www.vtpi.org
Info@vtpi.org
250-360-1560

Appropriate Response to Rising Fuel Prices

Citizens Should Demand, "Raise My Prices Now!"

6 November 2011

Todd Litman
Victoria Transport Policy Institute

Summary
This paper evaluates policy options for responding to rising fuel prices. There is popular support for policies that minimize fuel prices through subsidies and tax reductions, but such policies harm consumers and the economy overall because they increase total fuel consumption and vehicle travel, and therefore associated costs such as traffic and parking congestion, infrastructure costs, traffic crashes, trade imbalances and pollution emissions. Fuel price reductions are an inefficient way to help low-income households; other strategies do more to increase affordability and provide other benefits. Because many transport decisions are durable, low fuel price policies are particularly harmful over the long term. This report identifies responses that maximize total benefits, including mobility management strategies that increase transport system efficiency, incentives to choose fuel efficient vehicles, and revenue-neutral tax shifts. With these policies fuel prices can significantly increase without harming consumers or the economy, while helping to achieve other planning objectives.

Introduction

Motor vehicle fuel prices have increased significantly in recent years and are likely to stay high in the future. Between 2003 and 2008 average U.S. gasoline retail prices more than doubled, from $1.77 to $4.10 per gallon, and high prices are expected to continue due to growing international demand and rising production costs (Jackson 2007).

Fuel prices are an emotional issue. Even at lower prices many motorists feel they pay more than is fair. There are frequent demands for investigations into fuel price gouging, and popular campaigns to promote cheaper fuel through public policies and consumer boycotts.[1] As a result, consumers, consumer groups and policy makers are wondering how best to respond to rising fuel prices.

Which policies are considered optimal depends on how the problem is defined. If the only concern is *consumer unaffordability* (excessive financial costs to purchase important goods and services), then price minimization policies may seem sensible, but considering other impacts, such policies are undesirable because they impose costs elsewhere in the economy, and increase total fuel consumption and vehicle travel which exacerbates other economic, social and environmental problems. When all impacts are considered, solutions that increase transport system efficiency are usually considered best.

Advocates of price minimization policies typically argue that high fuel prices harm consumers and cripple the economy, but this focuses on the wrong factor. Consumers and businesses are affected by *total fuel costs*, the product of *fuel prices* (cost per gallon or liter) times vehicle *fuel economy* (miles per gallon or kilometers per liter)[2] times *vehicle mileage* (motor vehicle miles or kilometers driven), as summarized below:

Annual Fuel Cost = Fuel Price x Fuel Economy x Annual Mileage

Improving vehicle fuel economy and reducing per capita vehicle travel protect consumers and the economy from rising fuel prices and provide other benefits. Described differently, some policies represent *true economy* because they increase overall efficiency and help solve multiple problems, providing maximum benefits, while other responses represent *false economy* because the simply shift cost burdens from fuel to other goods, which increases total costs and exacerbates other problems.

This paper investigates these issues. It examines fuel price trends and evaluates potential policy responses in terms of various objectives. This is a timely issue because this is a transition period from declining to increasing fuel costs. It is therefore important to shift policies to reflect future needs.

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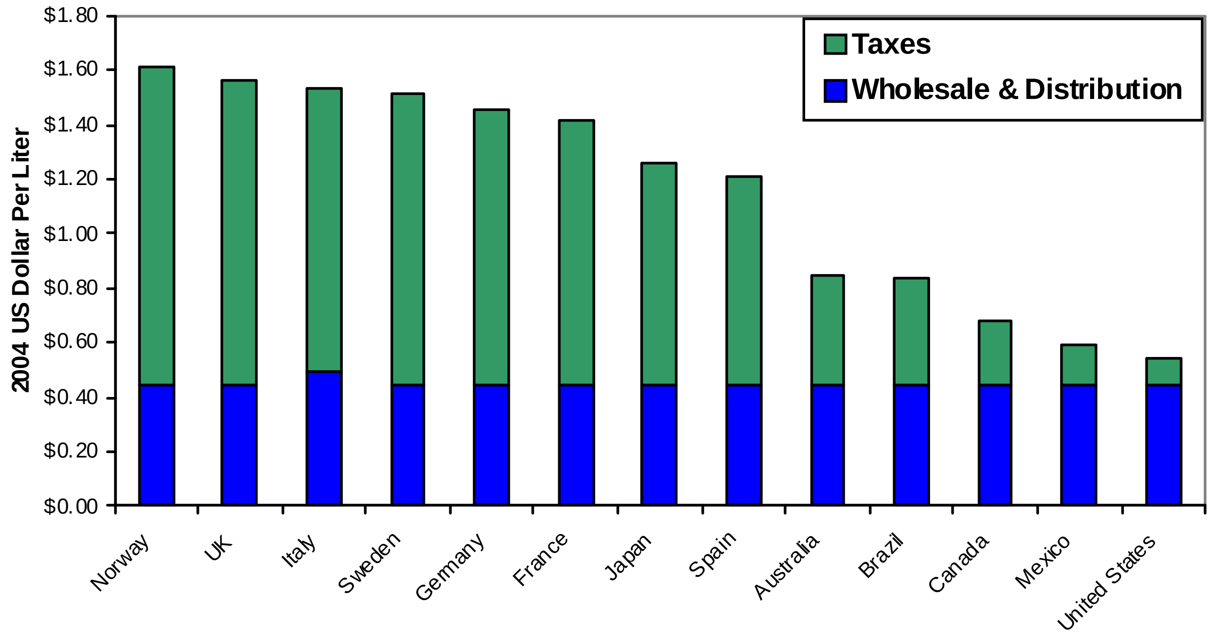
[1] For example, the *GasBuddy.com* Internet network designed to help consumers avoid fuel price gouging was established in 2000, when real fuel prices where at their lowest point in history.
[2] *Fuel economy* refers to fuel consumption per unit of travel. *Fuel efficiency* refers to fuel consumption per unit of output power. Increased fuel efficiency can either be used to increase vehicle fuel economy or performance (vehicle weight, carrying capacity and speed).

