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RESOURCES FOR THE FUTURE

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Abstract

This paper discusses several rationales for the Corporate Average Fuel Economy (CAFE) program, including reduced oil dependence, reduced greenhouse gas emissions, and the possibility that fuel saving benefits from higher standards might exceed added vehicle costs. We then summarize what can be said about the welfare effects of tightening standards, accounting for prior fuel taxes, and perverse effects on congestion and traffic accidents through the impact of improved fuel economy on the incentive to drive. Implications of CAFE on local air pollution, and the controversy over CAFE, vehicle weight, and road safety, are also discussed. Finally, we describe ways in which the existing CAFE program could be substantially improved and identify a variety of alternative, and much superior, policy approaches.

Key Words: fuel economy, externalities, oil dependency, vehicle safety, climate change

JEL Classification Numbers: R48, Q48, H23

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1. Introduction and Background

Public policy debates are often overheated, but those regarding government-mandated new-car fuel economy standards have been extreme. Proponents of more stringent standards allege that the declining fuel economy of the new-vehicle fleet in the United States plays into the hands of Al Qaeda; opponents claim that tighter standards would lead directly to smaller cars and, therefore, carnage on the highways. With important industries and public interests at stake, it is important to disentagle fact from fiction.

In the Energy Policy and Conservation Act of 1975 (EPCA), Congress created the Corporate Average Fuel Economy (or CAFE) program. Congress itself required each manufacturer of new passenger cars to meet a sales-weighted average of 18 miles per gallon (mpg) by Model Year 1978, increasing steadily to 27.5 mpg for Model Year 1985 and beyond. Congress also directed the National Highway Traffic Safety Administration (NHTSA) to establish fuel economy standards for what are called light-duty trucks—a category that includes pickup trucks, minivans and sport utility vehicles (or SUVs). Standards for light-duty trucks began with Model Year 1979, and today each manufacturer's fleet must average at least 20.7 mpg. Vehicle manufacturers have always had the option to pay $5.50 per vehicle sold for each 0.1 mile-per-gallon (mpg) that their fleet average falls short of the relevant standard. However, only a few European manufacturers of luxury cars (Mercedes and BMW, for example) have chosen this route; no Japanese or U.S. carmaker (prior to the merger of Daimler and Chrysler) has ever fallen short of the standards.

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Together in concert with higher real gasoline prices, which began rising in 1973 (see Figure 1), the new standards had a significant effect on fuel economy. According to the U.S. Environmental Protection Agency (EPA), new passenger car fuel economy rose from 17 mpg in 1978 to more than 22 mpg in 1982, an increase of more than 30 percent. Light-duty truck fuel economy rose 35 percent during this same period; the combined fuel economy of the entire new vehicle fleet rose by an even third (see Figure 2).

Note that fuel economy for both the new passenger car and the new light duty truck fleets continued to improve until 1988, at which point they exceeded by 44 and 42 percent respectively their levels when the CAFE program went into effect. The improvements beyond 1982 are significant because that is the year in which the price of gasoline began its precipitous decline, never to recover. If the fuel economy improvements of the late '70s and early '80s were a response only to rising gasoline prices, we might have expected a gradual fall-off in fuel economy in the years following 1982; it is likely that the CAFE standards established a floor preventing such a decline. Note finally from Figure 2 that while average fuel economy for new light-duty trucks has remained flat for the last twenty years, and that for new cars has increased modestly, combined new vehicle average fuel economy has *declined* 6 percent since 1987. This is because the light-duty truck share of the new vehicle fleet has gown from less than a quarter of all new vehicles sold in 1975 to more than half in 2002.

This backdrop raises a number of interesting questions. Should the government intervene to stimulate the fuel economy of the new vehicle fleet, and if so, why? What are the likely benefits and costs of such efforts? If a case can be made for intervention, is the CAFE program the best way to do so? These questions are back on the political agenda again.

In the next section, several rationales for government intervention regarding fuel economy are spelled out. We then summarize what can be said about the welfare effects of tightening CAFE, accounting for prior fuel taxes, and perverse effects on congestion and traffic accidents through the impact of improved fuel economy on the incentive to drive. Implications of CAFE on local air pollution, and the controversy over CAFE, vehicle weight, and road safety, are also discussed. Finally, we describe ways in which the existing CAFE program could be substantially improved and identify a variety of alternative, and much superior, policy approaches.

