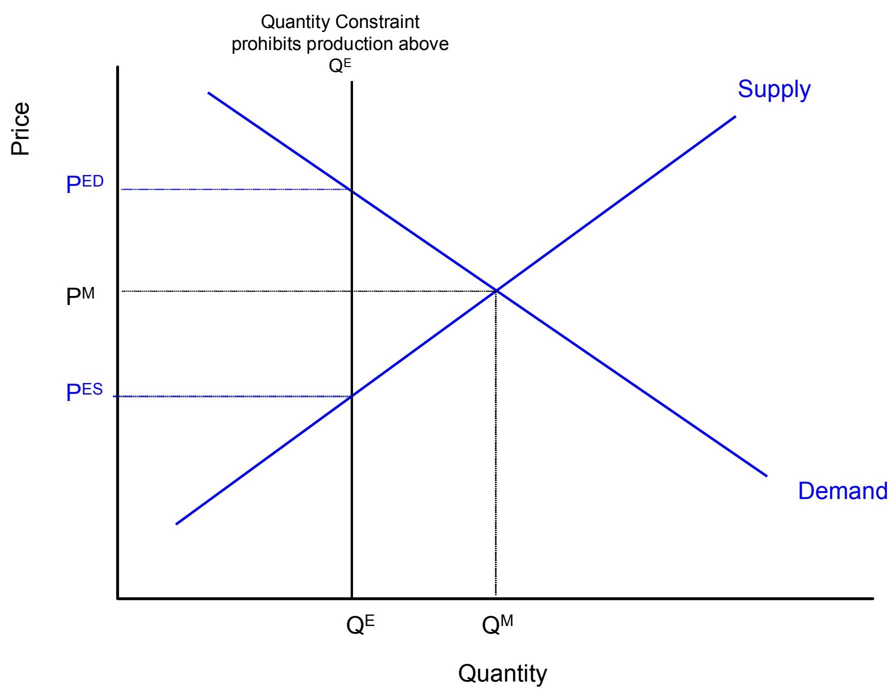
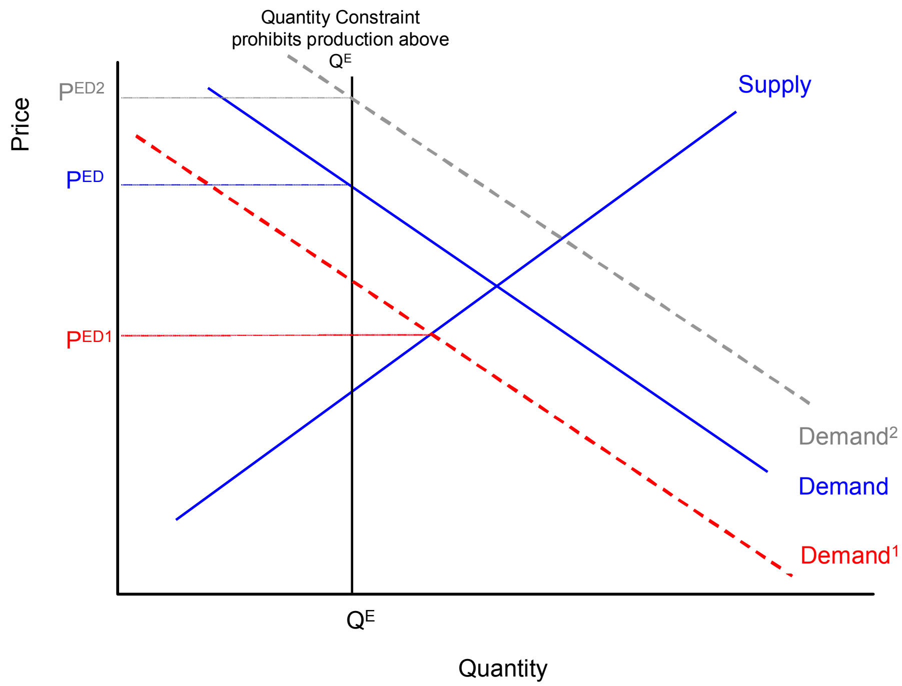


Figure A2 begins with a reproduction of Figure A1, focusing on the quantity constraint scenario. The solid black line at Q^E represents the quantity constraint that is determined based on the assumed supply and demand curve. By definition of the cap, this is the maximum amount of carbon emissions that can be created. In Figure A3 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 A3 illustrates, the actual prices in the market (P^{ED1} and P^{ED2}) will fluctuate significantly from the expected price (P^{ED}) when either demand curves shift or the government based its initial quantity cap on an inaccurate assessment of the actual market demand curve. The same arguments hold for the supply curves as well. Because the original positioning of the supply and demand curves are not known with certainty and due to changing market dynamics the supply and demand curves will change over time, price volatility arises in a market with a quantity constraint such as the cap-and-trade regulations.

Figure A3
Quantity Constraint, Price Volatility



Acknowledgement & References

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[8] Energy Information Agency (2006) Annual Energy Review 2005, Report No. DOE/EIA-0384(2005) Posted: July 27; Table 1.1.

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[11] Energy Information Agency (2006) Annual Energy Review 2005, Report No. DOE/EIA-0384(2005) Posted: July 27; Table 1.5.

[12] Energy Information Agency (2006) Annual Energy Review 2005, Report No. DOE/EIA-0384(2005) Posted: July 27; Table 1.5.

[13] Per capita numbers are calculated based on projected population in 2020 from the U.S. Census, www.census.gov/populations/projections.

[14] Schmalensee, R. (1996) Greenhouse Policy Architectures and Institutions, *Publications of the MIT Global Change Joint Program,* November*.*

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

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