Fuel Cost Trends

This section discusses current trends that affect transport energy costs.

Current North American fuel prices are relatively low by most standards. United States and Canada fuel prices are lower than most other high-income countries, as illustrated in Figure 1. Norway and the UK are particularly interesting for comparison because during the last few decades these countries were major petroleum producers, yet they retained high fuel prices as a strategic policy to encourage energy efficiency.

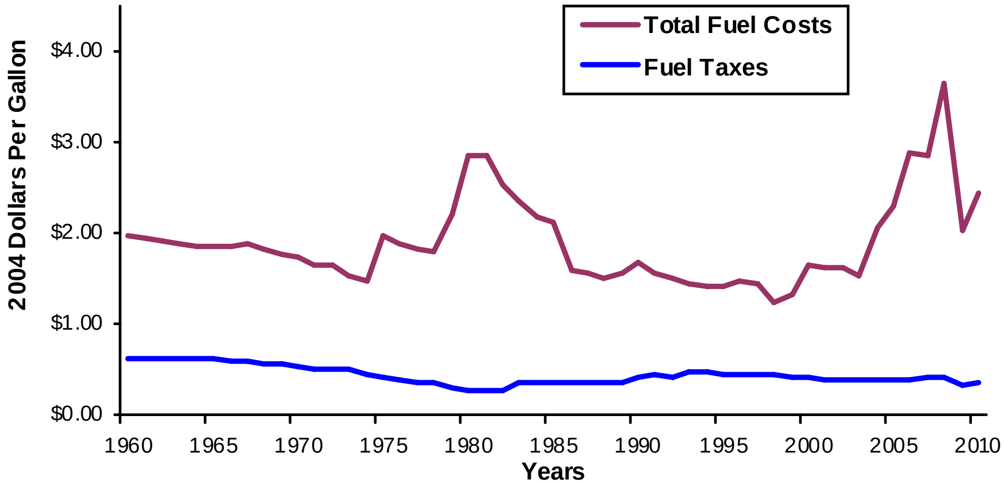
Figure 1 **2006 Transport Fuel Prices** (International Fuel Prices 2007)



North American fuel taxes and prices are far lower than those in most other developed countries.

Figure 2 illustrates inflation-adjusted fuel prices and taxes between 1960 and 2008. Between the mid-1980s and 2003 real prices tended to decline. Recent increases have raised fuel prices to historic highs. Prices are likely to increase in the future due to rising international demand, declining supply and increasing production costs, called *peak oil* (*Wikipedia* 2007; Jackson 2007). Most projections suggest that petroleum prices will stay above $80 per barrel, leading to retail prices exceeding $4.00 per gallon, and perhaps higher (Rubin and Tal 2008).

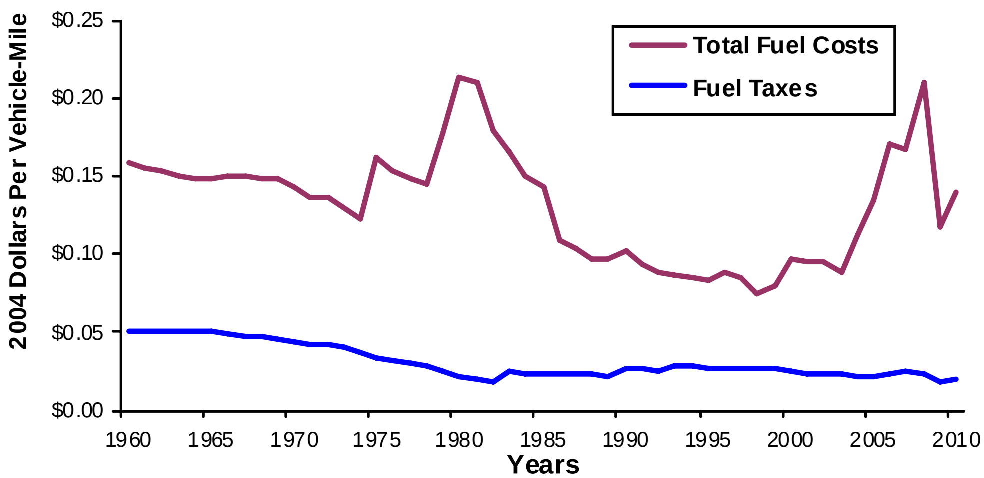
Figure 2 **U.S. Fuel and Fuel Tax Costs** (VTPI 2010)



This figure shows inflation-adjusted fuel prices and taxes per gallon between 1960 and 2010.

