A CBO STUDY

Reducing Gasoline Consumption: Three Policy Options

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Notes

Numbers in the text and tables of this report may not add up to totals because of rounding.

Unless otherwise indicated, all years referred to are calendar years.

Preface

Several Members of Congress and public interest groups have recently proposed policies that would reduce gasoline consumption in the United States. Such proposals stem primarily from a desire to enhance the nation's energy security and to decrease its emissions of carbon dioxide, a key greenhouse gas that affects the Earth's climate. This Congressional Budget Office (CBO) study—prepared at the request of the Senate Committee on Environment and Public Works—compares three methods of reducing gasoline consumption: increasing the corporate average fuel economy (CAFE) standards that govern passenger vehicles, raising the federal tax on gasoline, and setting a limit on carbon emissions from gasoline combustion and requiring gasoline producers to hold allowances for those emissions (a policy known as a cap-and-trade program).

The study weighs the relative merits of those policies against several major criteria: whether they would minimize costs to producers and consumers; how reliably they would achieve a given reduction in gasoline use; their implications for automobile safety; and their effects on such factors as traffic congestion, requirements for highway construction, and emissions of air pollutants other than carbon dioxide. In addition, the analysis examines two more policy implications that lawmakers may be concerned about: the impact on people at different income levels and in different regions, and the effects on federal revenue. In keeping with CBO's mandate to provide objective, impartial analysis, this report makes no recommendations.

The study was written by Terry Dinan and David Austin of CBO's Microeconomic and Financial Studies Division, which is directed by Roger Hitchner. Robert Dennis, Barbara Edwards, Arlene Holen, Mark Lasky, Deborah Lucas, John Peterson, and Tom Woodward of CBO provided valuable comments, as did Haynes Goddard of the University of Ohio at Cincinnati and Margaret Walls of Resources for the Future.

Christian Spoor edited the study, and Christine Bogusz proofread it. Angela McCollough and Cecil McPherson produced initial versions of the tables and figures, Kathryn Winstead prepared the study for publication, and Annette Kalicki prepared the electronic versions for CBO's Web site.

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Summary

Lawmakers concerned about the United States' dependence on foreign oil and its emissions of carbon dioxide—a key greenhouse gas—have proposed raising the corporate average fuel economy (CAFE) standards that govern cars and light-duty trucks. Improving the fuel efficiency of vehicles would reduce gasoline consumption. Another way to lower gasoline consumption is to raise the price of gasoline. Lawmakers could do that directly by increasing the federal tax on gasoline. They could also do it indirectly by setting a limit on total carbon emissions from gasoline combustion and requiring gasoline producers to hold rights (or allowances) for those emissions, which they could buy and sell among themselves after an initial allocation. That policy is known as a cap-and-trade program.

This study weighs the relative merits of tightening CAFE standards, raising the federal gasoline tax, and creating a cap-and-trade program against several major criteria:

- *Cost-Effectiveness.* Reducing gasoline consumption would impose costs (both monetary and nonmonetary) on various producers and consumers. A cost-effective policy would keep those costs to a minimum.

- *Predictability of Gasoline Savings.* How reliably would the policy bring about the desired reduction in gasoline consumption?

- *Effects on Safety.* How would the policy alter the number and severity of traffic accidents?

- *Effects on Other External Costs Related to Driving.* Reducing gasoline consumption would affect not only the United States' energy security and carbon emissions but other driving-related external costs (ones whose full weight is borne by society at large rather than by an individual). Those external costs include traffic congestion, the need for highway construction and maintenance, and emissions of air pollutants besides carbon dioxide.

In addition to those factors, the three policy options would have other implications that policymakers may care about—such as their effects on people at different income levels and in different parts of the country and their impact on the amount of revenue collected by the federal government.

Details of the Three Policy Options

Significant decreases in U.S. gasoline consumption could lead to measurable declines in both the nation's dependence on oil and its carbon emissions. Gasoline use by motor vehicles accounts for about 43 percent of U.S. oil consumption and about 11 percent of world oil consumption. It also accounts for 20 percent of U.S. emissions of carbon dioxide.

The methods to produce those declines that are examined in this study are not new concepts. Fuel economy standards have been in place since 1978; the federal government has taxed gasoline since 1932; and cap-and-trade programs have been used to address environmental problems for many years.

CAFE Standards

Under current CAFE standards, each automaker's output is divided into three fleets: imported passenger cars, domestically produced passenger cars, and light trucks (which include pickup trucks, minivans, and sport utility vehicles). To comply, a manufacturer must ensure that the average fuel efficiency of each of its fleets equals or exceeds the applicable CAFE standard. Today, those standards are 27.5 miles per gallon (MPG) for domestic or imported cars and 20.7 MPG for light trucks. (Vehicles weighing more than 8,500 pounds are exempt from CAFE requirements.) Producers must pay a penalty of $5.50 per vehicle for every 0.1 MPG that their fleet average falls below the relevant standard.

Gasoline Taxes

In 1932, the federal government levied a tax on gasoline of 1 cent per gallon—about 6 percent of the price of gasoline at that time—as a way to raise revenue. Since then, the tax rate has gradually increased; it now stands at 18.4 cents per gallon.

State and local governments also tax gasoline consumption. Currently, the average tax paid on a gallon of gasoline in the United States is about 41 cents—or roughly 27 percent of the price (assuming an average retail price of $1.50). Those 41 cents of tax include average state and local taxes of 22.6 cents.

Today, revenue from the federal gasoline tax (as well as from taxes on diesel, gasohol, and other special fuels) goes into the budget's Highway Trust Fund. That fund was created in the mid-1950s mainly to provide a dependable source of financing for the nation's Interstate highways. Since the early 1980s, revenues in the Highway Trust Fund have also been used to pay for mass transit.

Cap-and-Trade Programs

The concept of trading pollution rights (what this study calls emission allowances) was first introduced in the academic literature in 1968. Since then, the federal government has used trading programs to achieve several environmental goals, such as reducing emissions of sulfur dioxide (which cause acid rain), decreasing the lead content of gasoline, and phasing out the use of ozone-depleting chemicals.

Under the cap-and-trade program envisioned in this study, the government would set a limit on total carbon emissions resulting from gasoline combustion and issue the number of allowances corresponding to that limit. Gasoline producers and importers would be required to hold allowances for the carbon emissions that would result from the gasoline they sell in the United States. The government could auction off the allowances to gasoline companies or distribute them for free. Either way, after the initial allocation, firms would be allowed to buy and sell allowances among themselves. Holding those allowances would become a cost of doing business for gasoline companies, which would lead to higher prices at the gas pump.

Cost-Effectiveness

Policies that produced meaningful reductions in gasoline consumption would entail costs for producers and consumers. The reason is that such policies would compel producers and consumers to undertake gasoline-saving activities that they would not have found it in their best interests to pursue otherwise. The costs to producers would take the form of lower profits, and the costs to consumers would take the form of reductions in their well-being, because of both monetary costs (such as higher prices) and nonmonetary costs (such as decreased safety from driving a smaller, lighter car; reduced satisfaction from driving a less-powerful vehicle; or inconvenience associated with carpooling).

Ideally, the costs of reducing gasoline use should be weighed against the benefits (principally from fewer carbon emissions and less energy consumption). That way, policymakers could encourage gasoline reductions as long as the benefits of additional reductions exceeded the cost of additional reductions. However, quantifying the costs and benefits of gasoline reductions is difficult and is beyond the scope of this analysis.

A less challenging criterion is to design policies that are "cost-effective"—in other words, that keep losses in producers' profits and consumers' welfare to a minimum for any given level of gasoline savings. Automakers and drivers could make numerous technological or behavioral changes to use less gasoline, changes that could be combined in various ways or traded off for each other depending on their costs. Thus, policies would be most cost-effective if they gave people the flexibility and the incentive to make as many of those changes as possible. By contrast, policies that encouraged a few gas-saving activities but not others would not produce the most cost-effective reduction in gasoline consumption.

A cap-and-trade program or a well-designed increase in the gasoline tax—for example, one that applied to all uses of gasoline that could be reduced at a cost lower than the tax—would be cost-effective ways to decrease gasoline consumption. Both policies would raise the price of gasoline and thus provide an incentive for households to undertake all measures that would lower their gasoline use (provided that the cost of those measures was less than the savings in gasoline spending that would result). Such measures could include buying more-fuel-efficient vehicles, reducing their driving (for example, by carpooling or taking public transportation), improving their vehicles' maintenance, or driving more slowly.

Raising CAFE standards, by contrast, would not be a cost-effective way to cut gasoline consumption because it would not encourage all potential gas-saving activities. By focusing solely on the fuel economy of vehicles, it would give people no incentive to make gas-saving changes in their driving behavior, such as carpooling. In fact, by making vehicles more fuel efficient and thus lowering the cost of driving, higher CAFE standards could lead to more driving rather than less. Research suggests that a 10 percent increase in CAFE standards would result in roughly a 2 percent increase in the number of miles driven. That effect would reduce, though not eliminate, the gasoline savings caused by the improvement in fuel economy.

Further, the current structure of CAFE standards could encourage automakers to engage in strategies that would bring them into compliance but would not increase fuel economy—such as modifying the design of passenger cars so they would qualify as light trucks and be subject to a lower standard. Improvements in the design of CAFE standards could reduce the use of such "unproductive" compliance methods. However, improved standards would still not provide an incentive to reduce driving.

If lawmakers' primary objective was to lower carbon emissions rather than simply to decrease gasoline consumption, then a tax or a cap-and-trade program that covered all sources of carbon emissions would be more cost-effective than a policy that targeted only gasoline use. For example, a tax on the carbon content of all fossil fuels or a cap-and-trade program that applied to all sources of carbon emissions would encourage emission reductions in the utility sector, which accounts for 38 percent of U.S. carbon emissions.

Predictability of Gasoline Savings

Some lawmakers might want assurance that the policy they adopted would actually reduce gasoline consumption by a given amount. Neither an increase in CAFE standards nor a rise in the federal gasoline tax would ensure a specific decline in consumption. However, predicting the gasoline savings that would result from a rise in well-designed CAFE standards would be easier than predicting the savings from a specific increase in the gasoline tax. If CAFE standards were redesigned so that automakers had no incentive to use unproductive compliance methods, an increase in those standards would provide a fair amount of certainty about the resulting rise in fuel efficiency. Thus, estimating gasoline savings would mainly involve predicting increases in the number of miles driven. By contrast, estimating the gasoline savings from a tax increase would entail predicting increases in fuel efficiency as well as decreases in total miles driven.

Despite its greater uncertainty, an increase in the gasoline tax could be modified over time to achieve a desired reduction target. Furthermore, any given decrease in consumption could be made at a lower cost through the gasoline tax than through CAFE standards (as discussed in the previous section).

A cap-and-trade program could be constructed to reach a specific target for gasoline use. The government would issue the number of emission allowances that corresponded to that target level, and (assuming adequate enforcement) only that amount of gasoline would be sold in the United States. However, a specific target would not limit the cost of reductions in gasoline consumption. Alternatively, the government could set a maximum price for allowances and agree to sell an unlimited quantity at that price (otherwise, a fixed supply of allowances would cause the price to rise). Such a policy would be analogous to a gasoline tax: it would limit the cost of reducing gasoline consumption by another gallon but would not ensure that a given level of consumption was met.

Effects on Safety

Policy changes that lowered gasoline use could have various effects on the safety of driving. If they led to the production of smaller or lighter cars, they would tend to make accidents more dangerous, but if they led to lighter trucks, they could reduce fatalities. If policies encouraged people to drive fewer miles, they would tend to decrease the number of accidents. The safety implications of CAFE standards have been particularly controversial, and studies of the topic have produced mixed results. Virtually no research has been done on how a higher gasoline tax or a cap-and-trade program would affect the safety of driving.

Recently, a special committee of the National Research Council reviewed the empirical evidence about the safety effects of CAFE standards. Most of the committee concluded that declines in the size and weight of cars that have occurred since those standards took effect have led to increased fatalities. The committee offered an alternative design for CAFE standards intended to enhance safety. That design would discourage automakers from reducing the weight of cars as a way to comply with fuel economy standards while still encouraging them to reduce the weight of light trucks.

Effects on Other External Costs Related to Driving

The three policy options discussed in this study would have implications for various external costs that result from driving (costs that individuals do not always consider when making decisions because they do not bear the full weight of those costs). Such external costs include not only U.S. energy security and carbon emissions but also traffic congestion, the need for highway construction and maintenance, and emissions of various other air pollutants (carbon monoxide, nitrogen oxides, and volatile organic compounds—all of which, unlike carbon dioxide, are regulated by the federal government).

A higher gasoline tax or a cap-and-trade program would tend to decrease congestion, road construction and maintenance, and emissions of regulated pollutants by discouraging driving. Higher CAFE standards, by contrast, would encourage driving and thus would tend to increase those costs—with the exception of emissions of nitrogen oxides and volatile organic compounds. They would decline because lower gasoline consumption would reduce the emissions of those pollutants that occur when gasoline is produced and delivered, and such a decrease would more than offset the rise in tailpipe emissions that would result from increased driving.

Unless the policy changes that occurred were very large, the impact on those other driving-related external costs would most likely be small. In the case of traffic congestion, however, recent studies suggest that even small changes could have significant economic costs.

Other Policy Implications

The policy options in this study are not intended specifically to alter the distribution of income in the United States or to raise federal revenue. Nevertheless, increasing the gasoline tax, tightening CAFE standards, or enacting a cap-and-trade program would have distributional and revenue effects, which policymakers might want to consider.

Distributional Effects

The burden imposed by a policy change to reduce gasoline consumption will differ according to people's income level and where they live. Several researchers have looked at how the effects of a higher gasoline tax or a cap-and-trade program for carbon emissions would vary among U.S. households on the basis of those factors. For CAFE standards, however, no evidence about distributional effects is available.

Measuring the incidence (who currently bears the burden) of the federal gasoline tax is difficult because of inaccuracies in reported data on annual incomes and a lack of data on households' longer-term ability to pay the tax. Some studies indicate that a rise in the gasoline tax would be regressive—that is, would place a heavier burden on lower-income households than on higher-income ones. Other research suggests that the effect would be proportional among households in different income categories. Regardless of the initial incidence of the tax, the impact on some lower-income households would be reduced if the tax increase caused a rise in government payments (such as Social Security benefits and Supplemental Security Income payments) that are indexed to changes in consumer prices. Those payments make up a larger share of income for lower-income households than for higher-income households.

Available evidence also suggests that an increase in the gasoline tax would impose a bigger cost on people in rural areas than in urban areas. The ultimate distributional effects of the tax increase would depend on what the federal government did with the additional revenue. If laws governing the use of Highway Trust Fund revenue were changed, the government could use the additional money to offset the distributional effects of higher gasoline prices.

Like a gasoline tax, a cap-and-trade program would raise the price of gasoline. The distributional effects of that price increase would be the same as those from an equivalent price rise resulting from a gasoline tax. If the government decided to distribute emission allowances for free, the recipient gasoline companies (and, by extension, their shareholders) would receive windfall profits. That outcome would tend to benefit higher-income households, who on average receive a larger share of their income from stocks than lower-income households do. Conversely, if the government chose to auction off the allowances, the ultimate distributional effects would depend on how it used the resulting revenue.