2. Rationales for Fuel Economy Standards

The current discussion of CAFE standards takes place against renewed concerns about growing oil consumption in the United States, and particularly about the sources of that oil. As Figure 3 shows, U.S. oil consumption recently reached an all-time high, as did the fraction accounted for by imports (now more than half of oil consumption). Moreover, the OPEC cartel supplies the United States with slightly less than half of its oil imports, or about a quarter of all the oil it uses; gasoline accounts for just under half of oil use.[1] There are several alleged externalities or market imperfections associated with U.S. oil consumption: the macroeconomic impact associated with oil price "shocks"; market power in global oil markets; the environmental consequences of burning oil, especially the risk of greenhouse warming; and the possibility that consumer myopia, or technology spillover effects, may lead to insufficiently small investments in fuel efficiency. We take each of these in turn.

2.1 Macroeconomic Effects of Oil Price Shocks

A number of analysts have called attention to the significant and apparently causal negative relation between oil price volatility and macroeconomic performance (e.g., Brown and Yücel ,2002; for a contrary view, see Barsky and Killian in this issue). This relation has weakened over time; Americans now use 0.8 barrels of oil per $1000 dollars of (real) GDP compared with 1.5 barrels in the early 1970s (Energy Information Administration, 2002). One might imagine that the benefits of oil price reductions would offset the costs of price increases; but the empirical literature has identified an apparent asymmetry in response—rising oil prices seem to retard economic activity more than falling prices spur it (see Hamilton, 1996). To the extent that this asymmetry is due to adjustment costs elsewhere in the economy (e.g., transitory unemployment, costs incurred from re-optimizing capital stocks) that are not taken into account by energy consumers and producers, there can be an externality (see Bohi and Toman 1996 and Bernanke et al. 1997 for another explanation of this asymmetry). Importantly, neither the level of oil imports nor their countries of origin are germane to this argument. Even if the United

[1] Data on the sources and uses of energy in the United States can be found at http://www.eia.doe.gov.

States produced all the oil it used, it would still suffer from supply disruptions anywhere in the world because the price of oil is set in world markets. The only way to insulate ourselves from these disruptions is to further reduce the oil intensity of our economy or limit the size of the price spikes themselves.

2.2 Market Power

Another issue has to do with market power, possessed most obviously by the OPEC cartel. Production restraint by a few low-cost producers in the Middle East, notably Saudi Arabia, keeps the price of oil far above its marginal cost. On the demand side, no individual purchaser of imported oil buys enough to affect the price; however, through policies that affect the demand by all American users, the U.S. government can be said to have monopsony power in the oil market. Some observers have suggested that this power could be used to neutralize partly the anticompetitive behavior of OPEC and reduce the world price of oil. The policies most commonly discussed for this purpose include an oil import quota or tariff, although any policy that restricts oil use—such as CAFE—would very likely have the desired effect on imports. Again, the magnitude of these "externality" benefits is controversial, being sensitive to assumptions about how OPEC supply, and demand from other importing countries, would respond to a reduction in U.S. consumption (Leiby et al. 1997).

A recent panel of experts (National Research Council 2002) surveyed the literature and tentatively valued the combined macroeconomic and monopsony externalities at $5 per barrel of oil, or 12 cents per gallon of gasoline (with a range of 2–24 cents). Arguably, there are other costs of our oil dependency, such as the power that it gives to undemocratic governments in the Middle East, though these are very difficult to quantify.[2]

[2] It is sometimes argued that Middle East military expenditures constitute an external cost from oil consumption. This is questionable because these expenditures also serve other objectives, such as the security of Israel. Moreover, much of this spending might be regarded as a fixed cost that would not fall in proportion to a (moderate) reduction in US imports.