Fuel costs per vehicle-mile declined during most of the last four decades because manufacturers responded to high fuel prices in the 1970s and 80s by developing more efficient vehicles. Overall average fuel economy for all road vehicles (including large trucks) rose from 12.4 miles-per-gallon (mpg) in 1960 to 17.0 mpg in 2004, a 38% increase. The decline in real fuel prices and increased vehicle efficiency during the last two decades explains the popularity of trucks and SUVs for personal travel during that period: consumers could afford larger and higher performance vehicles without paying more per vehicle-mile in fuel costs. Figure 3 shows average fuel prices and taxes per vehicle-mile.

Figure 3 **U.S. Per-Mile Fuel Costs And Taxes** (VTPI 2010)

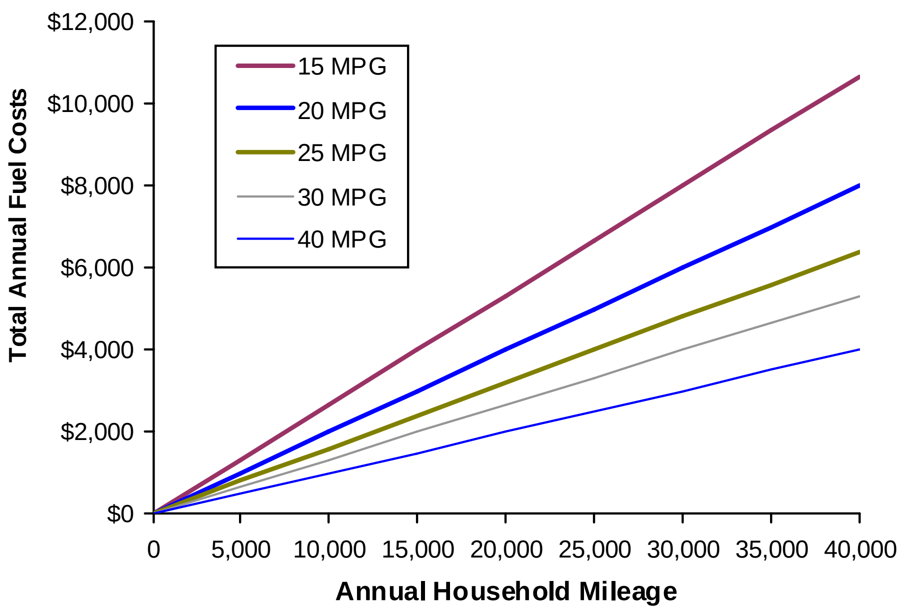


This figure shows U.S. fuel prices and taxes per vehicle-mile between 1960 and 2008. Fuel efficiency increased during the 1970s and 80s, reducing per-mile costs.

Policies that attempt to reduce fuel prices through subsidies and tax reductions usually only provide modest consumer savings (a few cents per gallon or liter). This is because larger reductions are so costly (the subsidies needed to offset recent oil price increases would bankrupt most governments). In addition, producers often capture a portion of the savings through higher profit margins rather than passing savings on as price reductions.

Decisions concerning vehicle selection, travel patterns and location can have larger effect on total fuel costs than fuel prices. For example, at $4.00 per gallon a motorist who drives 15,000 annual miles in a 15 mile-per-gallon (mpg) vehicle pays $4,000 in total annual fuel costs, compared with $1,333 for a 30 mpg vehicle driven 10,000 annual miles. Similarly, a two vehicle household in an isolated location that requires 20,000 annual miles per vehicle averaging 20 mpg pays $8,000 for fuel, twice the $4,000 annual fuel costs if a more accessible location allows them to drive just 10,000 annual miles per vehicle. Figure 4 shows the effects of fuel efficiency and annual mileage on total fuel costs, indicating a ten-fold increase between the most and least efficient households.

Figure 4 **Total Annual Fuel Costs At $3.45 Per Gallon**



This graph shows how fuel efficiency and annual mileage affect total household fuel costs with fuel at $4.00 per gallon. An automobile-dependent household with two 15 mpg vehicles each driven 20,000 annual miles spends ten times as much on fuel as a transportation-efficient household with a 40 mpg car driven 10,000 annual miles.

Fuel represents only about a quarter of total vehicle costs. Policies that reduce total vehicle ownership and travel provide large additional savings ("Costs of Driving" VTPI, 2006). Households in communities with accessible locations and good transport options (good walking and cycling conditions and high public transit service quality) save thousands of dollars annually on transportation costs (Bernstein, Makarewicz and McCarty 2005; CTOD and CNT 2006).