Revenue Effects

Raising the gasoline tax would increase federal revenue. Although higher prices would discourage gasoline consumption, that effect would not be large enough to offset the additional revenue created by the higher tax rate. With changes to current law, that revenue could be used in myriad ways, such as reducing federal debt, offsetting some of the distributional effects associated with higher gasoline prices, or lowering other taxes. Using the revenue to reduce taxes on capital and labor, for example, could benefit the economy because those taxes discourage economic activity.

Tightening CAFE standards would lead to a decline in federal gasoline-tax receipts because more-fuel-efficient vehicles would use less gasoline. The dampening effect on tax receipts would grow over time as more vehicles were retired and replaced by ones that met the higher standards.

For a cap-and-trade program, the effects on revenue would depend on whether the government sold emission allowances or gave them away. If the government sold them, the effects would be similar to those of a gasoline tax, and federal revenue (including auction proceeds and gasoline-tax receipts) would rise. If allowances were distributed for free, receipts from the gasoline tax would fall, and the government would not collect any offsetting revenue from selling allowances.

Conclusions

Concerns about oil dependence and climate change have caused some policymakers to propose actions that would reduce gasoline consumption. Increasing the federal tax on gasoline, creating a cap-and-trade program for gasoline-related carbon emissions, or raising the CAFE standards could bring about such a reduction, but they would measure up differently against the various criteria considered in this analysis.

- A higher gasoline tax would be cost-effective in that it would minimize the reduction in corporate profits and consumers' welfare that would result from lower gasoline consumption. The reason is that a tax increase would provide an equal incentive for producers and consumers to undertake all possible gas-saving activities, rather than focusing on a few activities (such as improving vehicles' fuel economy). By discouraging driving, a higher gasoline tax would also tend to decrease various driving-related external costs, such as traffic congestion, the need to build and maintain highways, and emissions of regulated vehicle pollutants. However, a tax increase would not reliably ensure a given reduction in gasoline use; it would have to be modified over time to achieve a desired level of gasoline savings. Moreover, available research does not indicate how raising the federal gasoline tax would affect the safety of driving.

Studies provide conflicting evidence about how the cost of a higher federal gasoline tax would be distributed among households at different income levels, but they do find that rural households would tend to see higher cost increases than urban households would. Regardless of how those costs were distributed, an increase in the gasoline tax would boost federal revenue. The government could use that revenue in various ways, which would have differing effects on the economy as well as different distributional consequences.

- A cap-and-trade program could be constructed that would be just as cost-effective as a gasoline-tax increase and would reduce driving-related external costs to the same degree. Depending on how the program was designed, however, it could differ from a tax increase with respect to how predictably it would deliver a specific amount of gasoline savings, its distributional effects, and its impact on federal revenue. No research is available on the safety implications of a cap-and-trade program.

- Raising CAFE standards would not be a particularly cost-effective way to reduce gasoline consumption because it would rely on improving the fuel efficiency of passenger vehicles rather than encouraging the full range of gas-saving activities by producers and consumers (some of which might be less expensive). Further, by lowering the cost of operating a vehicle, higher CAFE standards could encourage people to drive more, which could increase congestion. In addition, under the standards' current design, automakers could use unproductive compliance methods that would impose costs on producers or consumers but not reduce gasoline consumption. An increase in CAFE standards would offer more certainty about achieving a specific reduction in gasoline use than a tax increase would but less than a cap-and-trade program with a fixed cap would. (The Congressional Budget Office is currently analyzing the cost of lowering gasoline consumption under alternative CAFE designs.)

  The effect of CAFE standards on safety is a controversial topic. A majority of a committee formed by the National Research Council concluded that the weight and size reduction of cars that has accompanied CAFE standards has led to more vehicle fatalities. The committee proposed an alternative design for the standards that would address safety concerns.

  An increase in CAFE standards would lead to lower revenue from the federal gasoline tax. No information is available about the possible distributional effects of higher CAFE standards, however.

Finally, the three policies described in this study are not mutually exclusive. For example, lawmakers could choose both to tighten CAFE standards and to increase the federal tax on gasoline. In fact, policies that raised the price of gasoline (such as a higher tax or a cap-and-trade program) would tend to lessen the burden of CAFE standards on automakers because they would increase consumers' demand for fuel-efficient vehicles. However, the total cost to producers and consumers of reducing gasoline consumption would be minimized by relying on policies that raise the price of gasoline rather than policies that require changes in fuel economy.

CHAPTER

1

Introduction

Members of Congress have recently discussed improving the fuel economy of cars and light trucks—a subject that is likely to continue being debated in the future. Those who support raising the corporate average fuel economy (CAFE) standards that govern passenger vehicles hope that doing so will lead to a decline in gasoline use. Such a decline could help achieve two policy goals: enhancing the United States' energy security and reducing its emissions of carbon dioxide (the predominant greenhouse gas that affects the Earth's climate).

Other policy changes could decrease gasoline consumption by raising its price. For example, lawmakers could increase the federal tax on gasoline, which now stands at 18.4 cents per gallon. Or they could institute a cap-and-trade program for the carbon dioxide emissions that result when gasoline is burned. (Those emissions are referred to here as carbon emissions for short.) Under a cap-and-trade program, the government would set a limit on carbon emissions from U.S. gasoline consumption. Companies would be required to hold rights—called allowances—for each metric ton of carbon contained in the gasoline that they produced or imported for domestic consumption. Holding the allowances would become a cost of doing business and would lead to higher prices at the gas pump.

A mandated increase in CAFE standards, a rise in the gasoline tax, and a cap-and-trade program could achieve the same policy goals, but they would have very different consequences. (Although the three policy options are not mutually exclusive, their relative merits are clearer when the policies are considered individually.) This study compares those policy options on the basis of their cost-effectiveness, the predictability with which they would curb gasoline use, their implications for the safety of driving, and their effects on other driving-related factors, such as congestion, highway construction, and emissions of pollutants other than carbon dioxide. In addition, the analysis looks at those policies' distributional effects—how their impact would vary among regions and among people at different income levels—and their effects on federal tax revenues.

This study does not examine the full array of policies that could ultimately reduce gasoline consumption. For example, the Department of Energy and the U.S. Council of Automotive Research have announced a partnership to promote the development of hydrogen as a primary fuel for cars and trucks. If successful, that effort could lower gasoline use substantially, but the results would not be realized for many years. This study focuses on more-direct policies that could decrease gasoline consumption within the next two decades.

The Rationale for Reducing Gasoline Consumption

The security of the United States' energy supplies was a major concern during the 1970s, when CAFE standards were introduced. That concern is still voiced by some lawmakers today. Energy security can be measured in many ways—for example, as the share of the nation's total demand for energy that is met by imports, or as the military cost of protecting oil supplies from the Persian Gulf, or as the economic cost that is avoided when the world's oil supplies are not disrupted. The Congressional Budget Office (CBO) believes that the last measure is the most useful. Thus, it considers the most relevant benefits of energy security to be the macroeconomic losses from higher oil prices that are avoided when there are no political disruptions to oil supplies. Many analysts argue that the United States would be less vulnerable to such disruptions if it used less oil. Consumption of finished motor gasoline (which is derived from oil) accounts for about 43 percent of U.S. petroleum use—and about 11 percent of world petroleum use.[1]

Reducing U.S. oil consumption could have other benefits. Because the United States is such a large consumer, a significant drop in its demand would tend to lower the world price of oil. If collusion by oil suppliers did not keep that price from falling, a policy that reduced U.S. consumption would save money not only because the nation would buy less oil but because it would spend less on the oil it did buy.[2]

Concern about climate change is another driving force behind policymakers' desire to decrease gasoline consumption. A recent report on CAFE standards by the National Research Council cited that concern as the key reason to make a policy change.[3] Scientists have known for more than a century that rising concentrations of carbon dioxide and other gases in the atmosphere affect the Earth's climate. Burning a gallon of gasoline releases 8.9 kilograms of carbon dioxide into the atmosphere.[4] Carbon emissions make up 84 percent of the United States' emissions of greenhouse gases, and motor vehicles account for 20 percent of U.S. carbon emissions.

Carbon dioxide emissions differ from several other vehicle pollutants in that they are unregulated. For emissions of hydrocarbons and carbon monoxide, for example, the federal government sets a limit of so many grams per mile driven. Vehicles must have pollution-control equipment (and, in some states, periodic emission inspections) to meet those limits. Consequently, gas-guzzling cars do not emit more of those pollutants than fuel-efficient cars do, so improvements in fuel economy would not lead directly to decreases in those emissions. That is not the case for carbon dioxide, however. Reductions in gasoline consumption would lead to roughly proportional reductions in carbon emissions.

Although lowering gasoline use significantly could lessen dependence on oil and decrease carbon emissions, it would impose costs on the U.S. economy. A decline in gasoline consumption would make society better off only if the cost of achieving the decline was less than its benefits. Ideally, the United States would lower its gasoline use as long as the benefit of additional reductions exceeded the cost of additional reductions. However, quantifying the benefits and costs of lower gasoline consumption and identifying the optimal level of reduction are beyond the scope of this study. Instead, this analysis compares policies on the basis of whether they would bring about a given reduction at the lowest possible cost.

A Brief History of the Three Policy Options

The policies discussed in this study are not new concepts. The federal government has used a gasoline tax to raise revenue since 1932. Fuel economy standards have been in place since the late 1970s. And cap-and-trade programs have been used for years to address a variety of environmental problems.

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1. Data on finished motor gasoline as a share of U.S. oil use come from Energy Information Administration, *Petroleum Supply Annual 2001*, vol. 1 (June 2002), Table 2 (available at www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/current/pdf/table_02.pdf). The United States accounts for approximately 26 percent of world oil consumption; see Energy Information Administration, *International Petroleum Monthly* (August 2002), Table 2.4 (available at www.eia.doe.gov/emeu/ipsr/t24.txt).

2. Under collusion, a cartel of oil suppliers would scale back production, artificially limiting supply in an effort to keep the price of oil at the level that had existed before U.S. demand dropped. Under competition, by contrast, the lowest-cost oil supplies would be brought to market to meet the reduced demand at a reduced price, and oil supplies that cost more to market than the new, lower price would be idled.

3. See National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, D.C.: National Academy of Sciences, 2002), p. 8.

4. Ibid., p. 85.

CAFE Standards

Corporate average fuel economy standards were mandated by the Energy Policy and Conservation Act of 1975. All manufacturers that sell more than 10,000 vehicles in a given year must comply with the standards. Each manufacturer's output is divided into four categories: imported passenger cars, domestically produced passenger cars, two-wheel-drive light trucks, and four-wheel-drive light trucks.[5] (Light trucks include pickup trucks, minivans, and sport utility vehicles, or SUVs.) To comply, a manufacturer must ensure that the average fuel efficiency of its vehicles in a particular category meets or exceeds the standard for that category. Imported and domestically produced cars have the same standard, but a manufacturer's imported and domestic fleets must comply with that limit separately. Since 1992, manufacturers have had to meet a combined standard for their two-wheel-drive and four-wheel-drive trucks. Vehicles that weigh more than 8,500 pounds are exempt from CAFE requirements.

Producers that fail to meet CAFE standards must pay a penalty of $5.50 per vehicle for every 0.1 mile per gallon (MPG) that their fleet average falls below the relevant standard. Manufacturers can use "credits"—which they earn by producing alternative-fuel vehicles or by exceeding CAFE standards in a given year—to determine their compliance. Credits may be carried forward or backward up to three years.

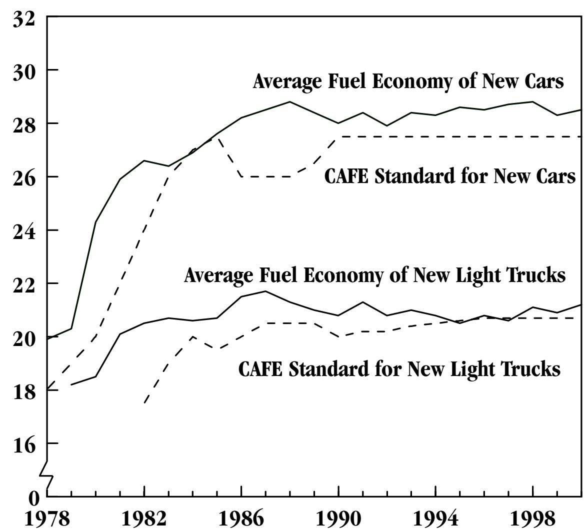
When the CAFE requirements took effect in 1978, new cars had to meet a standard of 18 MPG. Today's standard for cars is 27.5 MPG and has remained at that level since 1990 (*see Figure 1*). The current standard for light trucks is 20.7 MPG.

Over the past 15 years, the average fuel economy of new cars and light trucks has improved little. Meanwhile, the average horsepower of new cars has increased by more than 30 percent, and the average weight has risen by over 10 percent (*see Table 1*). With CAFE standards unchanged and real prices for gasoline relatively constant (as discussed below), recent improvements in technology have been aimed at adding power to vehicles, while continuing to comply with current CAFE standards, rather than at increasing fuel economy.

Figure 1.

Vehicles' Average Fuel Economy Compared with CAFE Standards, Model Years 1978-2000

(Miles per gallon)



Source: Congressional Budget Office based on data from the National Highway Traffic Safety Administration (available at www.nhtsa.dot.gov/cars/problems/studies/fuelecon/).

Note: Light trucks include pickup trucks, minivans, and sport utility vehicles.

Gasoline Taxes and Prices

The federal government levied its first tax on gasoline in 1932 at a rate of 1 cent per gallon—approximately 6 percent of the price of gasoline at that time. By 1950, the tax had risen to 15 cents per gallon. Since then, it has gradually increased to 18.4 cents per gallon.[6] That tax covers nearly all on-road uses of gasoline, except purchases by state and local governments. Off-road commercial uses (including farming, construction, and timber harvesting) are exempt from the tax.

5. An automobile generally qualifies as domestically manufactured if at least 75 percent of its cost to the manufacturer is attributable to value added in the United States or Canada.

6. Adjusted for inflation, the gasoline tax has ranged from a low of 6 cents per gallon in 1982 to a high of 19.6 cents per gallon in 1993 (measured in 1996 dollars).

Table 1.