2.3 Environmental Concerns

The primary environmental justification for government intervention to reduce gasoline consumption is concern about future global climate change. Unlike other automobile emissions, abatement technologies do not exist for carbon dioxide so emissions are proportional to gasoline use. A number of studies have estimated the economic impacts of future climate change on agriculture, forestry, coastal activities, human health and so on. These estimates are highly speculative as there is controversy, among other things, over appropriate discount rates, how to value non-market effects such as species extinction, the likelihood and extent of instabilities within the climate system, the greater vulnerability of poor countries to climate change, and the possibility of catastrophic changes in climate.

Mainstream damage estimates tend to be fairly moderate because the bulk of world manufacturing and services is not especially sensitive to predicted changes in climate over the next century, and discounting greatly reduces the present value of distant costs. A wide range of estimates of the value of carbon abatement appears in the literature, from negative values to well over $100 per metric ton of carbon equivalent (MTCE), though most estimates are below $50 per MTCE (for discussion, see Nordhaus 1994, Tol et al, 2000, and the references cited therein). A value of $50 per MTCE, the value assumed by the National Research Council (2002), implies damages of 12 cents per gallon of gasoline. Combining this with the NRC's assumed value for oil dependency externalities, yields an external cost so far of 24 cents per gallon; since annual gasoline consumption in the United States is about 130 billions gallons per year, these external costs amount to about $30 billion annually, or about 15 percent of the value of all gasoline sales.

It is tempting to think that gasoline consumption may result in another negative environmental externality, namely emissions of carbon monoxide and the hydrocarbons and oxides of nitrogen that create smog and airborne particulates. In fact, however, local air pollution effects are both more subtle and ambiguous. First, tailpipe emissions from new vehicles are regulated in the U.S. on a grams-per-mile basis rather than a grams-per-gallon-of-gasoline basis. Thus, better fuel economy has no direct effect on pollutant emissions (aside from a minor impact on upstream emissions leakage during fuel refining and distribution).

Next, since tighter fuel economy standards will make it less expensive to drive an additional mile, to the extent people respond by driving more (as argued below in more detail), local pollution could actually *increase*. Moreover, if tighter fuel economy standards drive up the cost of new cars and light-duty trucks, the retirement of older vehicles will be delayed because these latter vehicles meet less stringent emissions standards. Also, emissions control performance deteriorates with age, an element that, when combined with tighter CAFE, could either increase or decrease emissions. But perhaps most importantly, the new vehicles potentially affected by tighter CAFE standards are already subject to increasingly more stringent limits on their per-mile emissions. It is our assessment that local pollution effects would probably play a minor role in any welfare assessment of proposed changes in the CAFE program.

2.4 Imperfect Markets for Improvements in Fuel Economy

A particularly contentious issue is whether, even in the absence of environmental or oil dependency externalities, the market would provide the efficient level of fuel economy. Many engineering studies suggest that there is a wide range of technological possibilities for improving new vehicle fuel economy, which could more than pay for themselves in terms of discounted fuel savings over vehicle lifetimes. For example, a thorough assessment by the National Research Council (2002) considered a range of technologies to improve both engine and transmission efficiency, reduce weight and aerodynamic drag and boost fuel economy in other ways. They concluded that the marginal value of fuel saving benefits might exceed the marginal costs of vehicle redesign for improvements in efficiency from anywhere between 0 and 50 percent above current standards, across a wide range of vehicle classes. Do these examples of technologies not offered to new vehicle buyers constitute a market failure, where more stringent government fuel economy standards could produce net economic benefits, before even counting external benefits?

Several hypotheses have been advanced to explain why vehicle manufacturers may not adopt so-called “no-regrets” technologies that would seem to pay for themselves. For example, consumers may undervalue future savings in gasoline purchases because they lack information, have short horizons, or are uncertain about future fuel prices. In addition, the automobile industry might be viewed as oligopolistic, in which case profit-maximizing manufacturers could undersupply vehicle attributes even when potential buyers would value them.

Others, however, view the new vehicle market as efficient, aside from the externalities described above (e.g., Kleit 1990). According to this view, manufacturers have incentives to provide improvements in fuel economy that consumers are willing to pay for, and buyers are reasonably well informed about fuel economy, thanks in part to stickers that must be displayed on all new cars. Moreover, consumers can already choose from a wide range of cars with exceptionally good fuel economy—ten 2003 models get better than 45 mpg in combined city and highway driving.