Fuel Price Impacts On Energy Consumption and Travel

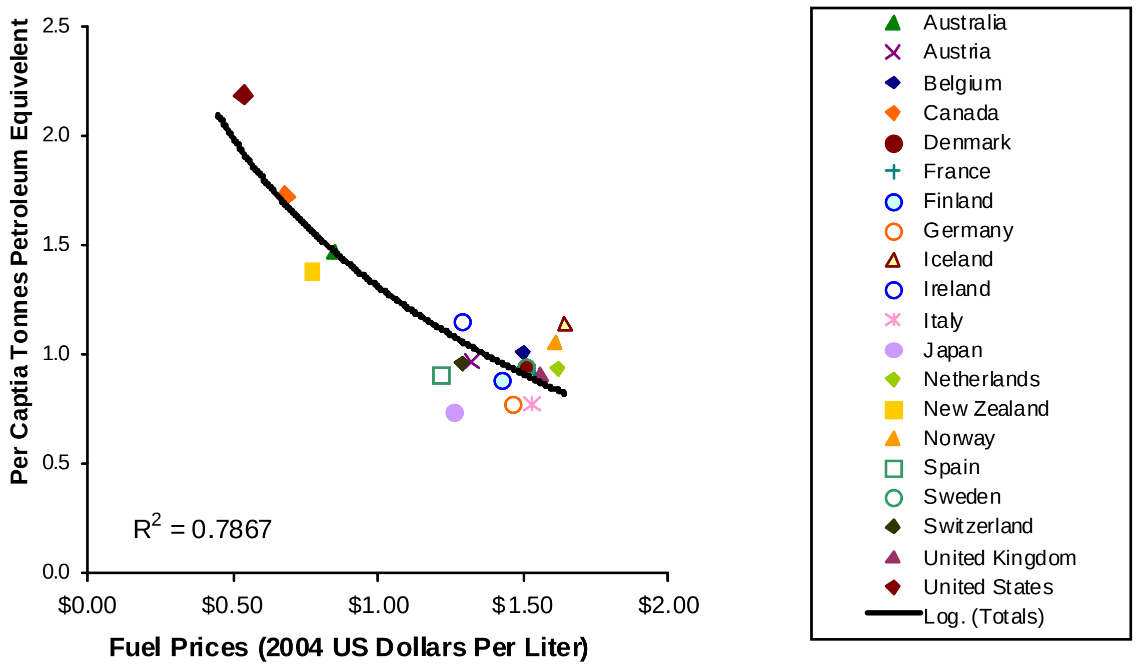
This section discusses how fuel prices affect transport energy consumption and travel activity.

Various studies have investigated the *price elasticity* of fuel, that is, how prices affect fuel consumption ("Transport Elasticities," VTPI 2006).[3] These studies indicate that over the long-run a 10% fuel price increase typically causes:[4]

- A 4-6% reduction in total long-term vehicle fuel consumption.
- A 3-4% increase in long-term fuel efficiency.
- A 1-3% reduction in vehicle mileage.

Figure 5 compares fuel prices and per capita transportation energy consumption in various countries. High fuel prices are associated with low energy consumption. The U.S., Canada, Australia and New Zealand have low fuel prices and high transportation energy consumption, while people in other developed countries pay two or three times as much for fuel and consume about half as much transport energy.

Figure 5 **Fuel Price Versus Per Capita Transport Energy Consumption** (OECD 2005)[5]

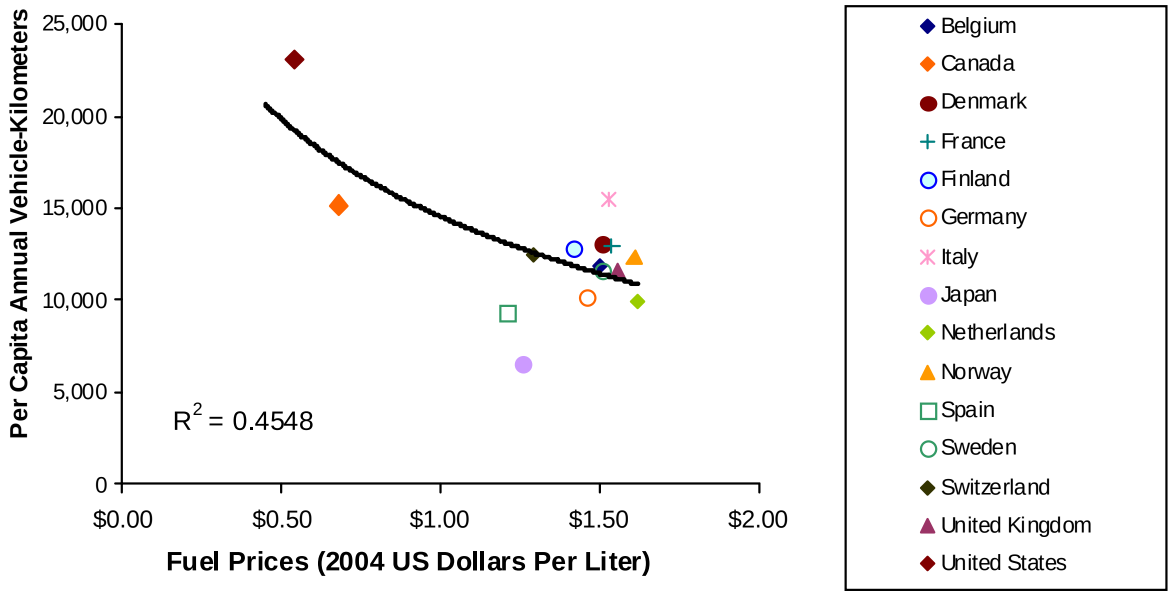


As fuel prices increase, per capita transportation energy consumption declines.