Average Characteristics of New Cars, Model Years 1978-2000

Model Year	Fuel Economy (Miles per gallon)	Curb Weight (Pounds)	Interior Space (Cubic feet)	Engine Size (Cubic inches)	Horsepower per 100 Pounds of Weight
1978	19.9	3,349	112	260	3.68
1979	20.3	3,180	110	238	3.72
1980	24.3	2,867	105	187	3.51
1981	25.9	2,883	108	182	3.43
1982	26.6	2,808	107	173	3.47
1983	26.4	2,908	109	182	3.57
1984	26.9	2,878	108	178	3.66
1985	27.6	2,867	108	177	3.84
1986	28.2	2,821	106	169	3.89
1987	28.5	2,805	109	162	3.98
1988	28.8	2,831	107	161	4.11
1989	28.4	2,879	109	163	4.24
1990	28.0	2,908	108	163	4.53
1991	28.4	2,934	108	164	4.42
1992	27.9	3,007	108	169	4.56
1993	28.4	2,971	109	164	4.62
1994	28.3	3,011	109	169	4.79
1995	28.6	3,047	109	166	4.87
1996	28.5	3,047	109	164	4.92
1997	28.7	3,071	109	164	4.95
1998	28.8	3,075	109	161	5.05
1999	28.3	3,116	110	166	5.21
2000	28.5	3,126	111	167	5.27

Source: Congressional Budget Office based on data from the National Highway Traffic Safety Administration (available at www.nhtsa.dot.gov/cars/problems/studies/fuelecon/).

The federal government also taxes diesel, gasohol, and other special fuels. Revenue from those taxes, the gasoline tax, and various truck-related taxes goes into the Highway Trust Fund. That fund was created in 1956 primarily to ensure a dependable source of financing for the National System of Interstate and Defense Highways. Initially, it was used exclusively for highways, but in 1983 an account was established to fund mass transit needs. The balance in the Highway Trust Fund stood at $27.7 billion at the end of fiscal year 2001. Of that amount, $20.4 billion was directed to the highway account and $7.4 billion to the mass transit account. Excise taxes on gasoline brought $20.1 billion into the Highway Trust Fund in 2001.

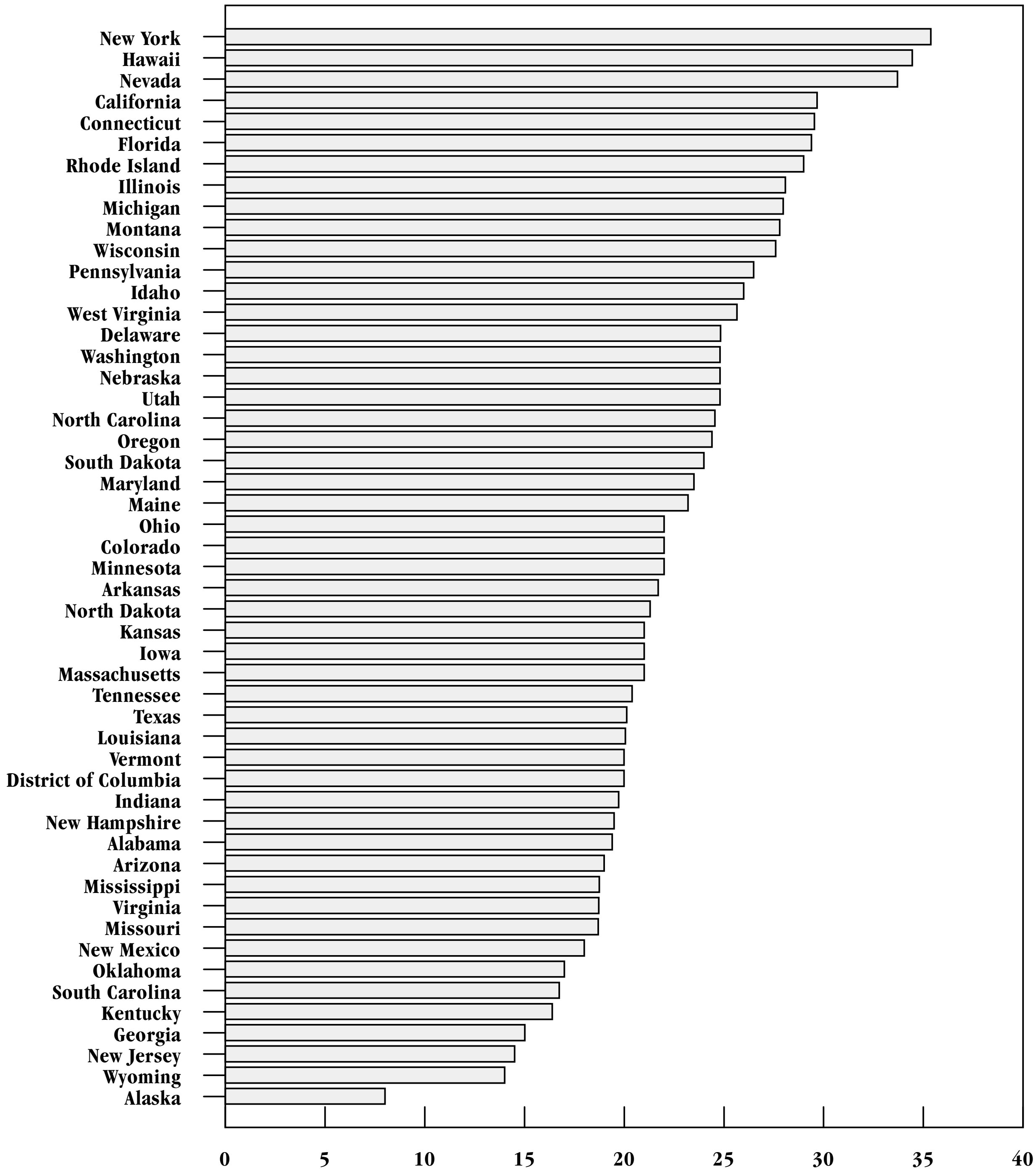
In addition to the federal government, state and local governments tax gasoline consumption. Total state and local taxes—including per-gallon taxes, sales taxes, and environmental fees—vary from a high of 35 cents per gallon in New York to a low of 8 cents per gallon in Alaska (*see Figure 2*). The average tax paid on a gallon of gasoline in the United States is about 41 cents, which includes the federal tax of 18.4 cents and average state and local taxes of 22.6 cents.

Although the federal tax on gasoline has changed gradually, the price of gasoline (including taxes paid) has moved much more dramatically. Nevertheless, in real terms (adjusted for inflation), the price of gasoline has been relatively stable for the past 15 years. In 2000, the nominal price of gasoline was over five times higher than it had been in 1950, but the real price was lower than in 1950 (*see Figure 3*). The real price of gasoline hit an all-time high of $2.17 in 1981 (measured in 1996 dollars). But it hovered between $1.20 and $1.35 in 11 of the 15 years

Figure 2.

Total State and Local Gasoline Taxes, End of 2001

(Cents per gallon)



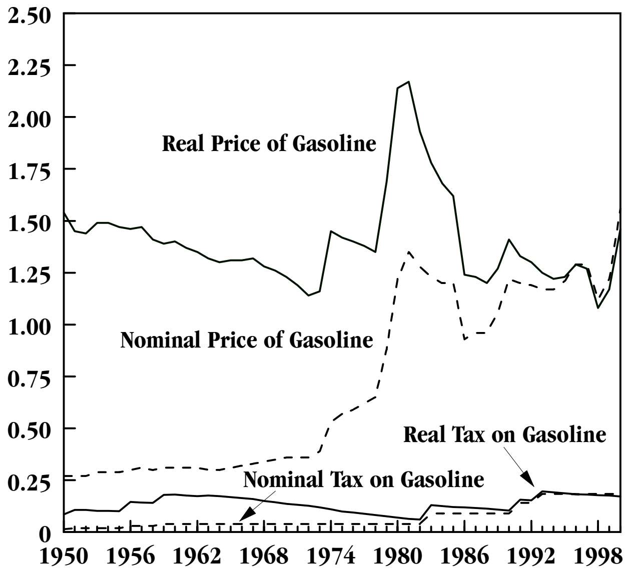
Source: Congressional Budget Office based on data from the Minnesota House of Representatives Research Department (available at www.house.leg.state.mn.us/hrd/pubs/gastax.pdf).

Note: Numbers include state and local sales taxes on gasoline and special per-gallon fees used to fund environmental cleanup programs.

Figure 3.

Gasoline Prices and Federal Gasoline Taxes, 1950-2000

(1996 Dollars)



Source: Congressional Budget Office based on data from the Energy Information Administration and the Federal Highway Administration (available at www.eia.doe.gov/emeu/aer/ttt/tab0522.htm and www.fhwa.dot.gov/ohim/hs00/fe101a.htm).

Note: Real numbers are adjusted to account for inflation.

from 1986 to 2000. That recent stability in the real price of gasoline has contributed to consumers' lack of interest in fuel economy and to the trend toward larger and more powerful vehicles.

Cap-and-Trade Programs

The concept of trading in pollution rights (what this study calls emission allowances) first appeared in the academic literature in 1968. Trading programs have been used to achieve various environmental objectives, such as gradually lowering the amount of lead in gasoline and phasing out the use of ozone-depleting chemicals.[7]

The first federal trading program with a fixed cap applied to sulfur dioxide emissions by electricity generators. That program, which began in 1995, was designed to reduce damage from acid rain. More recently, the Environmental Protection Agency issued a rule that would require 22 eastern states and the District of Columbia to reduce their emissions of nitrogen oxides, a major component of smog. States could allow sources of nitrogen oxides within their borders to participate in a trading program with other sources throughout the affected region.[8]

Under the program envisioned here, the government would set a cap on the total amount of carbon contained in all of the gasoline consumed in the United States and enforce the cap by issuing a limited number of allowances.[9] The government could sell the allowances to gasoline producers and importers or distribute them for free. After the initial allocation, producers and importers would be permitted to buy and sell allowances among themselves.

The Evaluation Criteria Used in This Study

A rise in CAFE standards, an increase in the gasoline tax, and a cap-and-trade program would differ in various ways. This study highlights those differences by evaluating the performance of the three policies against four main criteria:

- *Cost-Effectiveness.* Reducing gasoline use would impose costs on consumers and producers. Would the policy create incentives that would keep those costs to a minimum?

- *Predictability of Gasoline Savings.* How reliably would the policy achieve the desired decrease in gasoline consumption?

7. For an overview of a wide variety of state and federal environmental trading programs, see Robert C. Anderson and Andrew Q. Lohof, *The United States' Experience with Economic Incentives in Environmental Pollution Control Policy* (report prepared for the Environmental Protection Agency by the Environmental Law Institute, August 1997).

8. For more information about that program, see Congressional Budget Office, *Factors Affecting the Relative Success of EPA's NO_x Cap-and-Trade Program* (June 1998).

9. All of the carbon in a gallon of gasoline is released when the gasoline is burned, and no abatement equipment exists that can reduce that amount. Thus, limiting carbon emissions from gasoline combustion would be equivalent to limiting gasoline production and use.

- *Safety Effects.* How would the policy affect the number and severity of traffic accidents?

- *Other Driving-Related External Costs.* How would the policy affect other external costs (ones borne by society at large rather than by an individual) that result from driving? Those costs include traffic congestion, the need for highway maintenance, and emissions of vehicle pollutants other than carbon dioxide.

Those criteria are described in detail in Chapters 2 through 5.

In addition to those effects, the three policy options would have other implications that lawmakers may care about. Those include:

- *Distributional Effects.* How would the costs of the policy be distributed among U.S. households at different income levels and in different parts of the country?

- *Revenue Effects.* How would the policy affect the amount of revenue collected by the federal government?

Those criteria are examined in Chapter 6.

CHAPTER

2

Cost-Effectiveness

Gasoline consumption can be reduced in many ways—through technological improvements in the design of vehicles as well as through a variety of behavioral changes on the part of motorists. For example, manufacturers could increase the fuel economy of new vehicles or produce vehicles that use alternative fuels, such as ethanol. Consumers could purchase relatively fuel-efficient vehicles and hasten the retirement of older, less efficient ones. They could shift some of their driving to the most efficient car they own, reduce the number of miles they drive (such as by carpooling, using public transportation, or forgoing long trips), maintain their vehicles better, or drive more slowly.

Each of those gas-saving activities would impose costs on the producer or consumer who undertook it. People can be expected to make such changes voluntarily when the benefits to them would outweigh the costs. For example, drivers would choose more-fuel-efficient vehicles if they anticipated that their gasoline savings would be greater than the disadvantages that might be associated with such vehicles (say, a higher price or less horsepower). Likewise, manufacturers would voluntarily improve the fuel economy of their vehicles if they expected that doing so would boost their profits.

If the federal government raised the gasoline tax, tightened CAFE standards, or created a cap-and-trade program, it would generate further gasoline savings by inducing producers and consumers to undertake such activities to a greater degree than they would otherwise.[1] In all three cases, the costs to producers would take the form of lower profits, and the costs to consumers would take the form of reductions in their well-being, because of both monetary costs (such as price increases) and nonmonetary costs (such as reduced satisfaction from driving a less-powerful vehicle or inconvenience associated with carpooling).

The three policy options would differ in which parties they would affect directly and indirectly. Raising the tax would have a direct impact on consumers of gasoline because it would increase the amount they could save by reducing their gasoline use. It would affect automakers and gasoline producers indirectly by raising consumers' demand for fuel economy in new vehicles and lowering their demand for gasoline. A cap-and-trade program, in contrast, would affect gasoline producers and importers directly by requiring them to hold emission allowances. It would have an indirect effect on gasoline consumers (who would face higher prices) and on automobile producers (who would see greater demand for fuel economy). Raising CAFE standards, unlike the other two policies, would have a direct impact on automakers by requiring them to meet more-stringent fuel economy standards. It would affect car buyers indirectly through changes in the vehicle characteristics that manufacturers offered and the prices they charged.

1. Given recent gasoline prices, automakers have found it most profitable to produce vehicles that just meet CAFE standards. Higher standards would therefore compel automakers to sell more-fuel-efficient vehicles than consumers want and would impose costs on both producers and consumers. If gasoline prices rose significantly, an increase in CAFE standards might not impose costs, because higher gasoline prices would boost consumers' demand for fuel-efficient vehicles. In that case, however, the gasoline savings would have occurred even in the absence of tighter CAFE standards.

Higher CAFE standards would also affect gasoline producers indirectly by lessening the demand for gasoline.

Some proponents argue that raising CAFE standards would not impose any costs. They contend that automakers have low-cost ways to improve fuel economy, that the gasoline savings from those technologies would make consumers better off, and that without increases in CAFE standards, producers would fail to make use of those technologies. Their argument rests on the assumption either that consumers lack information about vehicles' fuel efficiency (in other words, they do not know what is best for them) or that producers lack an incentive to respond to consumers' preferences for fuel efficiency. (That issue is discussed in detail later in this study; see Box 2 on page 16.)

Most economists do not believe that either assumption is valid. Vehicles' current level of fuel efficiency most likely reflects consumers' trade-offs between fuel economy and other characteristics that drivers want, such as vehicle size, horsepower, and safety. The same technologies that can be used to boost fuel economy can be used to hold fuel economy constant while increasing vehicles' weight, size, or power. Thus, the fact that producers have done the latter rather than the former in recent years suggests that they have responded to buyers' preferences by targeting available technologies toward other features that consumers desire. Raising CAFE standards would impose costs on both consumers and automobile producers by forcing improvements in fuel economy that car buyers may not want.

Society would be best off if the costs of a policy to decrease gasoline consumption were weighed against the benefits of the decrease. In an ideal world, policymakers would encourage reductions in gasoline use up to the point at which the incremental cost—the cost of reducing an additional gallon of gasoline—that those reductions would impose on producers and consumers equaled the incremental benefit that would result (from fewer carbon emissions and less energy consumption). However, quantifying the benefits and costs of such reductions to determine that ideal point is a difficult task and one that is beyond the scope of this analysis.