Engineering studies alone may give a very unreliable guide to the actual costs of mandated increases in fuel economy. They may not capture many important costs of actually implementing a new technology, such as marketing, maintenance, consumer unfamiliarity, and retraining of mechanics. Moreover, auto manufacturers have for the past several decades devoted their technological skills principally to the introduction of technologies that improve vehicle performance (e.g., acceleration and towing capacity) rather than fuel economy; therefore, the real cost of devoting technology to improving fuel economy is the foregone performance enhancements that might have resulted. Additionally, there is no guarantee that manufacturers would respond to tighter CAFE standards by adopting new, fuel-saving technologies. Instead, it may make more sense for them to lower the relative price of existing cars with high fuel economy to increase their market share, eliminate some of the performance enhancements that have been so attractive, or reduce the weight of new vehicles.

Another potentially significant market failure arises from possibly inadequate incentives for R&D into vehicle fuel economy. R&D will be sub-optimal if manufacturers cannot fully appropriate spillover benefits to other firms from their own innovation; for example, even if they obtain a patent, it may be easy for other firms to imitate around the patent by producing their own modified versions of the original technology. A number of empirical studies suggest that the social return to R&D may greatly exceed the private return (e.g., Mansfield et al. 1977); if so, this implies that innovation incentives are in fact sub-optimal. To the extent that tighter CAFE standards spur new innovation, this could lead to an additional source of welfare gain; however these gains may be limited if the added R&D effort in the vehicle sector comes at the expense of crowding out R&D efforts elsewhere in the economy.

3. Unintended Consequences of CAFE and the Controversy over Highway Safety

3.1 Prior Fuel Taxes

It is important to recognize that the welfare effects of induced changes in the demand for gasoline depend on the marginal external costs of gasoline, *net of any pre-existing gasoline taxes*. If fuel taxes perfectly correct for externalities, then a reduction in gasoline demand does not lead to any net welfare gain, as the source of market failure has effectively been eliminated; and if taxes over-correct for externalities, a reduction in the demand for gasoline will actually lower social welfare. For example, if we assume combined oil dependency and carbon externalities of 24 cents per gallon, then a reduction in gasoline demand by one gallon will save 24 cents in avoided externalities, but will cost federal and state governments the tax revenues on one gallon, which on average amount to about 40 cents.[3]

3.2 The Rebound Effect

Another possibly perverse effect of mandated higher fuel economy is that, by lowering the per-mile cost of driving, it may induce people to drive their vehicles more. Gasoline consumed is the product of gallons/mile times the number of miles traveled. While CAFE standards *reduce* gallons/mile, they *increase* the number of miles traveled by making driving cheaper. In fact, empirical estimates by Jones (1993) and Greene et al. (1999) suggest that this "rebound effect" offsets 10–20% or more of the initial fuel reduction from tighter CAFE standards. The significance of this rebound effect is its implications for the costs of other externalities that vary with the amount of driving, namely congestion and traffic accidents.

Economists measure congestion costs by the extra time it takes to drive under congested conditions, multiplied by the value of travel time (usually taken to be about half the market wage). Detailed analyses by the Texas Transportation Institute suggest that travel delays and the resulting extra fuel combustion now cost the nation around $70 billion annually (Schrank and Lomax 2002). A "best estimate" for the economy-wide marginal congestion cost, one that reflects the shares of driving in both rural and urban areas and at peak- and off-peak periods, as well as the smaller elasticity of demand for driving during congested periods, is 3.5 cents per mile (Parry and Small 2001).

Even congestion costs might be swamped by the societal costs of road accidents occasioned by increased driving, which are responsible for around 40,000 deaths each year; other costs include non-fatal injuries, property damage, and traffic holdups. Miller (1993) pegged aggregate accident costs in 1988 at more than $300 billion. However, we need to be careful in assessing what portion of accident costs is actually external—pedestrian injuries, travel delays, and a portion of property damage are probably external, but people presumably internalize injury risks to themselves. Whether one person's driving raises the accident risk to other drivers is unclear: the frequency of collisions rises with more road traffic but, if people drive more slowly in heavier traffic, a given accident will be less deadly. Parry and Small (2001) put the average accident externality at 3 cents per mile for the United States. Note that this accident effect is separate from and in addition to the well-publicized controversy about accidents attributable to CAFE's effect on vehicle size, which we take up below.