[3] For more additional information see *Transportation Elasticities: How Prices and Other Factors Affect Travel Behavior* at www.vtpi.org/elasticities.pdf.
[4] Some studies indicate smaller price impacts, but they usually reflect shorter-run effects, during the first year or two after a price change. Long-run impacts tend to be two to four times higher.
[5] For data see the *OECD Country Data Summary Spreadsheet* (www.vtpi.org/OECD2006.xls)

Motorists in fuel efficient countries tend to drive more efficient vehicles, drive fewer annual miles, rely more on alternative modes and choose more accessible communities. Transport and land use policies provide better travel options (better walking and cycling conditions, and better quality public transit services) than what exists in more automobile dependent communities. Figure 6 shows a negative relationship between fuel prices and annual motor vehicle mileage. The relationship is weak because other demographic and geographic factors (income, transport and land use policies) also affect travel.

Figure 6 **Fuel Price Versus Per Capita Vehicle Travel** (OECD 2005)[6]



Higher fuel prices tend to reduce per capita vehicle travel.

Recent studies found that U.S. fuel price elasticities declined between 1990 and 2005 (CBO 2008). There is debate as to whether this is temporary, due to unique factors that occurred during that period such as declining real fuel prices, demographics (the baby boom was at its peak employment and driving age) and development policies that encouraged sprawl, or a permanent structural change reflecting irreversible consumer preferences for highly mobile and energy-intensive lifestyles. Hughes, Knittel and Sperling (2006) compared gasoline price and income elasticities in two periods of similarly price increases, 1975 to 1980 and 2001 to 2006. Short-run price elasticities declined from -0.21 to -0.34 for 1975-80 down to -0.034 to -0.077 for 2001-06. Similarly, Small and Van Dender (2005 and 2007) used cross sectional data from U.S. states from 1966-2001 to evaluate fuel price and income elasticities. Over the entire period they found gasoline price elasticities of approximately -0.09 in the short run and -0.40% in the long run, about half the values of previous periods. These studies indicate that structural changes have reduced U.S. consumer responsiveness to fuel prices.

[6] For data see the *OECD Country Data Summary Spreadsheet* (www.vtpi.org/OECD2006.xls)

However, in 2007 and 2008, per capita fuel consumption and vehicle travel declined, suggesting that fuel consumers are again responsive to fuel prices due to their increasing household budget impacts (CERA 2006; Litman 2011). For example, in 2004, when gasoline averaged $1.88 per gallon, an average household that drives 20,000 annual miles in 20 miles per gallon (mpg) vehicles spent about $1,900 annual on fuel, about 3.3% of total household expenditures. A less efficient vehicle that gets 15 mpg, or a more isolated home location that requires 30,000 annual miles, increases fuel costs several hundred dollars annually, but could still be considered affordable to most households. In July 2008, when fuel averages about $4.10 per gallon, the average household must pay $4,100 for 20,000 miles at 20 mpg, nearly as much as previously spent by the highest fuel consuming households (15 mpg, 30,000 annual miles), and driving a less efficient vehicle or high annual mileage adds thousands of dollars to annual fuel costs.

Table 1 **Fuel Costs as Portion of Household Expenditures, 2004 and 2008**

	2004			2008		
Fuel Price	$1.88 per gallon			$4.10 per gallon		
Fuel Economy	30 mpg	20 mpg	15 mpg	30 mpg	20 mpg	15 mpg
10,000 annual miles	$627 (1.4%)	$940 (2.2%)	$1,253 (2.9%)	$1,367 (2.8%)	$2,050 (4.2%)	$2,733 (5.6%)
20,000 annual miles	$1,253 (2.9%)	$1,880 (3.3%)	$2,507 (5.8%)	$2,733 (5.6%)	$4,100 (8.5%)	$5,467 (11.3%)
30,000 annual miles	$1,880 (4.3%)	$2,820 (6.5%)	$3,760 (8.7%)	$4,100 (8.5%)	$6,150 (12.7%)	$8,200 (16.9%)

This table compares fuel expenditures in 2004, when vehicle fuel prices averaged $1.88, and 2008 when fuel prices averaged $4.10. Values in parenthesis indicate fuel purchases as a portion of total average household expenditures.

Komanoff (2008) estimates that US short-run fuel price elasticity reached a low of -0.04 in 2004, but increased to -0.08 in 2005, -0.12 in 2006 and -0.16 in 2007. In 2007 and 2008 there have been substantial declines in the sale of fuel inefficient vehicles such as SUVs and light trucks, and reduced demand for housing in automobile-dependent locations, indicating that consumers are taking fuel costs into account when making long-term decisions (Cortright 2008). This suggests that structural changes in consumer demands and markets have returned U.S. fuel price elasticities to normal levels.

Policies that force consumers to purchase more fuel efficient vehicles than they would otherwise choose result in *rebound effects*: as fuel costs per vehicle-mile decrease, motorists drive more annual miles (reflecting the price elasticity of vehicle travel). So, for example, doubling average fuel efficiency can be expected to cause average annual vehicle mileage to increase about 20% compared with what would otherwise occur (CBO 2003). Although there is still an 80% net energy savings, the additional mileage exacerbates problems such as congestion, facility costs, accidents and some environmental impacts (Litman 2005).

These responses temper the burdens on consumers of rising fuel prices and reduce the total savings to consumers of fuel subsidies and tax reductions. For example, over the long run a 10% fuel price increase only raises total fuel costs by about 4%, after consumers make these adjustments. Conversely, efforts to reduce fuel prices through production subsidies or lower taxes will cause consumers to choose less efficient vehicles and drive more than would otherwise occur.