A less demanding criterion is to make policy changes that are "cost-effective"—in other words, that keep the decline in producers' profits and consumers' welfare to a minimum for any given level of gasoline savings. The incremental cost of a gasoline-saving activity will rise as the level of that activity grows. (For example, if automakers sought higher and higher levels of fuel economy, the cost of making an additional improvement in fuel economy would increase.) Because producers and consumers have so many methods to reduce gasoline use, which can be combined in various ways or traded off for each other, policies would be most cost-effective if they gave people the flexibility to pursue as many of those methods as possible, up to the point at which each method reached the same incremental cost. (For instance, the total cost of decreasing gasoline consumption could be lessened by relying more heavily on reduced driving and less heavily on improvements in fuel efficiency if the incremental cost for the former activity was lower than for the latter.) By contrast, policies that put all of their eggs in a few baskets—by encouraging some gas-saving activities but not others—would not produce the most cost-effective reductions in gasoline use.

The Cost-Effectiveness of Raising CAFE Standards

Increasing the stringency of CAFE standards would most likely reduce gasoline consumption, but it would not do so in a cost-effective way. The reason is that CAFE standards do not directly encourage either producers or consumers to decrease gasoline use, so they do not offer the flexibility or the incentives for gasoline reductions to occur at the lowest possible cost. That lack of cost-effectiveness springs in part from shortcomings in the current design of CAFE standards, which would allow automakers to comply with higher standards in ways that would not increase the average fuel economy of their vehicles. It also springs from problems that are intrinsic to any policy that regulates fuel economy instead of providing a direct incentive to reduce gasoline consumption.

Automakers' Compliance Strategies

Raising CAFE standards gives manufacturers a strong incentive to increase the average fuel economy of the vehicles they sell (because otherwise they must pay a fine). Automakers could use five different strategies, individually or in combination, to comply with higher standards.

First, and most obvious, they could improve the fuel economy of some or all of the vehicles they sell through technological changes. One general way to boost a vehicle's fuel economy is to increase the overall efficiency of its power train (the mechanism that transfers power from the engine to the axles) in order to reduce energy losses. Another way is to decrease the amount of energy needed to propel the vehicle, by altering its weight, aerodynamics, rolling resistance, or the power drain on the engine from components such as the cooling fan and the air-conditioning compressor.[2]

Second, manufacturers could give consumers financial incentives to buy their more-fuel-efficient vehicles. That strategy, called mix shifting, involves subsidizing (through lower prices) the sale of more-fuel-efficient vehicles and charging a premium (through higher prices) for less-fuel-efficient ones. Because there are separate standards for cars and light trucks, mix shifting could occur within each category but not between categories. Some studies have shown that mix shifting is more expensive than technology improvements and that although some mix shifting takes place, automakers have relied mainly on technological changes to comply with CAFE standards.[3]

Third, manufacturers could alter the domestic content of their vehicles. Because they must comply with separate (though identical) standards for their domestic and imported fleets, automakers cannot use relatively fuel-efficient imports to offset less efficient domestically produced vehicles. (Imported cars are typically more fuel efficient than domestic ones because they also cater to foreign markets, where consumers often face higher gasoline prices than in the United States.) By altering the amount of their vehicles' value that is produced in the United States or Canada so that domestic cars can be reclassified as imports, automakers could use the higher fuel economy of their imported fleet to offset the lower fuel economy of what would otherwise be domestic vehicles. One researcher has concluded that such a strategy could lower manufacturers' compliance costs significantly, but the extent to which they have used it is unknown.[4]

Fourth, automakers could alter the design of cars so that they would be reclassified as trucks and thus face a lower CAFE standard. Anecdotal evidence of that practice exists (for example, Chrysler's PT Cruiser, which can carry just four passengers and cannot tow a trailer, qualifies as a truck because it has a removable backseat). However, the extent of that practice is unknown.[5]

Policymakers established a lower CAFE standard for light trucks because when the standards were created, light trucks were primarily work and cargo vehicles that needed extra power, different gearing, and less aerodynamic designs to perform their work-related functions. At that time, they accounted for about 20 percent of new vehicles sold. Today, light trucks constitute nearly half of new vehicles sold, and many of them are used almost exclusively for personal transport rather than for work or cargo.[6]

2. For a detailed discussion of technologies for improving fuel economy, see National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, D.C.: National Academy of Sciences, 2002).

3. Andrew Kleit found evidence of mix shifting in 1999 and concluded that it was a very expensive compliance strategy; see Andrew N. Kleit, *Short- and Long-Range Impacts of Increases in the Corporate Average Fuel Economy (CAFE) Standard* (Washington, D.C.: Competitive Enterprise Institute, February 7, 2002), available at www.cei.org/pdf/2398.pdf. David Greene and Yuehui Fan found that mix shifting had little effect on the gains in fuel economy that occurred between 1975 and 1993; see David L. Greene and Yuehui Fan, *Transportation Energy Intensity Trends: 1972-1992,* Transportation Research Record No. 1475 (Washington, D.C.: Transportation Research Board, 1995).

4. See Pinelopi Koujianou Goldberg, "The Effects of the Corporate Average Fuel Efficiency Standards in the US," *Journal of Industrial Economics*, vol. 46, no.1 (March 1998), pp. 1-33.

5. National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards*, p. 88.

6. Ibid, p. 88.

Box 1.

Making CAFE Standards More Cost-Effective by Improving Their Design

The same level of fuel efficiency that corporate average fuel economy (CAFE) standards require today might be achieved at a lower cost if the current CAFE program was restructured. That program includes distinct standards for cars and light trucks, requires automakers to comply separately for domestic and imported cars, and makes each company meet the standards individually rather than measuring compliance at the industry level. All three of those features limit manufacturers' behavior without reducing gasoline consumption. Easing those constraints could potentially lower the costs of complying with the current CAFE standards.

Setting a Single Standard for All Vehicles

Reducing gasoline consumption imposes some monetary and nonmonetary costs on producers and consumers; the issue is how best to minimize those costs. With most automakers required to meet several standards (for domestic cars, foreign cars, and light trucks), total costs will generally not be kept to a minimum. The reason is that the costs of complying with separate standards tend to be unequal at the margin (the point at which a final expenditure, price change, or weight reduction just brings a firm into compliance). Inequalities in marginal compliance costs indicate that the total cost of the CAFE program can be reduced without lowering overall fuel economy.

Any given level of fuel efficiency could be achieved more cheaply by allowing manufacturers to undercomply where their marginal costs were highest, as long as they overcomplied by an equivalent amount (in terms of gasoline savings) where their costs were lower. For instance, it may be cheaper for an automaker to save "one more gallon" of gasoline by raising the average mileage of its light trucks somewhat than by raising the average mileage of its domestic cars slightly. Likewise, a firm might be able to increase average mileage more cheaply for its imported vehicles than for its domestic fleet. If a unified standard applied to all of an automaker's light-duty passenger vehicles—including light trucks and domestic and imported cars—companies would be free to take advantage of such cost-saving trade-offs.

Moreover, if it was appropriately designed, a unified standard would eliminate manufacturers' incentives to use unproductive compliance methods. In other words, firms could not reduce compliance costs by designing cars that could be classified as trucks or by altering production practices so that cars were classified as imported instead of domestic. Further, a unified standard would not give consumers an incentive to switch from cars to trucks, since trucks would no longer be subject to less-stringent fuel economy requirements.

Making the transition to a single standard for all vehicles could pose difficulties, however. A unified standard that reflected the current average fuel economy of all new light-duty vehicles sold would benefit manufacturers that sell mainly cars and penalize firms that sell mainly trucks. For example, the existing car and truck standards (27.5 and 20.7 miles per gallon, respectively) and the roughly 50/50 mix of current car and truck sales imply a unified standard of 24.1 MPG. An automaker that produced 75 percent trucks and 25 percent cars and just met the separate car and truck standards would have an average mileage rating of 22.4 MPG for its total fleet. That firm would be out of compliance under the unified standard, even though it had been in compliance with the separate standards. In contrast, a company that produced 75 percent cars and 25 percent trucks and also just met the separate standards would have a combined fleet average of 25.8 MPG, which would exceed the unified standard.

One way around that problem would be to set a separate unified standard for each manufacturer—one that reflected the current requirements for cars and trucks as well as the manufacturer's existing mix of car and truck sales. Such a standard would not alter automakers' compliance status.

Box 1.

Continued

(In the above example, the first company would be required to meet a unified standard of 22.4 MPG, and the second company would have to meet a unified standard of 25.8 MPG.) But that design would "grandfather" lower standards for manufacturers that now produce a relatively large share of trucks. Alternatively, each automaker's standard could be adjusted annually to reflect that year's mix of car and truck sales. However, such an adjustment would not eliminate companies' incentives to use one unproductive compliance method. Specifically, manufacturers would be able to lower their overall compliance requirements by making vehicles that could be classified as light trucks rather than as passenger cars.

Setting a Standard for the Industry as a Whole

Under a unified standard for cars and trucks, cost differences would still generally exist among automakers because of differences in the average size and performance attributes of their vehicles and in their manufacturing costs. One way to reduce total costs would be to lessen differences in compliance costs among companies. That could be accomplished through fuel economy credit trading.[1]

Under such a trading system, the government would set a fuel economy standard for the entire auto industry. Manufacturers that exceeded the standard would generate credits, which they could sell to firms that fell below the standard. (The credits would be measured in gallons of gasoline saved.) Each company's compliance would be based on the fuel economy of the vehicles it sold in a given year, plus the number of fuel economy credits it held. Automakers with lower marginal compliance costs could raise their average MPG ratings above the required level in order to generate credits to sell. Other companies could buy those credits to make up a shortfall in their fleets' mileage ratings.[2] It would be cheaper for high-cost firms to buy credits than to achieve the standard directly. (That is roughly the same principle that underlies cap-and-trade programs, in which sources of pollution trade emission allowances.)

Letting overcomplying firms sell fuel economy credits to undercomplying firms could minimize total costs to producers and consumers. However, if the industrywide standard was a unified one covering both cars and trucks, credit trading would transfer wealth within the auto industry from companies that now sell a majority of trucks (and would need to buy credits under the unified standard) to companies that now sell a majority of cars (and would have excess credits to sell under the new standard). Of course, credit trading could be implemented either with or without a unified standard for all vehicles.

The potential for credit trading to reduce total compliance costs would depend on how much those costs would vary among automakers in the absence of trading. The greater that variation, the greater the possible savings from trading. Further, credit trading would minimize compliance costs only if the market for credits was competitive—that is, if no buyer or seller could influence the price of credits. More research is needed to determine the extent to which credit trading could actually lower the overall cost of meeting CAFE standards. The Congressional Budget Office is currently analyzing that issue.

1. Such trading was recommended in National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, D.C.: National Academy of Sciences, 2002).

2. Because some manufacturers already achieve greater fuel economy than the current standards require, credit trading could increase gasoline consumption if the standards themselves were not also raised. The reason is that sales of credits by overcomplying firms allow the buyers of the credits to undercomply by an equivalent amount. That would let some companies expand their sales of less-fuel-efficient vehicles. Alternatively, standards could be tightened enough to leave total gasoline consumption unchanged.

Fifth, manufacturers could make "flex-fuel" vehicles—which can operate on ethanol as well as gasoline—as part of their compliance strategy. The government assumes that such vehicles will be operated on gasoline only half of the time, and it counts only miles per gallon of gasoline for compliance purposes. For example, a vehicle that got 20 miles per gallon when running solely on gasoline would be classified as a vehicle with a fuel efficiency of 33 MPG if it was also capable of running on ethanol.[7]

Problems with the Current Design of CAFE Standards

Raising CAFE standards would fall short of the cost-effectiveness ideal in part because of the current design of those standards. As noted above, automakers can comply with them in ways that do not lead to lower gasoline use. Altering the manufacture or design of vehicles so they count as imported rather than domestic or as light trucks rather than cars neither raises the overall fuel economy of passenger vehicles nor reduces gasoline consumption. Producing flex-fuel cars can also achieve CAFE compliance without decreasing gasoline use if those cars are not actually run on ethanol, as seems to be the case.[8] The lower the price of gasoline—and hence the less that buyers want relatively fuel-efficient cars—the more incentive manufacturers have to find ways of complying with CAFE standards that do not involve altering the fuel economy of their vehicles and do not lead to lower gasoline consumption.

In addition, manufacturers can avoid CAFE constraints altogether by producing vehicles that exceed 8,500 pounds. For example, the Ford Excursion, which is used as a passenger vehicle, weighs more than 8,500 pounds and thus is not subject to any CAFE limit.

If higher standards caused car prices to increase more than light-truck prices, some consumers might switch from buying cars to buying light trucks that use more gasoline.[9] Such switching would not put manufacturers out of compliance but would lead to greater gasoline consumption.

Another problem with the standards' current design is that since each manufacturer must meet CAFE standards for its own fleet, the incremental cost of further improvements in fuel economy will differ among automakers. The total cost of improving fuel economy would be lower if manufacturers with relatively high compliance costs were allowed to undercomply, so long as manufacturers with relatively low costs overcomplied by the same amount (as measured in gasoline consumption).[10]

Those shortcomings of the CAFE program could be reduced by making various design modifications to the current standards. (For more details, *see Box 1* on page 12.)

Problems with Targeting Fuel Economy

Even if the previous shortcomings were addressed, raising CAFE standards would not be cost-effective for at least two reasons, which are intrinsic to any policy that targets fuel economy. First, those standards do not give people an incentive to change their driving habits in ways that would reduce gasoline use. Instead, CAFE-induced improvements in the fuel efficiency of new vehicles would lower the cost of driving those vehicles and could cause their owners to drive more. Researchers generally assume that a 10 percent decline in the fuel-related costs of driving

7. Those MPG figures account for the fact that ethanol is 15 percent gasoline; they assume that such a vehicle would get 15 MPG running on ethanol. See Richard C. Porter, *Economics at the Wheel* (San Diego: Academic Press, 1999).

8. Using information from the Energy Information Administration, the National Research Council estimated that less than 1 percent of the fuel consumed by flex-fuel vehicles in 1999 was ethanol; the rest was gasoline. See National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards*, p. 89. Moreover, in 2000, only 113 fueling stations in the United States offered ethanol; see Department of Energy, *Transportation Energy Data Book: Edition 21* (October 2001), Table 7-15 (available at www-cta.ornl.gov/data/tedb21/Spreadsheets/Table7_15.xls).

9. One study suggests that consumers will respond that way, but its results are illustrative rather than based on empirical data. See Steven G. Thorpe, "Fuel Economy Standards, New Vehicle Sales, and Average Fuel Efficiency," *Journal of Regulatory Economics*, vol. 11 (1997), pp. 311-326.