To add up the negative externalities associated with the possible additional driving that might result from tighter fuel economy standards, let's assume a rebound effect of 15% and on-road fuel efficiency of 20 miles per gallon. A "back-of-the-envelope" calculation would be that the rebound effect results in added congestion and accident externalities of 19.5 cents for each

[3] More generally, the resulting welfare cost per gallon of fuel reduction (ignoring externalities) equals the gasoline tax rate times the marginal social value of fuel tax revenue. If the social value of a dollar of tax revenue is assumed to be a dollar, the welfare loss is simply the tax rate. In practice, revenues finance highway maintenance and expansion; in this more general case the welfare loss is higher (lower) than the tax rate if the marginal social value of highway spending is greater (less) than a dollar.

gallon of mandated fuel economy improvement (= $6.5 \times 0.15 \times 20$), or perhaps 95% of the carbon and oil dependency benefits.[4]

3.3 Fleet mix effects and its implications for safety

Opponents of fuel economy standards often assert that they force people into lighter vehicles, and that more use of lighter vehicles will adversely affect road safety. We discuss each assertion in turn, though based on current evidence it is hard to draw definitive conclusions.

Vehicle manufacturers could meet tighter CAFE standards by adopting fuel-saving innovations, by lowering the relative price of small vehicles relative to big vehicles, or by reducing weight and other vehicle attributes. The first strategy has no first-round implications for vehicle safety, though the latter two do. However, economic studies on the likely choice of these strategies have come to mixed conclusions (for example, Kwoka 1983, Kleit 1990, and Greene 1991), depending in part on how much time carmakers are given to meet more stringent standards.

CAFE might also affect the average weight of the vehicle fleet by altering the sales mix of cars versus light-duty trucks, though again the magnitude of this effect is unclear. The CAFE standard is more stringent for cars than light trucks, though that may not greatly increase the price of cars relative to light trucks if achieving a given level of fuel economy is less costly for the former than the latter. The growth in demand for light trucks may be more of a reflection of changing consumer preferences than CAFE-induced price effects. Indeed the growth in the light truck market began well before the onset of CAFE in the late 1970s, and the share of trucks in new vehicle sales then declined sharply between 1978 and 1981—after CAFE—before resuming a steady upward climb (Davis 1999).

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[4] This calculation assumes carbon and oil dependency costs of 12 cents per gallon each, scaled back by 15% to account for the rebound effect. The miles per gallon figure is obtained by splitting the mandated fuel efficiency for cars and light trucks (27.5 and 20.7 respectively) 50−50, and scaling back by 15% because on-road fuel economy is lower than recorded by EPA-required dynamometer testing.

Of course, the welfare cost of the rebound effect could be greatly diminished if other policies were to be implemented to address mileage-related externalities, such as peak period congestion charges, and per mile insurance reform.

Let us make the assumption that tightening fuel economy standards would result in at least somewhat lighter vehicles. How would this affect safety? In single vehicle accidents, which account for roughly half of vehicle occupant deaths, both vehicle size and weight are important factors in determining injury risks; size determines the "crush space" (i.e., the ability of vehicle components to absorb the energy impact rather than transmitting it to vehicle occupants). In multi-vehicle collisions it is not mass per se but rather the *disparity* in the masses of the vehicles that determines injury risk. Recent work by the National Highway Traffic Safety Administration (1997) shows that a 100-pound weight reduction increases fatalities by the same amount for cars and trucks in accidents involving stationary objects. For collisions between cars and light trucks, a 100-pound reduction in car weight increases the combined fatality risk for both cars by 2.6 percent, while a comparable reduction in light-truck weight reduces the combined fatality rate by 1.4 percent. Thus, if most of the downweighting occurred in cars, fatality risks would tend to increase; but the converse could be true if most of the downweighting instead occurred in light trucks.