Problem Definitions and Potential Solutions

The problems of rising fuel prices can be defined in various ways, as summarized in Table 2.

Table 2 **Problem Definitions**

Problem Definition	Definition	Indicators
Fuel unaffordability	Consumers consider fuel too expensive. Lower income motorists cannot afford essential vehicle travel.	Fuel retail prices
Transportation unaffordability	Consumers consider transport too expensive. Lower income consumers are unable to afford essential travel.	Total household transport expenditures
Energy dependence	Economic costs and risks of importing petroleum.	Petroleum import costs
Vehicle fuel inefficiency	Motor vehicles are fuel inefficient. Per-mile fuel costs and emissions are excessive.	Vehicle fuel economy
Transport system inefficiency	The transport uses resources inefficiently. Total economic, social and environmental costs are excessive.	Total transport costs relative to benefits

Table 3 lists examples of various types of possible responses.

Table 3 **Potential Responses**

Do Nothing	Minimize Price Increases	Alternative Fuels	Efficient Vehicles	Mobility Management
Raise taxes to account for inflation Allow prices to increase and markets to respond	Subsidize fuel production. Reduce fuel taxes.	Support alt. fuel technology development. Support alt. fuel production and consumption. Reduce taxes on alt. fuels and increase taxes on conventional fuels.	Support efficient vehicle technology development. Support efficient vehicle production and purchase. Tax or forbid inefficient vehicles. Increase fuel taxes.	Improve alternative modes. Efficient incentives (road and parking pricing, fuel taxes, commute trip reduction programs). Smart growth land use policies.

This table lists various potential solutions to rising fuel prices.

These responses affect problems differently. Table 4 indicates whether a solution solves or exacerbates various problems. Efforts to minimize fuel price tend to exacerbate most other problems because of increased vehicle travel and energy consumption.

Table 4 **Evaluating Potential Solutions**

Problem	Minimize price increases	Alternative fuels	Efficient vehicles	Mobility management
Fuel Inaffordability	✓	✓		
Transport Inaffordability	✓	✓	✓	✓
Energy Insecurity	✗	✓	✓	✓
Vehicle Inefficiency	✗		✓	
Transport System Inefficiency	✗		✗	✓

Different problem definitions justify different types of solutions. (✓ = helps solve; ✗ = exacerbates)

Comprehensive Evaluation

This section identifies various impacts that should be considered when evaluating potential responses to rising fuel prices.

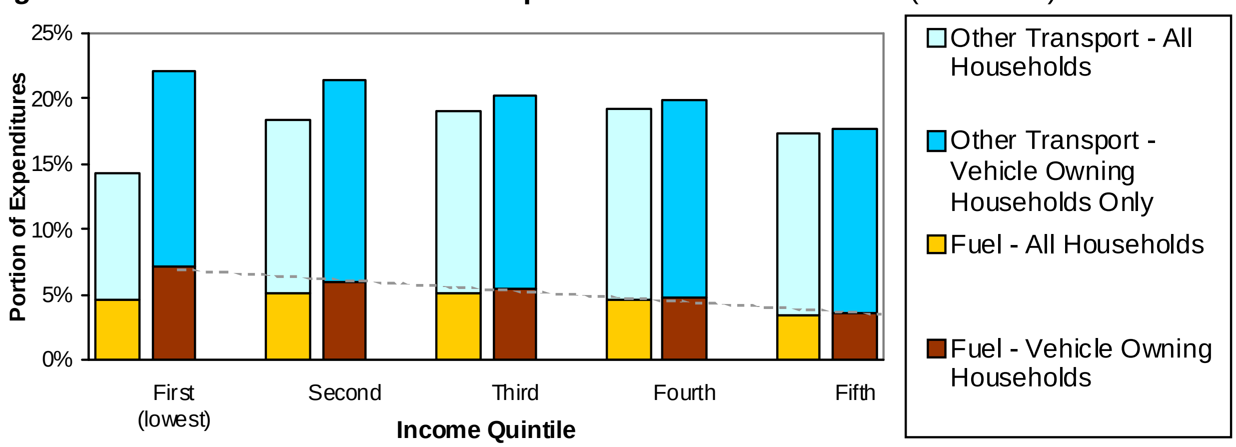
Consumer Impacts

Consumer impacts refers to direct costs and benefits to consumers, including fuel and vehicle costs, and mobility impacts. These are discussed below.

Fuel Costs

Vehicle fuel is a moderate household cost. In 2005 consumers devoted about 5% of total household budgets to fuel (this has probably increased somewhat due to subsequent price increases). This represents about a quarter of total transportation expenditures, as indicated in Figure 7.[7] Considering all households, fuel and transport expenditures are not regressive – the lowest income quintile spends a smaller portion of household budgets on fuel and transport than the second and third quintile. However, for vehicle-owning households as a group, fuel costs are regressive, declining from 7.1% of expenditures for the lowest income quintile down to 3.6% for the highest income quintile.

Figure 7 **Portion of Household Expenditures Devoted to Fuel** (BLS 2005)



Vehicle fuel expenditures are not regressive overall (yellow bars), but are regressive for vehicle-owning households (red bars and dashed line).