10. Equivalent increases or decreases in MPG ratings would not produce equivalent changes in gasoline consumption. For example, raising fuel economy from 33 MPG to 34 MPG would save 0.09 gallons per 100 miles driven, whereas lowering fuel economy from 21 MPG to 20 MPG would increase gasoline use by 0.24 gallons per 100 miles.

leads to about a 2 percent increase in the number of vehicle miles driven.[11]

Second, an increase in CAFE standards could cause some drivers to delay buying new vehicles and instead operate their older, less-fuel-efficient ones longer. Such delays would tend to occur if manufacturers complied with higher CAFE standards by making technological changes that raised car prices. Although all old vehicles would be retired eventually, delaying new-car purchases would postpone the full realization of the fuel-saving benefits associated with technology improvements.[12]

The Cost-Effectiveness of Raising the Gasoline Tax

A well-designed increase in the federal tax on gasoline would give consumers a direct incentive to reduce gasoline consumption. As a result, it would encourage them to undertake all of the activities that could lead to lower gasoline use. Consumers would have an incentive to drive less, to rely more heavily on the most fuel-efficient car they owned, to retire gas-guzzling vehicles earlier, and to buy more-fuel-efficient vehicles. In general, people engage in each of those activities up to the point at which the cost of the activity equals the savings in gasoline spending that it brings about. A higher gasoline tax would encourage consumers to undertake more of each of those activities by increasing the value of their gasoline savings. Thus, it could lead to a cost-effective reduction in gasoline consumption.

Moreover, an increase in the gasoline tax would not create incentives for manufacturers to make unproductive design changes that would raise their fleets' MPG ratings by reclassifying vehicles without reducing gasoline use. With a gasoline-tax hike, sales of more-fuel-efficient vehicles would increase (relative to sales of less-fuel-efficient ones) and the fuel economy of vehicles would improve because of changes in consumer demand, not because manufacturers had to meet regulatory requirements.

To be most cost-effective, an increase in the gasoline tax would need to be well designed in at least two ways. First, it would have to cover all uses of gasoline that could be reduced at a cost lower than the tax. As noted in Chapter 1, gasoline purchased by state or local governments or for off-road commercial uses is exempt from the tax. The extent to which such exemptions would reduce the cost-effectiveness of a rise in the gasoline tax would depend on the potential for gas-saving changes in the exempted sectors. If that potential was low (in other words, gasoline consumption in those sectors would not change under the tax), then exempting the sectors would not significantly limit the cost-effectiveness of the tax increase.

Second, a significant rise in the gasoline tax would have to be matched by an equivalent rise in the tax on diesel fuel. Otherwise, drivers might shift to diesel-powered vehicles, lessening the effectiveness of the gasoline-tax increase. (Currently, less than 1 percent of new automobiles sold in the United States are powered by diesel fuel.)[13]

Further, a tax increase would be most effective at reducing gasoline consumption if it was perceived as permanent and was adjusted to keep pace with inflation. If people expected that a rise in the gasoline tax would be removed

11. Estimates of that response vary: some research suggests that a 10 percent decrease in fuel costs could lead to as much as a 4 percent rise in vehicle miles driven, whereas other studies show little effect. Most studies find increases of between 1 percent and 3 percent, and an estimate of 2 percent is frequently used in empirical research. For a discussion of the estimates, see David L. Greene, *Why CAFE Worked* (Oak Ridge, Tenn.: Oak Ridge National Laboratory, November 1997).

12. One study claims that manufacturers' mix shifting could lead to increased gasoline consumption. The reason is that mix shifting could raise the total number of vehicles purchased (if buyers of relatively fuel-efficient vehicles were more likely to increase their purchases when prices fell than buyers of less-fuel-efficient vehicles were to decrease their purchases when prices rose). However, that study fails to account for the effect that increased sales would have on the retirement of vehicles. If higher sales were matched by accelerated retirements, gasoline consumption would fall. See John E. Kwoka, "The Limits of Market-Oriented Regulatory Techniques: The Case of Automotive Fuel Economy," *Quarterly Journal of Economics*, vol. 97 (November 1983), pp. 695-704.

13. In 2000, 0.26 percent of new retail automobile sales in the United States were of diesel-powered vehicles. See Department of Energy, *Transportation Energy Data Book: Edition 21* (October 2001), Table 7-3 (available at www-cta.ornl.gov/data/tedb21/Spreadsheets/Table7_03.xls).

Box 2.

Is the Market for Fuel Economy in New Vehicles Efficient?

An increase in the gasoline tax would lead to the production of more-fuel-efficient vehicles only if it caused consumers to attach a higher value to fuel economy and if producers responded to the rise in demand for more-efficient vehicles. Some advocates of corporate average fuel economy (CAFE) standards argue that a regulatory approach is necessary because the market for fuel economy is not efficient—that is, consumers and producers would not respond in those ways to a rise in the gasoline tax.[1]

Some proponents of CAFE standards maintain that although fuel economy is displayed on the labels of new vehicles (in the form of miles per gallon for highway and city driving), consumers lack the information to precisely determine their individual savings from greater fuel economy. Those savings depend on the amount of highway versus city driving they will do, their projections of future gasoline prices, and the discount rate (the interest rate used to determine the present value of future benefits and costs) that they select.

Although few consumers may make those calculations, the fuel economy information on labels does let them assess the relative fuel economy of vehicles. Without making actual calculations, consumers who expect higher gasoline prices in the future and who are concerned about operating costs (perhaps because they drive a great deal or have tight budgets) will tend to value fuel economy more than consumers who drive less, have larger budgets, or expect lower gasoline prices in the future. There is little reason to believe that a tax increase that significantly raised gasoline prices would not increase the value that consumers attach to fuel economy.

Another problem with the automobile market, according to CAFE advocates, is that buyers cannot be expected to take the time and effort to balance their preference for fuel economy against the numerous other features they may care about, such as size, reliability, style, and performance. That does not mean, however, that fuel economy does not affect vehicle choice. Fuel economy, like cargo space or performance, is one of multiple features that influence a buyer's preference for one vehicle over another. Consumers would need to make trade-offs among the relative importance of those features, but in cases in which other features were the same, they would prefer a vehicle with higher fuel economy. If a gasoline-tax increase caused consumers to prefer more fuel economy, producers would have an incentive to take that preference into account when redesigning models.

Finally, some proponents of CAFE standards argue that producers would be reluctant to make design changes that would boost fuel economy, because if they made a design mistake, they could lose a significant share of the market for a single vehicle model. Conversely, producers could gain market share by choosing designs that better reflected consumers' preferences for all features, including fuel economy. There is little reason to believe that automakers would be more reluctant to meet consumers' demand for fuel economy than for any other feature.

1. This description of potential failures in the market for fuel economy is based on David L. Greene, *Why CAFE Worked* (Oak Ridge, Tenn.: Oak Ridge National Laboratory, November 1997), pp. 3-4.

or would fall over time because of inflation, they would have less reason to buy more-fuel-efficient vehicles.

Some advocates of CAFE standards have argued that failures in the automobile market would prevent an increase in the gasoline tax from leading to improvements in the fuel economy of vehicles (*see Box 2*). However, most analysts agree that a gasoline-tax increase could be effective in boosting fuel efficiency.

In addition, studies have found that consumers respond to higher gasoline prices by reducing their gasoline consumption, particularly in the long run. (For more details of those studies, *see Box 3*.) In the short run, consumers may respond to higher prices mainly by driving less (for example, by carpooling or using public transportation) or by switching some of their driving to the most fuel-efficient vehicle they own. In the long run, consumers can make more-drastic changes to reduce their gasoline use.

Box 3.

The Effect of Price Changes on Gasoline Consumption

Consumers' responsiveness to price changes is measured in the form of a "price elasticity." That elasticity indicates the extent to which a 1 percent increase in price would affect the demand for a good or service (measured as a percentage change in the quantity sold).

Empirical estimates of price elasticities for gasoline vary greatly, in part because they are sensitive to the type of model used to estimate them. A 1991 survey analyzed 97 price-elasticity estimates for gasoline.[1] It defined 18 different categories of models and estimated the average short-run and long-run price elasticity for the types of models most appropriate for measuring those elasticities. The authors found an average short-run elasticity of -0.26 and an average long-run elasticity of -0.86.[2] Based on those estimates, a 15-cent increase in the tax on gasoline (or a 10 percent increase in price, assuming a price of $1.50 per gallon) would cause a 2.6 percent decrease in the amount of gasoline used by passenger vehicles in the short run and an 8.6 percent decrease in the long run. An equivalent decline in gasoline consumption would result from increasing the stringency of corporate average fuel economy standards by roughly 10 percent.[3]

Consumers' responsiveness to changes in gasoline prices could alter over time because of numerous factors, such as changes in average income, options for public transit, and the availability of technologies for improving fuel economy. Some (though not all) more-recent studies have estimated lower long-run price elasticities. Based on a review of those studies, the Department of Energy suggests a long-run price elasticity of -0.38—implying that a 15-cent rise in the gasoline tax would eventually cause a 3.8 percent decline in the amount of gasoline used by passenger vehicles.[4] Measuring price elasticities is a difficult task, however, and the elasticities discussed here should be viewed only as rough estimates.

1. Carol Dahl and Thomas Sterner, "Analyzing Gasoline Demand Elasticities: A Survey," *Energy Economics* (July 1991).

2. Seven different categories of models were found to be appropriate for measuring short-run and long-run elasticities. The average elasticity estimates for the categories considered appropriate for measuring the short-run price elasticity ranged from -0.22 to -0.31. The average estimates for categories appropriate for long-run elasticities ranged from -0.80 to -1.01.

3. That estimate assumes that a 10 percent increase in fuel economy would result in a 2 percent increase in vehicle miles traveled. It also assumes that the increase in CAFE stringency would not cause consumers to switch from cars to trucks and would not cause manufacturers to shift vehicle production from domestic cars to light trucks and imported cars.

4. Department of Energy, Office of Policy and International Affairs, *Policies and Measures for Reducing Energy Related Greenhouse Gas Emissions: Lessons From Recent Literature*, DOE/PO-0047 (July 1996).

For instance, they can trade in their vehicles for models with greater fuel economy or choose to live closer to their work.

The Cost-Effectiveness of Creating a Cap-and-Trade Program

Like a tax increase, a cap-and-trade program for gasoline-related carbon emissions would reduce gasoline consumption in a cost-effective way. Companies would have to buy emission allowances in order to continue producing or importing gasoline, which most likely would lead to higher prices at the pump. By raising the price of gasoline, a cap-and-trade program would give people an incentive to engage in all possible gas-saving activities, including buying more-fuel-efficient vehicles as well as changing their driving habits.

If the main objective of the cap-and-trade program was to decrease carbon emissions, the same level of emission reductions could be achieved at a lower cost by extending the program as broadly as possible—in other words, by making it apply to all sources of carbon emissions throughout the economy, not just the combustion of gasoline.

Under one type of broad program (an "upstream" program), all producers and importers of oil, coal, and natural gas would be required to hold allowances based on the carbon content of their fuel—that is, the carbon emitted when the fuel is burned.[14]

The cap on carbon emissions would limit the production of carbon-based fossil fuels and would cause the price of those fuels to rise—with price increases reflecting each fuel's allowance requirements and, hence, its carbon content.[15] Those price increases would raise companies' and consumers' costs, encouraging them to decrease their use of fossil fuels and energy-intensive goods and services. As a result, households and businesses throughout the economy would have an incentive to reduce all forms of carbon consumption and thus carbon emissions. (For example, utilities, which account for 38 percent of U.S. carbon emissions, would have an incentive to rely less on coal, which is the most carbon-intensive fossil fuel.) In short, an upstream cap-and-trade program would create an economywide incentive to decrease carbon emissions and would ensure that reductions were made at the lowest possible cost.

In contrast, a cap-and-trade program that covered only producers and importers of gasoline would confine incentives for cutting carbon emissions to the gasoline-consuming sector—which accounts for just 20 percent of U.S. carbon emissions. Such a system would not encourage potentially lower-cost reductions that might have been made outside that sector.

Similarly, raising the gasoline tax would reduce carbon emissions from gasoline consumption but would not encourage reductions in other sectors. Alternatively, levying a tax on the carbon content of all fossil fuels—much like enacting an upstream cap-and-trade program—would create an incentive for carbon reductions throughout the economy.

14. Requiring that companies hold an allowance for each ton of carbon introduced into the economy through production or importation of fossil fuels is equivalent to requiring an allowance for each ton of carbon emitted into the atmosphere. That is because there is no economically viable method (such as scrubbing emissions from smokestacks) for reducing the amount of carbon emissions per unit of fuel burned.

15. For example, the carbon released per million British thermal units (MBTU) of coal is 1.8 times the amount released per MBTU of natural gas.

CHAPTER

3

Predictability of Gasoline Reductions

In adopting a policy to decrease gasoline consumption, lawmakers might want assurance that the policy would achieve the reductions intended. However, neither raising corporate average fuel economy standards nor increasing the federal gasoline tax would ensure a given decline in gasoline use. In both cases, the ultimate decrease in consumption would depend, at least in part, on how consumers and producers responded to the policy change. Between those two changes, however, the uncertainty about the resulting gasoline reduction would most likely be greater for an increase in the gasoline tax than for an increase in well-designed CAFE standards. For a cap-and-trade program, the predictability of gasoline savings would depend on the design of the program.

CAFE Standards

Under the current design of the CAFE standards, estimating how much gasoline use would decline in the long run because of a given increase in the standards would require estimating the size of several changes in producers' and consumers' behavior. Particularly important are the extent to which:

- Manufacturers would comply with higher standards by using unproductive strategies that would not increase the overall fuel efficiency of the vehicles they sold,

- Price changes caused by the higher standards would cause consumers to switch from cars to light trucks,

- CAFE-induced price changes would cause consumers to buy vehicles that exceed the weight limit that the standards apply to (8,500 pounds), and

- Lower operating costs would cause buyers of new vehicles to drive more miles.[1]

If the CAFE standards were redesigned so that automakers had to meet a single, unified requirement for their entire fleet—including trucks, cars, and foreign and domestic vehicles—then producers and consumers would not have an incentive to engage in the first two activities (see Box 1 on page 12). In that case, raising the CAFE standards would be expected to produce a corresponding increase in the fuel economy of cars and light trucks (assuming that the penalty for noncompliance was high enough that manufacturers would meet the standards).

Some of the potential gasoline savings from a rise in fleet-wide fuel economy would be offset by increases in driving. However, that offset would probably be limited to about 20 percent. (Estimates vary, but most lie between 10 percent and 30 percent, as noted in Chapter 2.)[2] Thus, unless higher CAFE standards caused consumers to buy vehicles weighing more than 8,500 pounds, the gasoline savings associated with an increase in well-designed CAFE standards would be relatively easy to predict.

1. Increases in the stringency of CAFE standards could also slow the retirement of existing vehicles. However, that effect would not alter the long-run gasoline savings associated with raising CAFE standards, which are the savings that would occur once the existing stock was replaced with vehicles subject to the new standards.