From the perspective of pure economic efficiency, what matters is the implications of lighter vehicles for the overall external costs of traffic accidents, which is quite different from the effects on total highway deaths, not least because they exclude own-driver risk. Studies using detailed data on highway crashes find that external accident costs per mile driven tend to be about the same, or moderately lower, in most cases for lighter passenger vehicles (see Miller et al. 1998 and Parry and Gruenspecht 2003), though more research on this is required before we can draw conclusions with confidence.

3.4 Would Tighter CAFE Standards Increase or Decrease Social Welfare?

We would like to be able to sum up this discussion with a clear message about CAFE standards. Unfortunately, this is difficult to do with confidence until more consensus emerges on some key issues about which there is great controversy and little solid evidence.

When we account for the existing taxes on gasoline and the likelihood of a rebound effect, it appears that tightening CAFE could significantly reduce social welfare overall. Of course, there is a lot of uncertainty and differences in opinion about the nature and value of externalities. Moreover, assessments of marginal external damages may rise significantly in the future. For instance, the United States will become more dependent on oil imports over the next 25 years as world production becomes ever more concentrated in the Persian Gulf, where two-thirds of the world's reserves are located. Also, according to Nordhaus and Boyer (1999), marginal damages from carbon emissions may also increase several-fold over the course of the next century; climate change damages are a convex function of the atmospheric stock of greenhouse gases so that, as gases accumulate in the atmosphere over time, the marginal damage from further additions to the stock become progressively higher.

Nonetheless, at least based on currently available evidence, it appears difficult to make a watertight case for tightening fuel economy standards now, *based on externality grounds alone*. However, there are other important issues—particularly the possibility of sub-optimal incentives for fuel economy innovation—that need to be resolved and incorporated in a broader cost/benefit assessment. It seems plausible to us that tightening CAFE could still be welfare-improving overall—despite the rebound effect and prior fuel taxes—*if* the market does in fact provide too little incentive for fuel economy improvement.

4. Alternatives to the Current CAFE Policy[5]

The current CAFE policy is only one of many policies that could reduce petroleum consumption.

4.1 Improvements within the existing CAFE structure

Even if CAFE were kept basically intact, a number of modifications could be made to the program to make it more cost effective. One problem with the existing program is that the same fuel economy standard for both car and light-duty truck fleets is imposed across vehicle manufacturers, regardless of how costly it is for them to comply. Moreover, manufacturers who do better than their target in a given year in one segment (say light-duty trucks) can only use the

[5] For a more detailed discussion of some policy options related to fuel economy, see Congressional Budget Office (2002) and National Research Council (2002).

credits they earn to offset worse-than-required performance in that same vehicle segment, and only then for the next three years, after which the credits expire.

If manufacturers were allowed to trade fuel economy credits both between their own car and light-duty truck fleets, and also between one another, those with high marginal compliance costs could purchase credits from those with low marginal costs. This would allow a given (aggregate) target for fuel economy to be achieved at lower overall social cost. In the jargon of environmental economics, this is simply a replacement of the current "bubble" policy, which allows averaging within a manufacturer's own car and truck fleets, by a system of tradable allowances between cars and trucks and among manufacturers. Creating a market price for CAFE credits would also shed light on the real costs of improving fuel economy.

A system of tradable CAFE credits could also incorporate a cost cap. This could be implemented via a standing government offer to provide unlimited additional CAFE credits at a fixed price, providing an "escape valve" for manufacturers/consumers in the event that market or technological conditions would otherwise result in excessive price or performance penalties. Should the cap be triggered, the program becomes a "price-type" instrument that fixes compliance costs rather than a "quantity-type" instrument that sets average fuel economy regardless of cost.

4.2 Other policies to increase fuel economy

A variety of other approaches have been put forward that would have the effect of promoting greater fuel economy. For instance, current and proposed programs encourage the purchase of new fuel-efficient vehicles through federal tax deductions. Similarly, some have called for the imposition of fees on gas guzzlers that would be rebated to those purchasing gas "sippers." Such "feebate" programs generally have the same advantages and drawbacks as CAFE regulation. In particular, they do nothing to influence how much vehicles are driven and risks unintended consequences of additional driving.