This suggests that high fuel prices burden low-income households if they lack transport options, so there are two ways to help such consumers: reduce fuel prices or improve affordable transport options available to low-income households (Golub 2010). The second approach is particularly beneficial to households and society because it reduces total vehicle costs, not just fuel, providing far larger total savings than would be feasible with virtually any fuel price minimization policy, as described below.

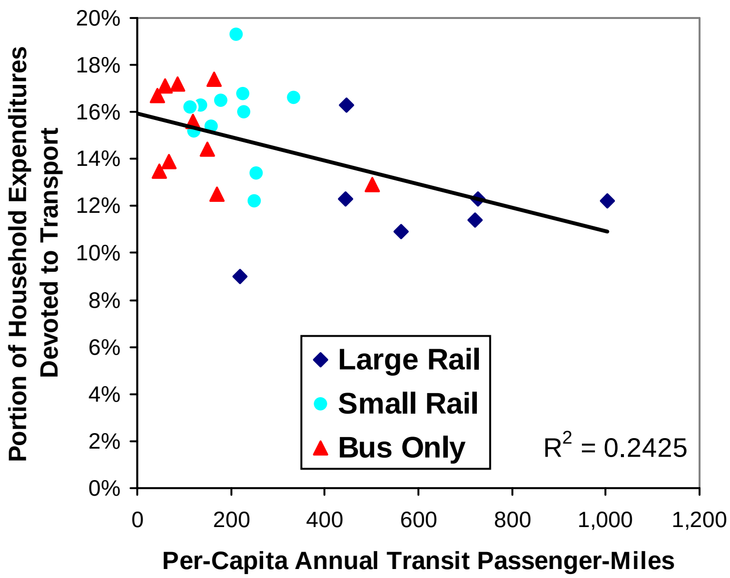
[7] Fuel is regressive when evaluated relative to household *income* rather than *expenditures*. Most economists consider expenditures a more accurate indicator of equity.

Vehicle Costs

Increasing fuel economy and accommodating alternative fuels (such as biofuels) increases vehicle production costs to develop and implement fuel saving technologies, but these are offset by future fuel savings. These are often cost effective investments (fuel savings repay incremental costs), although consumers typically demand very short paybacks on such investments and fail to anticipate future fuel price increases, and so are likely to choose less efficient vehicles than what they will consider optimal in the future. This suggests that incentives for vehicle purchasers to choose efficient vehicles may be justified to overcome consumer ignorance and bias.

As described above, strategies that improve travel options can provide large total savings by reducing total vehicle costs, which are about four times greater than fuel costs. Residents of more accessible, multi-modal communities tend to spend much less on fuel and transportation than residents of more automobile-dependent communities. According to one study, transportation costs represent only about 10% of household expenditures in multi-modal communities, but about 25% in automobile dependent communities (CTOD and CNT, 2006). Residents of cities with high-quality rail transit systems tend to spend a much smaller portion of household income on transportation and fuel, as illustrated in Figure 8. In 2003, residents of such communities saved about $450 annually on total transportation expenditures (these annual savings have probably increased since due to rising fuel prices), plus additional savings from reduced residential parking costs and traffic accidents, improved health, and time savings from reduced need to chauffeur non-drivers (Litman, 2004; also see Bernstein, Makarewicz and McCarty 2005).

Figure 8 **Percent Transport Expenditures** (Litman 2006)



The portion of total household expenditures devoted to transportation (automobiles and transit) tends to decline with high quality public transit service with high levels of transit ridership.

Vehicle Performance

Fuel efficient vehicles often provide less performance (speed, carrying capacity and occupant protection) than less efficient vehicles. Reduced performance can be considered a cost to consumers. However, part of the reason consumers choose larger vehicles is based on their *relative* attributes, that is, for the sake of prestige or because they feel safer in a vehicle that is large relative to other vehicles on the roadway. To the degree that this is true, it reduces the total costs to consumers from shifts to more fuel efficient vehicles by the overall vehicle fleet, rather than by individual motorists.

Mobility Impacts

Changes in mobility (the amount people travel) have various consumer impacts that should be considered in transport policy analysis (Litman 2006). Increased fuel prices force people to drive less, which reduces consumer surplus, or as somebody commented on an economics website, "Like it or not, this is a country that relies on the automobile for transportation. A gas tax is a limit on our freedom of movement."[8] But this is an exaggeration. Although increased mobility can increase some freedoms, it imposes costs that reduce other freedoms. This includes increased financial costs that reduces consumers' freedom to purchase other goods or forces them to work longer hours, reduced mobility options for non-drivers, increased crash injuries and disabilities, and more sprawl that increases the distances people must travel to access destinations. At the margin, many people would probably prefer to drive less and rely more on alternative modes, provided they are convenient, comfortable and prestigious.

Smart policies can minimize the costs and maximize the benefits of reduced mobility:

- Many of the problems that result when people are forced to reduce mobility reflect transition costs, that is, the costs of adjusting to new conditions. This burden is minimized if we plan for increased energy efficiency, for example, by building more accessible communities and improving the quality of alternative modes.
- Mobility management strategies that apply positive incentives increase consumer benefits overall. For example, if travelers reduce vehicle travel in response to improved transport options (better walking and cycling conditions, improved rideshare and public transit services), they must be better off overall or they would continue driving. Similarly, mileage reductions that result from positive incentives such as *Parking Cash Out* (commuters can choose cash instead of a subsidized parking space) represent net consumer benefits.
- The cost to consumers of reducing mileage depends on the quality of travel options (walking and cycling conditions, ridesharing and public transit service quality, telework and delivery service availability).
- Efficient pricing gives consumers incentives to reduce their least valued trips, while higher value trips continue, and often with less congestion delay.