2. See note 11 in Chapter 2.

A Gasoline Tax and a Cap-and-Trade Program

An increase in the gasoline tax would not ensure a specific decline in gasoline use, nor—unlike improved CAFE standards—would it cause a specific increase in fuel economy. Thus, estimating the gasoline savings that would result from a particular tax increase would require estimating changes in fleetwide fuel economy (which depend on changes in consumer demand) as well as changes in the number of vehicle miles traveled. Price elasticities provide estimates of the expected change in gasoline consumption for a given price increase (see Box 3 on page 17), but such estimates are rough ones. Despite its uncertainty, however, a gasoline tax could be adjusted over time to meet a specific reduction target.

A cap-and-trade program could be designed to ensure that a given target for gasoline consumption was reached. Because the amount of carbon in gasoline is fixed, a limit on carbon emissions would essentially curtail the production of gasoline. The government could set an overall target and issue the number of emission allowances that corresponded to the target level. However, such a policy would not limit the cost of reductions in gasoline consumption. In other words, gasoline use would be reduced to the target level even if the cost of making reductions became very high as the target was approached. (Low-cost methods would be used first, leaving successively higher-cost methods as the amount of reductions was increased.)

Alternatively, the government could set a ceiling on the price of allowances by agreeing to sell an unlimited quantity of them at that price (otherwise, the fixed supply of allowances would cause the price to rise). Setting a maximum price for allowances would limit reductions in carbon consumption to ones that cost less than that price. It would not, however, ensure that the target was met. If, through trading, the allowance price rose to the ceiling, the government would sell additional allowances at that price, and the amount of gasoline consumed would exceed the target level. In that case, the cap-and-trade program would be analogous to a gasoline tax, with the tax rate equal to the ceiling price for allowances.

CHAPTER

4

Effects on Safety

Policy changes that reduce gasoline consumption could have varying effects on the safety of driving. Policies that led to smaller or lighter cars would tend to make accidents more dangerous, whereas policies that led to lighter trucks could reduce fatalities. Policies that encouraged people to drive fewer miles would tend to lower the number of accidents.

Studies of the safety implications of corporate average fuel economy standards have produced mixed results. Virtually no research has been done on the safety implications of a higher gasoline tax or a cap-and-trade program for carbon emissions.

CAFE Standards

The effect of CAFE standards on driving safety has been a much debated—and highly contentious—issue. Numerous studies have examined the topic and reached varying conclusions. A recent report by the Committee on the Effectiveness and Impact of Corporate Average Fuel Economy Standards, formed by the National Research Council, discussed that controversy and weighed the existing empirical evidence.[1] This section draws heavily on the committee's discussion and analysis.

During the first five years that CAFE standards were in effect, the weight and size of new cars declined rapidly: average weight fell by 800 pounds, and average wheelbase decreased by seven inches. Light-duty trucks also declined in weight, though to a lesser extent. In the past decade, both cars and light trucks have grown again. Today, cars are about 600 pounds lighter than they were in 1976, on average, and light trucks are about 30 pounds heavier.

Changes in the weight and size of cars and light-duty trucks can be expected to have different effects on safety. The occupants of lighter vehicles experience greater force in collisions with other vehicles or with fixed objects. In addition, smaller vehicles offer smaller crush zones and less interior space for restraint systems to operate effectively. Thus, decreasing the weight and size of cars would lead to a higher number of fatalities. Theoretically, the same would be true for trucks, but the increased risk to occupants of lighter trucks during collisions is offset by the reduced risk to occupants of other (usually much lighter) vehicles involved in those collisions.[2] As a result, declines in the weight of light trucks tend to decrease fatalities overall.

Sorting out the impact of CAFE standards on vehicle safety is complicated by the fact that many other factors also affect safety. Death rates from motor vehicle crashes have fallen steadily over the past half century, including during the period when CAFE standards went into effect and vehicle weights declined (*see Figure 4*). That trend is thought to have resulted from better vehicle designs, less drunk driving, greater use of safety belts, and improved road design.

Although vehicle safety has improved, the relevant question with regard to CAFE standards is whether travel in

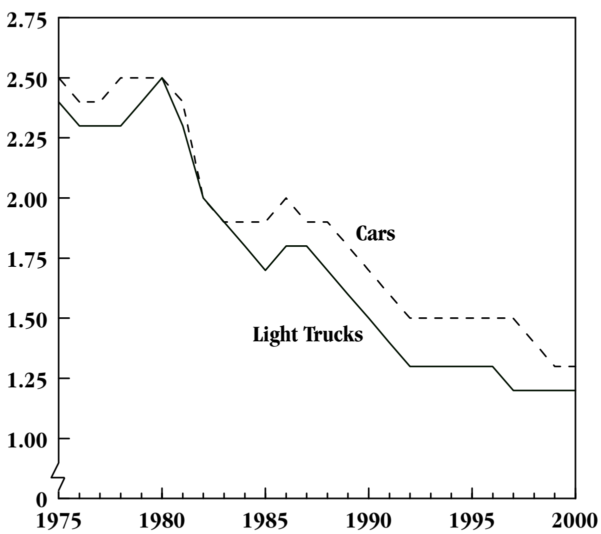
1. See National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, D.C.: National Academy of Sciences, 2002).

2. Ibid., p. 27.

Figure 4.

Fatality Rates for Cars and Light Trucks, 1975-2000

(Fatality rate per 100 million vehicle miles traveled)



Source: Congressional Budget Office based on National Highway Traffic Safety Administration, *Traffic Safety Facts 2000* (December 2001), Tables 7 and 8 (available at www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2000.pdf).

today's lighter cars is less safe than it would have been in the absence of those standards. Even more relevant is whether future increases in CAFE standards would lead to declines in safety.

Using research by the National Highway Traffic Safety Administration,[3] the majority of committee members concluded that the weight and size reduction of passenger vehicles that occurred during the late 1970s and early 1980s led to significant increases in crash fatalities. According to the committee's work, there would have been 1,790 fewer fatalities in 1999 if vehicle weights had been the same then as they were in 1976.[4] That number would have been larger in years when cars were even lighter. For example, the committee estimated that 2,000 lives would have been saved if vehicle weights in 1993 had been the same as they were in 1976.[5]

The committee did not draw any conclusions about what share of vehicle downsizing and weight reduction since 1975 resulted from the CAFE standards. But it did conclude that similar decreases in the size and weight of future vehicles would be likely to produce similar fatality results. An important—and unanswered—question is how raising CAFE standards would affect the size and weight of vehicles in the future. The committee proposed a modification to the current CAFE design that could help prevent weight reductions (*see Box 4*).

Not all committee members agreed that CAFE standards have led to a decrease in vehicle safety. Two of the 13 members stated that the conclusions drawn by the majority were "overly simplistic and at least partially incorrect."[6] Although the minority agreed that reducing the weight of relatively light cars (holding the weight of other cars constant) would cause fatalities to rise, they argued that, given existing data, it is not possible to understand the implications of all of the changes in vehicle weight that have occurred over the past few decades. Specifically, the minority argued that the "relationships between vehicle weight and safety are complex and not measurable with any degree of certainty at present."[7] Those members maintained that data limitations and uncertainties inherent in the National Highway Traffic Safety Administration's research invalidate any of its quantitative results.

Although the committee focused on how CAFE standards would affect the severity of accidents, it did not discuss the impact that CAFE-induced increases in driving might

3. See C.J. Kahane, *Effect of Car Size on Frequency and Severity of Rollover Crashes* (National Highway Traffic Safety Administration, 1990).

4. The National Research Council committee estimated the fatality reductions associated with having 1993 cars weigh the same as 1976 cars and the reductions associated with the increase in vehicle weights between 1993 and 1999. The Congressional Budget Office combined those two figures to estimate the fatality implications of having 1999 cars weigh the same as 1976 cars. The 95 percent confidence range for that estimate is between 1,290 and 2,200.

5. The 95 percent confidence range is between 1,300 and 2,600.

6. National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards*, p. 117.

7. Ibid., p. 123.

Box 4.

Changing the Design of CAFE Standards to Improve Auto Safety

Since corporate average fuel economy (CAFE) standards were introduced, the average difference in weight between cars and light trucks has widened greatly.[1] At the same time, the ratio of new cars to new trucks sold has shifted from about 4 to 1 to near parity.[2] According to many experts, that combination of trends has significant implications for vehicle safety.[3]

A recent study of CAFE standards by the National Research Council (NRC) proposes altering the standards' current design—which focuses on fuel economy for entire classes of vehicles—so that further regulation of fuel efficiency would not affect safety. Fuel economy is strongly related to weight; all other things being equal, heavier vehicles are less fuel efficient than lighter ones. Thus, the NRC study proposes setting fuel economy targets specific to vehicle weight: the lighter the vehicle, the more stringent the target it would have to meet.[4] Vehicles above a certain weight would all have to meet the same target, reducing automakers' incentive to build very heavy gas-guzzlers.

That system of standards could be designed to yield the same total fuel efficiency as the current system. As now, each vehicle's contribution to its manufacturer's overall compliance would depend on the gap between its fuel economy and the relevant target. With weight-based targets, however, the mileage of a lightweight gas-sipper would no longer tend to exceed the applicable fuel economy target, meaning that lightweight cars would no longer be especially effective at helping an automaker comply with the CAFE standards. At the same time, manufacturers would have an incentive to lighten heavier vehicles that were subject to a single (non-weight-based) target, because that would help them comply with the fuel economy standards.

The expected result of instituting a weight-based CAFE system would be to discourage the production of very small and very large vehicles while encouraging a more uniform and narrower distribution of vehicle weights. That change would help reverse the growing disparity in vehicle weights that many experts feel has been a primary contributor to the apparent safety cost of CAFE regulation. A weight-based system can also be seen as a way to regulate firms that specialize in fuel-efficient vehicles on a more equal footing with firms that sell heavier vehicles (and thus are more constrained by the standards).

Improvements to vehicle safety could come with several costs, however. The NRC study cites three. First, weight-based targets could lessen regulators' ability to induce automakers to improve the overall fuel economy of their fleets. (Weight reduction is a reliable method for improving fuel efficiency. No matter how stringent weight-based targets were, they would reduce the cost-effectiveness of that method.) Second, those targets would diminish companies' incentives to develop new, stronger lightweight materials. And third, the average weight of vehicles could increase, resulting in greater fuel consumption (although that effect would depend on the specific weight targets chosen).[5]

1. National Highway Traffic Safety Administration, "Overview of Vehicle Compatibility/LTV Issues," (February 1998), available at www.nhtsa.dot.gov/cars/problems/studies/LTV/.

2. Light trucks now make up about 47 percent of passenger vehicles sold; see Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2001*, EPA 420-R-008 (September 2001).

3. See, in particular, National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, D.C.: National Academy of Sciences, 2002).

4. Under current CAFE regulations and in the proposed system, standards are averages for a manufacturer's entire fleet of a given class of vehicles; individual vehicles do not have to meet any particular standard. The NRC study distinguishes between *standards* for a fleet and *targets* for individual vehicles. In either system, compliance would be determined at the fleet level; thus, it is appropriate to refer to individual targets based on weight and an overall standard for fleet miles per gallon.

5. National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards*, p. 107.

have on the total number of accidents. If improvements in fuel economy led to a greater number of vehicle miles traveled, the number of accidents—and thus the number of fatalities—would tend to increase.

A Gasoline Tax and a Cap-and-Trade Program

There has been little discussion or study of how a gasoline-tax increase or a cap-and-trade program would affect the safety of driving. Research would be necessary to determine how new vehicles might change as a result of the higher gasoline prices that those policies would bring about and how those changes might affect the severity of accidents. To the extent that higher gasoline prices would reduce vehicle miles traveled, a policy that raised prices would tend to lower the number of accidents.

CHAPTER

5

Effects on Other External Costs Related to Driving

The primary motivation for current proposals to reduce gasoline consumption is to lower two external costs related to that consumption: the United States' dependence on oil and its carbon emissions. (External costs are ones whose full weight is borne by society at large rather than by an individual. Thus, individuals have less incentive to take those costs into account when making decisions.) At the same time, tightening corporate average fuel economy standards, raising the federal gasoline tax, or creating a cap-and-trade program would have implications for other external costs that result from driving—such as emissions of air pollutants besides carbon dioxide, traffic congestion, and the need for highway construction and maintenance. The three policy options examined in this study would have indirect effects on those factors, which would result mainly from changes in the number of vehicle miles traveled (VMTs).

Emissions of Regulated Air Pollutants

The Environmental Protection Agency (EPA) regulates three air pollutants emitted by passenger vehicles: carbon monoxide, nitrogen oxides, and hydrocarbons (also known as volatile organic compounds). Carbon monoxide can irritate people's respiratory tracts and contribute to coronary damage. Nitrogen oxides and hydrocarbons are precursors to ground-level ozone (smog), which is also a respiratory irritant. EPA sets maximum emission rates (in grams per mile) for those three pollutants that vehicles are required to meet. Pollution-control equipment installed on vehicles is intended to prevent emissions from exceeding those rates.[1] As a result, improving the fuel economy of vehicles does not imply lower emission rates of those pollutants.[2] (However, those emissions will decline starting in a few years when stricter EPA standards go into effect.)[3]

Although not altering emission *rates*, higher CAFE standards could indirectly affect the *total amount* of those

1. In addition, the federal government requires vehicle emission inspections in certain areas that exceed standards for atmospheric ozone.

2. One study found that for model years 1979 through 1990, cars that got fewer miles per gallon had significantly greater carbon monoxide and hydrocarbon emissions than higher-MPG cars did. The author attributes that result to the degradation of pollution-control equipment over time. He cautions, however, that improvements in the reliability of that equipment since the 1979-1990 period could help keep emission rates from rising with fuel consumption as vehicles age in the future. Thus, he concludes, further tightening of CAFE standards would not necessarily reduce emissions. See Winston Harrington, "Fuel Economy and Motor Vehicles," *Journal of Environmental Economics and Management*, vol. 33, no. 3 (July 1997), pp. 240-252.

3. EPA will implement its stricter Tier 2 emissions standards beginning in 2004. Although standards for light trucks are currently less stringent than those for cars, by 2009 all passenger vehicles will be subject to the same emissions standards for the three pollutants.

vehicle emissions.[4] By lowering the cost of operating a vehicle, higher CAFE standards would increase vehicle miles traveled—by roughly 2 percent for each 10 percent increase in CAFE stringency.[5] More driving would mean more tailpipe emissions.

Gauging the total effect on emissions of those three pollutants, however, also requires accounting for changes in emissions that occur during the production and delivery of gasoline. Since an increase in CAFE standards would decrease gasoline consumption, it would reduce production- and delivery-related emissions. A life-cycle analysis of automobile-related air pollutants indicates that those fuel-production stages (from extraction of raw materials to delivery of the fuel to the final user) generate emissions of nitrogen oxides and volatile organic compounds "roughly equal to the emissions resulting from the lifetime of the vehicle."[6] On net, therefore, higher CAFE standards would reduce total emissions of nitrogen oxides and volatile organic compounds, because decreases in production- and delivery-related emissions are estimated to outweigh the increase in tailpipe emissions from greater VMTs. For carbon monoxide, by contrast, fuel production and delivery generate comparatively small amounts of emissions.[7] Thus, an increase in CAFE standards would be expected to lead to a small rise in carbon monoxide emissions because of the rise in VMTs.