4.3 Insurance Reform

It is worth mentioning one approach that could be both politically attractive, as well as providing significant incentives for reducing fuel demand, though that is not its primary motivation. We are referring to policies that encourage the transition from an automobile insurance system based on fixed annual charges to one where charges would be based on annual miles driven. Until recently, pay-as-you-drive (PAYD) insurance has been infeasible because there has been no inexpensive, reliable and tamper-proof way to monitor vehicle use, but the advent of global positioning systems (GPS) and on-board telemetering devices has reduced if not removed that obstacle. Political opposition to raising the cost of driving through pay-as-you-drive insurance may be lower than opposition to raising the gasoline tax, since it would not raise motoring costs for the average driver.[6] Its limitation is that it provides no incentives to improve fuel economy, as it penalizes miles driven rather than fuel use.

4.4 Gasoline taxes

On economic efficiency grounds alone, raising the gasoline tax would be a far better approach to reducing gasoline consumption than tightening CAFE standards, because it exploits all potential behavioral responses for reducing fuel use (e.g., Thorpe 1997, Congressional Budget Office 2002). Unlike CAFE, a fuel tax does not "work against itself" by encouraging people to drive more; instead it raises the cost of driving--and does so for both existing as well as new vehicles. Gasoline taxes encourage people to buy more fuel-efficient vehicles (and thus create incentives for automakers to produce them), to use more efficient vehicles if they have more than one, and to conserve fuel through their patterns of driving and maintenance.

The problem with gasoline taxes, of course, is not economic but political. In a country with low fuel prices and high fuel demand there is a powerful constituency lobbying against higher taxes (Goel and Nelson 1999). Nivola and Crandall (1995) have identified numerous obstacles to higher fuel taxes in the U.S. These include high levels of vehicle ownership, poorly developed mass transit systems, local land-use laws promoting low-density development and the

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[6] Many motorists pay similar amounts for insurance each year as they do for gasoline. For example, the typical motorist drives 12,000 miles each year. At 20 miles per gallon, she buys 600 gallons annually; at $1.40/gallon, total expenditures are $840, just about the same as the $800 annual insurance premium that is typical. Suppose that only half one's annual insurance premium was based on miles traveled. Dividing $400 by 12,000 miles traveled gives an insurance cost per mile of $0.033. At 20 mpg, this is the same as a gasoline tax of nearly $0.67/gallon, or more than one and a half times the current combined federal, state and local taxes!

lack of a constituency for higher taxes which are, unlike in Europe, earmarked for ground transportation, primarily roadbuilding. Notwithstanding the intrinsic merit of a policy instrument that would simultaneously reduce oil use, global and local pollution, road congestion and accidents, it is difficult to envision a major increase in the federal gasoline tax for the foreseeable future. To the contrary, the federal tax has remained unchanged since 1993 even though the consumer price index has increased more than 20 percent since then.

4.5 Policies Addressing Specific Externalities

If our real concern is the externalities that attend gasoline consumption, such as greenhouse gas emissions, a tax on the carbon content of gasoline and all other carbon-based fuels, or a system of tradable carbon permits, would be a far more efficient way to address it than fuel economy standards. In addition to reducing gasoline consumption, a price-based or quantity-based approach to carbon would exploit options for emissions reductions from fuel substitution in electricity generation, adoption of electricity-saving technologies by firms and households, fuel conservation in industry, and so on. Indeed according to Energy Information Administration (1998), under an efficient policy to reduce carbon emissions, around two-thirds of the emissions reductions would come from the electricity sector alone; vehicle transportation does not appear to provide many low-cost options for reducing carbon emissions. Similarly, gasoline accounts for only 43% of oil consumption in the United States (Energy Information Administration 2002, Table 5.11). A broad-based oil tax would be a far more efficient policy than fuel economy standards for reducing economy-wide oil dependency as it would also encourage conservation of aviation fuel, diesel fuel, home heating oil, and other oil-based products.