4. One study addresses that issue directly, estimating the change in pollutants that would result from a three-mile-per-gallon increase in fuel economy requirements for all passenger vehicles. The study finds that emissions of the three regulated pollutants would rise by 1.6 percent to 1.9 percent, primarily because of the expected increase in VMTs. See Andrew N. Kleit, *Short- and Long-Range Impacts of Increases in the Corporate Average Fuel Economy (CAFE) Standard* (Washington, D.C.: Competitive Enterprise Institute, February 7, 2002), available at www.cei.org/pdf/2398.pdf.

5. See note 11 in Chapter 2.

6. Lester Lave and others, "Life-Cycle Analysis of Alternative Automobile Fuel/Propulsion Technologies," *Environmental Science and Technology*, vol. 34, no. 17 (August 2000), p. 3601.

7. Fuel production generates only about 2 percent of the carbon monoxide emissions that would come from the tailpipe of a car that complied with existing emission requirements; ibid., p. 3601.

As with tighter CAFE standards, a higher gasoline tax or a cap-and-trade program would induce long-term increases in vehicles' fuel economy. Although that would not necessarily lower tailpipe emission rates of the three regulated pollutants, it would lower the total amount of those pollutants emitted, both by reducing production- and delivery-related emissions and by discouraging VMTs.

Congestion

A recent comparison of the external costs of driving found that costs associated with traffic congestion (such as lost time and productivity and delays in deliveries) exceed other external costs, including those from emissions of regulated pollutants and carbon dioxide and from motor vehicle accidents. That study used a cost estimate for congestion of 5 cents per mile, or $1 per gallon of gasoline.[8] Researchers have estimated congestion costs at between 1.2 cents and 14.8 cents per mile, or between $0.24 and $2.96 per gallon.[9]

All three policies discussed in this study would affect congestion indirectly by altering vehicle miles traveled: a higher gasoline tax or a cap-and-trade program would tend to lower VMTs (by raising gasoline prices), whereas tighter CAFE standards would tend to increase them (by lowering the operating costs of vehicles). None of those policies would be expected to have a big impact on the level of congestion. But given the large potential costs associated with congestion, even small policy-induced changes in the amount of driving could have significant economic costs.

None of those policies is well suited to discourage traffic congestion, which is primarily a problem of peak-period demand. The decline in VMTs from a gasoline-tax increase or a cap-and-trade program would not necessarily occur mainly during peak periods. Moreover, using CAFE

8. See Ian W.H. Parry, "Does Tightening CAFE Do More Harm Than Good?" (working paper, Resources for the Future, September 2002).

9. See Ian W.H. Parry and Kenneth A. Small, *Does Britain or the United States Have the Right Gasoline Tax?* Discussion Paper 02-12 (Washington, D.C.: Resources for the Future, March 2002), p. 16.

standards to reduce congestion would entail *lowering* those standards. Policies that target the cost of peak-period driving directly, such as tolls levied during those periods, are better suited for addressing congestion problems.

Highway Construction and Maintenance

By altering VMTs, an increase in CAFE standards or the federal gasoline tax or enactment of a cap-and-trade program would also indirectly affect requirements for highway construction and maintenance. Unless the scale of those policy changes was very large, however, the effects on miles traveled would be small. The resulting change in spending needed to continue current levels of highway construction and maintenance would most likely be smaller still.

Raising CAFE standards is the only one of the three policies that would be expected to stimulate demand for highway travel, and that increase in demand would occur gradually over a decade or so. Meanwhile, peak-period demand for highway travel will probably continue to grow independent of any change in the stringency of CAFE standards. That growth is likely to outweigh the effects of all but very large changes in CAFE standards and to be a much more important determinant of highway construction requirements.

The need for highway maintenance is largely determined by road degradation from vehicle travel. Damage to roads is primarily caused by freight and other heavy-duty trucks.[10] A higher gasoline tax would discourage some travel by light-duty vehicles but would not affect heavier, diesel-powered vehicles (unless the tax on diesel fuel was also raised). The same would be true of a cap-and-trade program geared toward gasoline combustion. Similarly, the increased travel caused by higher CAFE standards would be limited to vehicles that weigh less than 8,500 pounds. Thus, the effect of any of those policy changes on highway maintenance needs is likely to be very small.

10. A moderately loaded tractor trailer can weigh more than 60,000 pounds, whereas the heaviest sport utility vehicles weigh little more than 8,500 pounds. The difference in road damage associated with those vehicles is only partly reflected in differences in taxes on fuel and other taxes and fees.

CHAPTER

6

Other Policy Implications: Distributional and Revenue Effects

The policies to reduce gasoline consumption described in this study are not aimed at altering the income distribution in the United States or raising federal revenue. Nonetheless, increasing the federal gasoline tax, tightening corporate average fuel economy standards, or enacting a cap-and-trade program would have distributional and revenue effects, which policymakers might want to take into consideration.

Studies suggest that a gasoline-tax increase would impose higher costs on rural households than on urban households, but they disagree about how those costs would be distributed among households at different income levels. Depending on how it was designed, a cap-and-trade program could have similar distributional effects to those of a gasoline tax. Little research is available about the distributional effects of raising CAFE standards.

Increasing the gasoline tax would boost federal revenues (despite the decline in gasoline use that would result), whereas increasing CAFE standards would lower revenues. Under current law, additional receipts from a rise in the federal gasoline tax would be dedicated to the Highway Trust Fund, which pays for highways and mass transit. With changes to current law, those receipts could be used in myriad ways, which could have widely varying implications for the economy. The revenue effects of a cap-and-trade program would depend on whether the government chose to sell emission allowances or to give them away.

Distributional Effects

A policy change to decrease gasoline consumption will impose different burdens on households depending on their income level and where they live. Several researchers have examined how the effects of a higher gasoline tax would differ among U.S. households on the basis of those two factors, but few have examined the distributional effects of higher CAFE standards. Some studies have looked at the distributional effects of an economywide cap-and-trade program for carbon emissions,[1] but no research has been done on the effects of a cap-and-trade program that applies only to carbon emissions from gasoline use.

Effects on Households at Different Income Levels

Some advocates of raising CAFE standards argue that doing so would be more equitable than increasing the gasoline tax because gasoline taxes are regressive—in other words, they disproportionately burden people with lower income. That assertion is based on surveys of household consumption that find that gasoline purchases take up a much larger fraction of measured annual income for lower-income households than for higher-income households. However, spending on gasoline as a share of annual income may not be a good measure of the regressivity of

1. See Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000).

Table 2.

Estimated Burden of Gasoline Spending on Households

(In percent)

Income or Spending Decile[a] (Lowest to highest)	Gasoline Spending as a Share of Income, 1986[b]	Average Family Gasoline Spending as a Share of Average Family Income, 1976-1986[c]	Gasoline and Motor Oil Spending as a Share of Total Spending, 1986[b]
1	11.44	3.9	3.70
2	6.54	5.3	5.34
3	6.36	5.1	5.53
4	6.08	5.0	5.67
5	4.97	4.6	5.17
6	4.69	4.3	5.20
7	4.38	4.0	4.94
8	3.75	3.8	4.43
9	3.56	3.4	4.47
10	2.40	2.5	3.20

Source: Congressional Budget Office based on the sources cited below.

Note: Total spending includes the imputed value of rents and automobiles.

a. Each decile contains 10 percent of U.S. households, ranked on the basis of their income or their total annual spending.

b. From James M. Poterba, *Is the Gasoline Tax Regressive?* Working Paper No. 3578 (Cambridge, Mass.: National Bureau of Economic Research, January 1990).

c. From Howard Chernick and Andrew Reschovsky, "Who Pays the Gasoline Tax?" *National Tax Journal*, vol. 50, no. 2 (June 1997), pp. 233-259.

a gasoline tax. Using other measures, evidence about whether a gasoline-tax increase would be regressive is mixed.

The Burden of Gasoline Taxes. Many researchers believe that taxes should be compared with a household's long-term, or permanent, income rather than its annual income.[2] Measuring the tax burden relative to permanent income provides an estimate of a household's ability to bear a tax over a lifetime. Annual income, by contrast, could substantially underestimate the long-term ability of some households to pay a tax. For example, households with retired workers may have small annual incomes but large savings. In addition, households with people who are early in their careers may have low current incomes but expect substantially higher incomes in the future.

Howard Chernick and Andrew Reschovsky estimated an "intermediate-run" gasoline-tax burden.[3] They looked at average gasoline spending by families during the 1976-1986 period as a percentage of average family income in that period. Their results show that gasoline expenditures generally accounted for a larger share of average income for lower-income households than for higher-income households (*see Table 2*), which suggests that a rise in the gasoline tax would tend to be regressive. However, a drawback of their analysis is that it does not account for shortcomings in the available data on household income. Evidence suggests that those data may understate the resources available to some households—particularly at the bottom end of the income scale, where unreported income and private transfers (such as gifts from family

2. For a discussion of annual versus permanent measures of income, see Congressional Budget Office, *Federal Taxation of Tobacco, Alcoholic Beverages, and Motor Fuels* (August 1990); Gilbert Metcalf, "A Distributional Analysis of Green Tax Reforms," *National Tax Journal*, vol. 52, no. 4 (December 1999), pp. 655-681; and Diane Lim Rogers and Don Fullerton, *Who Bears the Lifetime Tax Burden?* (Washington, D.C.: Brookings Institution, 1993).

3. See Howard Chernick and Andrew Reschovsky, "Who Pays the Gasoline Tax?" *National Tax Journal*, vol. 50, no. 2 (June 1997), pp. 233-259.

members) may constitute a larger share of household resources.[4]

Some researchers believe that a household's spending provides a better measure of its long-term ability to pay a tax than its income does. Spending reflects both expectations of higher future income (to the extent that people can borrow money) and household saving (as people draw on accumulated resources). Thus, expenditures reflect households' permanent income better than annual income does. In addition, using expenditure data avoids the problem of understated household resources.

When gasoline spending is measured as a share of total expenditures, evidence on the distributional effects of a gasoline-tax increase is mixed. For example, the Congressional Budget Office found that spending on all motor fuels made up about 3 percent of total expenditures for the bottom four-fifths of the income distribution and 2.3 percent of total expenditures for the highest one-fifth.[5] A study by James Poterba ranked households in tenths (or deciles) on the basis of their total spending and found that gasoline and motor oil accounted for a smaller share of total expenditures for households in the lowest-spending decile than for households in all but the top-spending decile (*see Table 2*).[6] However, that study also found that the second, third, and fourth deciles had higher expenditure shares than any of the other deciles.

Data that are viewed at the decile level may hide considerable variation in households' burdens within deciles. For example, the Poterba study found that among households in the lowest decile, one-third reported no direct spending on gasoline, whereas 14 percent reported that gasoline accounted for more than one-tenth of their total spending. An increase in the gasoline tax, therefore, would impose a relatively large burden on those 14 percent of low-income households unless they received some compensation.

One way to at least partly offset higher gasoline-tax payments would be to increase government payments for some low-income households. Government payments that rise each year with changes in the consumer price index (such as Social Security benefits and Supplemental Security Income payments) would automatically increase as a result of a higher gasoline tax—provided that the tax caused the consumer price index to rise.

Indexed government payments generally make up a much larger share of income for lower-income households than for higher-income households. For example, Poterba found that indexed transfer payments constituted two-thirds of income for households in the lowest-spending decile. He estimated households' "unindexed exposure" to changes in gasoline taxes—that is, the share of higher gasoline spending that would not be offset by higher transfer payments. Poterba found that unindexed gasoline spending accounted for only 0.7 percent of total income for households in the lowest-spending decile and 2.8 percent for the second decile. Unindexed gasoline spending accounted for between 4.5 percent and 5.7 percent of total income for households in the remaining deciles.[7]

The rise in indexed transfer payments would depend on average gasoline consumption. Lower-income households that received transfer payments but consumed more than the average amount of gasoline would bear larger tax burdens than Poterba estimated.

The Burden of a Cap-and-Trade Program. The distributional effects of a cap-and-trade program would have two components: the effects of the increase in the price of gasoline and the effects of the decision about how to allocate emission allowances.

4. Studies that compare consumption with income find that consumption can look too large relative to income for poorer households. For example, according to reported data, households in the lowest fifth of the income distribution consume more than twice their annual income. See Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading?* p. 18.

5. See Congressional Budget Office, *Federal Taxation of Tobacco, Alcoholic Beverages, and Motor Fuels.*

6. See James M. Poterba, *Is the Gasoline Tax Regressive?* Working Paper No. 3578 (Cambridge, Mass.: National Bureau of Economic Research, January 1990).

7. Ibid., pp. 19-20.

Like a gasoline tax, a cap-and-trade program would raise the price of gasoline.[8] That price rise would have the same distributional effects as one resulting from a tax increase.

The second component would depend on policymakers' decision about how to allocate the allowances, which could have considerable value.[9] If policymakers chose to distribute them for free (for example, to producers and importers of gasoline), then the policy would create windfall profits for the recipient firms, and their shareholders would benefit. Stocks contribute a larger share of income for higher-income households than for lower-income ones, so giving the allowances away would tend to benefit higher-income households. (It would be analogous to taxing gasoline consumption and distributing the revenue to gasoline producers and importers.)

If, by contrast, policymakers chose to sell emission allowances through an auction, the government would capture the value of the allowances. In that case, the distributional effects of the cap-and-trade program would be equivalent to those of a rise in the gasoline tax. The ultimate distributional impact would depend on what the government chose to do with the auction revenue.

The Burden of CAFE Standards. None of the ways of measuring the incidence of a gasoline tax that were discussed above shed light on how its distributional effects would compare with those of higher CAFE standards. Moreover, no research on the distributional effects of an increase in CAFE standards is currently available.

Raising CAFE standards would directly affect the prices of new vehicles. That effect would tend to be progressive, assuming that new-car purchases make up a larger share of spending for higher-income households than for lower-income households. However, a complete picture of the distributional effects of higher CAFE standards would require understanding their indirect effects. For example, raising CAFE standards would be likely to increase the demand for used cars, leading to higher used-car prices as well.

Distributional Effects Among Regions

The effects of a gasoline-tax increase would vary among households in different parts of the country. In general, costs per household would be greater in rural areas than in urban areas.

Researchers at Resources for the Future (RFF) examined the regional impact of a 4.3-cent-per-gallon increase in the federal gasoline tax that took effect in 1993.[10] Although the magnitude of RFF's results was specific to that tax increase, the pattern of the results suggests how the effects of any rise in the federal gasoline tax would vary among parts of the country. Rural households would tend to see a greater increase in their tax payments than urban households would because they tend to drive more miles. RFF concluded that, on average, urban households would pay $32 more (in 1990 dollars) in taxes each year because of the 4.3-cent tax increase. Suburban households would pay an average of $39 more, and rural households would pay $45 more. On average, people in western and midwestern states would tend to see greater increases in their gasoline-tax payments than people in eastern states would (*see Figure 5*).

The variation in tax burdens among regions was greater when measured as a share of household income than when measured in dollars (*see Figure 6*). The region that paid the most in percentage terms (the west south central states) had a tax burden that was 82 percent higher than the region with the smallest tax burden (the mid-Atlantic states). Measured in dollar terms, by contrast, the highest-paying region (the mountain states) paid 64 percent more than the lowest-paying region (the mid-Atlantic states). That difference indicates that regions that would tend to

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8. The price increase would be the same regardless of whether the government distributed carbon allowances for free or sold them in an auction.

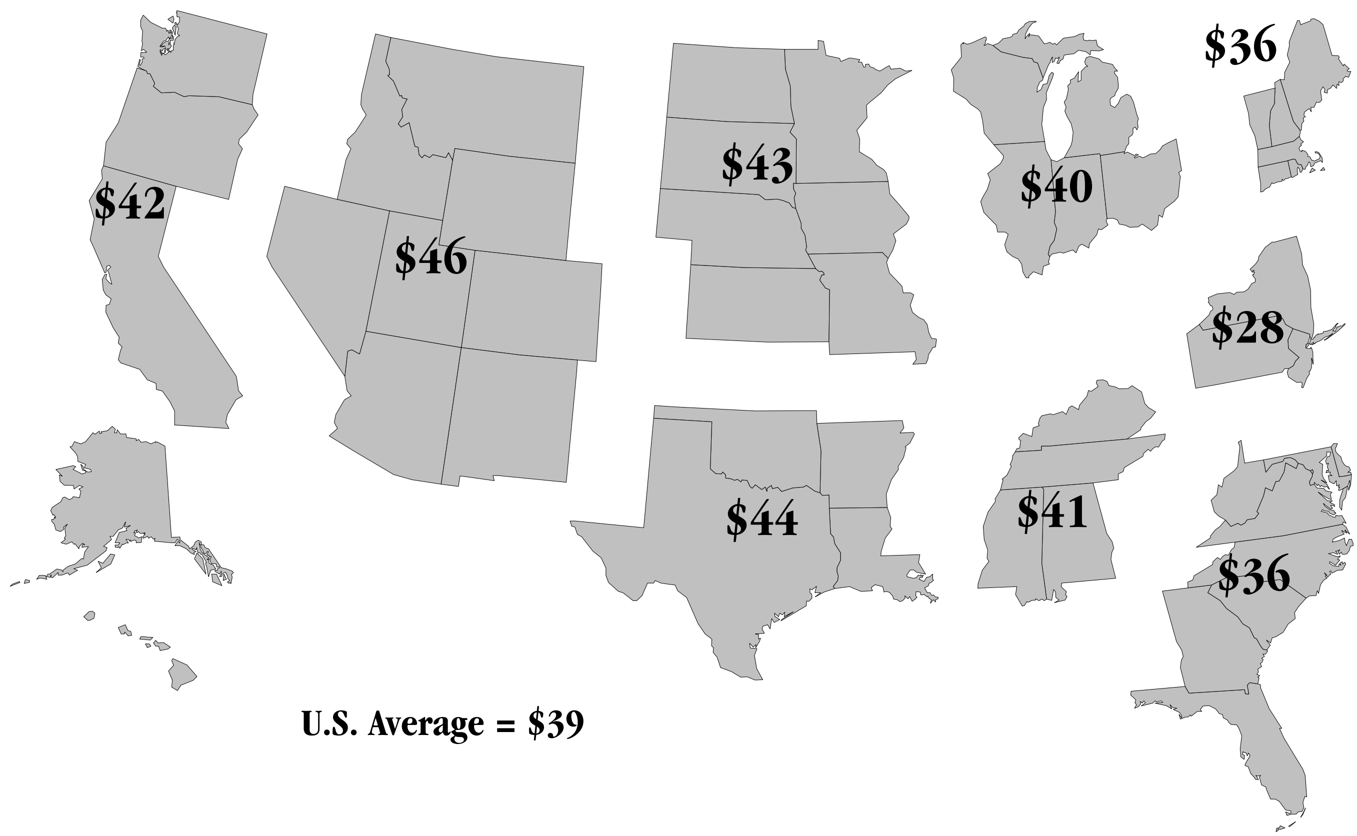
9. For a more detailed discussion about the distributional effects of allocation decisions, see Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading?* and *An Evaluation of Cap-and-Trade Programs for Reducing U.S. Carbon Emissions* (June 2001).

10. See Alan J. Krupnick, Margaret A. Walls, and H. Carter Hood, *The Distributional and Environmental Implications of an Increase in the Federal Gasoline Tax*, Discussion Paper ENR 93-24 (Washington, D.C.: Resources for the Future, September 1993).

Figure 5.

Annual Cost to Households in Different Regions from a 4.3-Cent Rise in the Federal Gasoline Tax

(In 1990 dollars)



Source: Congressional Budget Office based on Alan J. Krupnick, Margaret A. Walls, and H. Carter Hood, *The Distributional and Environmental Implications of an Increase in the Federal Gasoline Tax*, Discussion Paper ENR 93-24 (Washington, D.C.: Resources for the Future, September 1993).

Note: Numbers represent the net effect of higher federal gasoline-tax payments and of lower state gasoline-tax payments from reduced gasoline consumption.

experience higher tax payments also tend to have lower average income.

In February 1993, the Congressional Budget Office (CBO) testified about the possible effects of a 24-cent-per-gallon increase in the tax on motor fuels.[11] Like the RFF researchers, CBO concluded that the tax would impose a higher average cost on rural households than on urban ones. The average cost for all households was estimated at $179 per year (in 1994 dollars), compared with an average cost for rural households of $219 per year. Among urban households, the average annual cost was lowest in the Northeast ($157) and highest in the South ($181).[12] Of course, the ultimate distributional effects would depend on what the government did with the additional gasoline-tax revenue. That revenue could be used to offset disparities in regional effects.

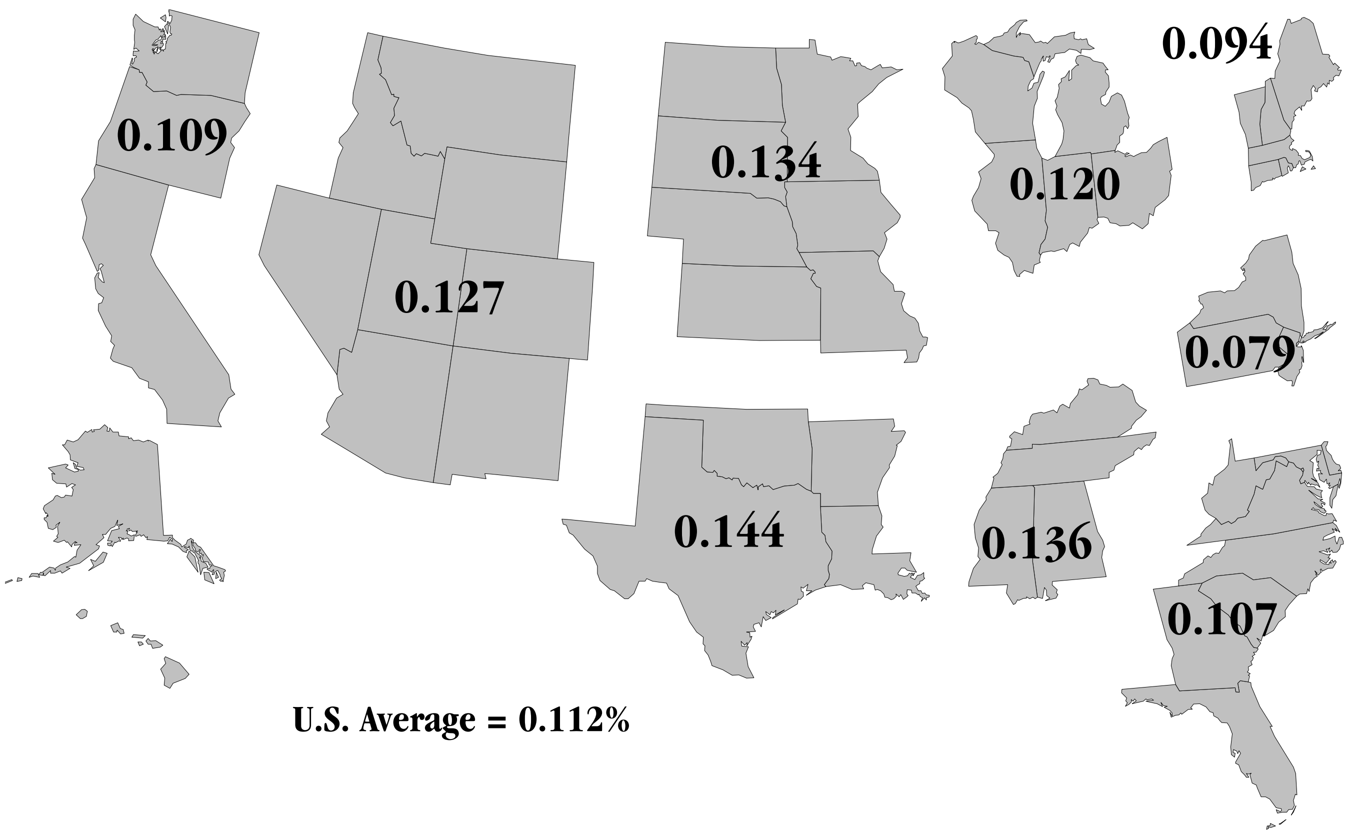
11. See the statement of Robert D. Reischauer, Director, Congressional Budget Office, before the Senate Committee on Energy and Natural Resources, February 24, 1993.

12. The average annual costs for urban households in the Midwest and West were $170 and $179, respectively.

Figure 6.

Annual Cost to Households in Different Regions from a 4.3-Cent Rise in the Federal Gasoline Tax, as a Share of Household Income

(Percent)



Source: Congressional Budget Office based on Alan J. Krupnick, Margaret A. Walls, and H. Carter Hood, *The Distributional and Environmental Implications of an Increase in the Federal Gasoline Tax*, Discussion Paper ENR 93-24 (Washington, D.C.: Resources for the Future, September 1993).

Note: Numbers represent the net effect of higher federal gasoline-tax payments and of lower state gasoline-tax payments from reduced gasoline consumption.

A cap-and-trade program that caused equivalent price increases to those described above would be expected to have similar regional effects. (Although the government could use the revenue from auctioning allowances in a way that would offset those effects.) CBO could not find any evidence on the regional impact of CAFE standards.

Effects on Federal Revenue

An increase in the federal gasoline tax (which is currently 18.4 cents per gallon) would bring in additional federal revenue because a higher tax rate would be charged on each gallon of gasoline consumed. At the same time, the higher rate would discourage gasoline consumption. The less elastic that gasoline purchases are—in other words, the less that people reduce their consumption when the price rises—the more that revenue would increase as the tax rate rose (and vice versa).

CBO estimated the additional revenue that would result from raising the federal gasoline tax by 15 cents per gallon—which would represent about a 10 percent price increase, at current prices. (That tax increase is not suggested as optimal but was chosen for illustrative purposes.) Accounting for both the expected growth in gasoline consumption (in the absence of the tax increase) and the

Table 3.

Revenue Effects of a 15-Cent Increase in the Federal Gasoline Tax

	Gasoline Consumption (Millions of gallons)		Total Federal Revenue Collected (Billions of dollars)		Increase in Federal Revenue Because of the Tax Increase (Billions of dollars)
	Without Tax Increase	With Tax Increase	Without Tax Increase	With Tax Increase	
Short Term (2003)	112,279	109,360	20.7	36.5	15.8
Longer Term (2012)[a]	143,855	131,483 to 138,388	26.5	43.9 to 46.2	17.4 to 19.7

Source: Congressional Budget Office.

a. The first and second numbers in the ranges are based on long-term price elasticities of -0.86 and -0.38, respectively. For more details, see Box 3 on page 17.

effect of the tax increase on that growth (using the elasticities described in Box 3 on page 17), CBO estimated that a 15-cent-per-gallon rise in the gasoline tax today would add nearly $16 billion to federal gasoline-tax revenue in 2003, an amount that would grow to between $17 billion and $20 billion in 2012 (*see Table 3*).[13] Unless states and localities also raised their gasoline taxes, their tax receipts would fall because of the decline in gasoline consumption.

If lawmakers removed the restriction that all gasoline-tax receipts go to the Highway Trust Fund, the government could use the additional revenue from a higher gasoline tax in many ways—such as paying down the national debt, spending more on federal programs, offsetting the distributional effects associated with a gasoline-tax increase, or decreasing certain taxes that discourage overall economic activity. The total cost that the gasoline-tax increase would impose on the economy would depend, in part, on the way the government chose to use the revenue. For example, using gasoline-tax receipts to offset existing taxes on capital and labor—such as payroll taxes and the corporate income tax—could benefit the economy by reducing those taxes' adverse incentives. (Taxes on labor and capital discourage households from working and saving and businesses from hiring additional employees and investing more.) In contrast, using gasoline-tax receipts to offset some of the distributional effects of the tax increase would not benefit the economy, but it might cause the policy change to be seen as more equitable.

The effects of a cap-and-trade program on federal revenue would depend on whether the government sold emission allowances or distributed them for free. If the government auctioned off the allowances, the effects would be similar to those of a gasoline tax, and government revenue (including auction receipts and gasoline-tax receipts) would rise. If the government gave the allowances away, gasoline-tax receipts would fall (because of the decline in gasoline consumption), and the government would not collect any money for the allowances.

An increase in CAFE standards would have an indirect effect on revenue collected for the Highway Trust Fund. Improvements in the fuel economy of new vehicles would reduce their gasoline consumption per mile traveled and thus bring in fewer gasoline-tax receipts. That decline in receipts would be partly offset as lower driving costs led to more vehicle miles traveled. (Research indicates that increases in VMTs due to lower driving costs could offset the gasoline savings from CAFE-induced changes in fuel economy by roughly 20 percent.) The decline in gasoline-tax revenue because of higher CAFE standards would increase over time as older vehicles were replaced by new vehicles that met the more-stringent standards.

13. Those estimates assume that the full amount of the tax increase is passed on to consumers in the form of higher gasoline prices. The discouraging effect on driving would be lessened to the extent that producers absorbed the tax increase without passing it on.

Raising the gasoline tax, tightening CAFE standards, or enacting a cap-and-trade program would also affect federal revenue in other, less direct ways. By imposing costs on producers and consumers, all of those policies would tend to discourage economic activity. That decrease in economic activity would lead to lower tax receipts in multiple ways—for example, collections of corporate income taxes would decline if the profits of automakers or gasoline companies fell.

The size of those indirect effects on tax collections would vary with the economic cost of the policy adopted. That cost in turn would depend on the targeted reduction in gasoline consumption (bigger reductions would be more costly than smaller ones) and the comprehensiveness of the policy. As discussed in Chapter 2, policies that encourage all gasoline-saving activities will produce a given gasoline reduction at a lower cost than policies that focus on a limited number of activities.

Further, for a gasoline tax or a cap-and-trade program, the total cost imposed on the economy would depend on how lawmakers opted to use the revenue from the gasoline tax or from an allowance auction. For example, using those receipts to encourage economic activity (perhaps by reducing taxes on capital or labor) would lead to lower total costs than using those receipts to offset the distributional effects of the policy.