5. Conclusion

There are several strong conclusions we can draw from the extensive literature pertinent to government-mandated fuel economy standards. First, there is no doubt that far more efficient tools exist for reducing oil consumption and greenhouse gas emissions. But the most efficient of these—taxes on gasoline or the carbon content of fuels, or tradable allowances for carbon emissions—face especially stiff opposition in the current political climate. Second, while it is a less efficient approach, the current regulatory edifice supporting CAFE standards would be greatly improved by making fuel economy credits transferable between passenger car and light-duty truck fleets and especially between different manufacturers. Such a change would engender much less political opposition than raising existing taxes or creating new ones.

However, if the *only* choice before us were tightening CAFE standards as they now exist or doing nothing at all, the authors of this paper could not reach agreement on a recommendation. More stringent standards would reduce oil consumption and carbon dioxide emissions, but not quite as much as one might expect because of the rebound effect. The social costs of this additional driving, moreover, could be about as large as the beneficial effects of CAFE. Throw in the pre-existing taxes on gasoline and it's quite possible that tightening CAFE could do more harm than good. This conclusion may change if the marginal benefits of reduced oil consumption and greenhouse gas emissions increase over time, or if technologies to improve fuel economy turn out to be relatively inexpensive.

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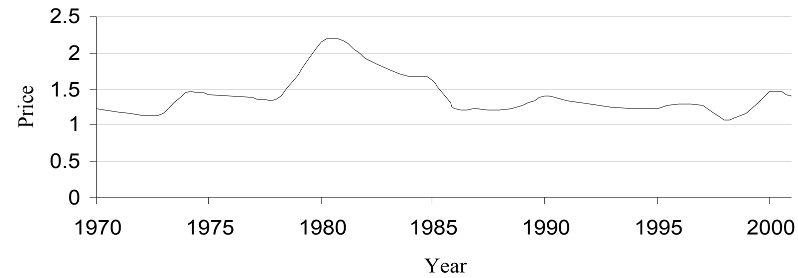
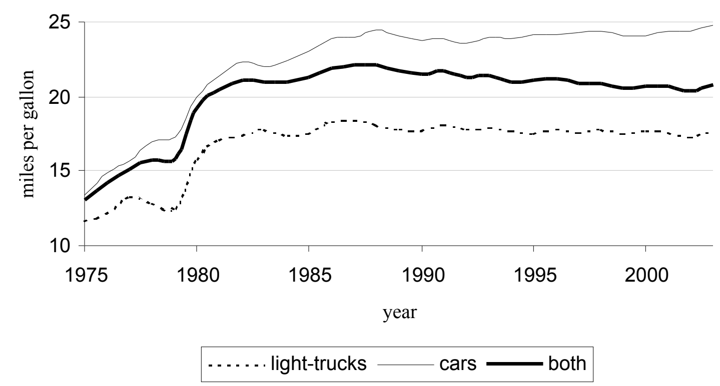
Figure 1. Gasoline Prices, 1970-2001
(all grades in $1996 per gallon)



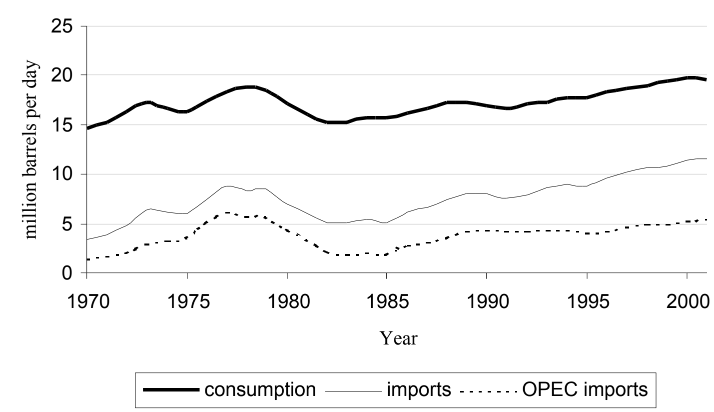
Source: Energy Information Administration (2002).

Figure 2. Fuel Economy by Model Year



Source: Environmental Protection Agency (2003).

Figure 3. Petroleum Consumption and Import Trends



Source: Energy Information Administration (2002).