Thus, reduced mobility can have minimal costs or net benefits to consumers if fuel price increases are predictable and gradual (so consumers can anticipate them when making longer term decisions), and policies improve transport options and land use accessibility.

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[8] http://econlog.econlib.org/archives/2004/03/oil_econ_follow.html.

Subsidy Costs

Many fuel price reduction strategies require subsidies, including production subsidies, tax exemptions, and uncompensated public costs (GSI 2007). Such subsidies are often indirect, such as tax polices that favor petroleum production and consumption ("Resource Externalities," Litman 2007a). These subsidies impose costs elsewhere in the economy. Fuel prices are often considered a road user fee, which should be high enough to at least recover expenditures on roads and traffic services (Metschies 2005). Since most fuel taxes are per unit (per gallon or liter), they must be increased periodically to account for inflation or they loose their value. Failure to do this is a hidden form of subsidy.

Transportation System Performance

Transportation system performance refers to factors such as travel speed, traffic and parking congestion, traffic accidents, and the quality of mobility options. Policies that increase total vehicle traffic tend to reduce transportation system performance by increasing congestion and per capita traffic accident rates, while policies that reduce total vehicle travel and improve mobility options tend to improve transport system performance.

Environmental Impacts

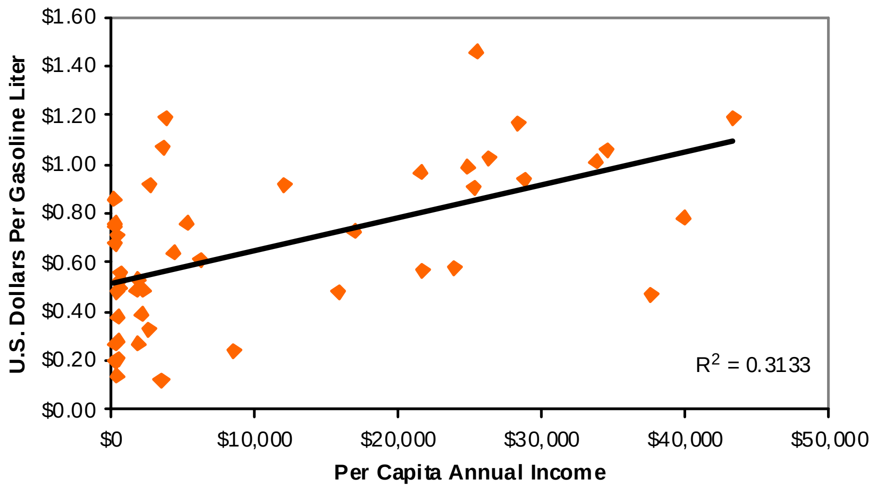
Environmental impacts include depletion of non-renewable resources (DNRR) such as petroleum; air, noise and water pollution emissions; and land use impacts ("Resource Costs," Litman 2007a). Increased vehicle fuel efficiency reduces resource depletion and pollution emissions but not the amount of land paved for transport facilities or the impacts of sprawl. Shifts to alternative fuels have various types of environmental impacts, depending on fuel type and how it is produced. For example, ethanol produced from corn provides virtually no reduction in climate change emissions, and increases water pollution and farm pollution emissions (GSI 2007). The environmental impacts of electric and hydrogen fuels depend on their energy source (if produced by coal, environmental benefits are minimal or negative). Producing fuel from coal gasification and oil sands is environmentally harmful. Reductions in total vehicle travel provide the greatest total benefits including energy conservation; air, water and noise pollution reductions; and reduced need to pave land for roads and parking facilities.

Economic Impacts

Economic development refers to a community's ability to achieve its economic objectives related to employment, productivity, and tax revenues. Transport energy policies affect economic development by affecting productivity, consumer expenditures and trade.

People often assume that, since vehicle travel tends to increase with wealth, low fuel prices support economic development and so fuel tax increases reduce economic activity, but this is not necessarily true. Reducing fuel prices through subsidies tends to be economically harmful because it imposes costs elsewhere in the economy, and increases energy consumption and transport problems. Many of the most economically successful countries (Japan, Germany, all Scandinavian countries) have high fuel prices, while many countries with low fuel taxes are impoverished as illustrated in Figure 9.[9]

Figure 9 **Annual Income Versus Fuel Price** (FinFacts 2005; Metschies 2001)



There is no evidence that low fuel prices contribute to economic development. Most high income countries have high fuel prices while many low income countries have low fuel prices.

Per capita GDP increases with fuel prices, particularly among oil consuming countries (countries that produce no petroleum), as illustrated in Figure 10. Several factors probably contribute to this positive relationship between fuel prices and GDP. Higher fuel prices encourage more efficient transportation and fuel conservation. For oil consuming nations, reduced fuel consumption reduces the economic costs of importing petroleum. For oil producing countries it leaves more product to export, increasing revenues and income. For all countries, reducing VMT reduces costs such as traffic congestion, road and parking facility costs, accident and pollution costs, helps maintain a diverse transportation system (walking, cycling and public transport), and reduces sprawl.

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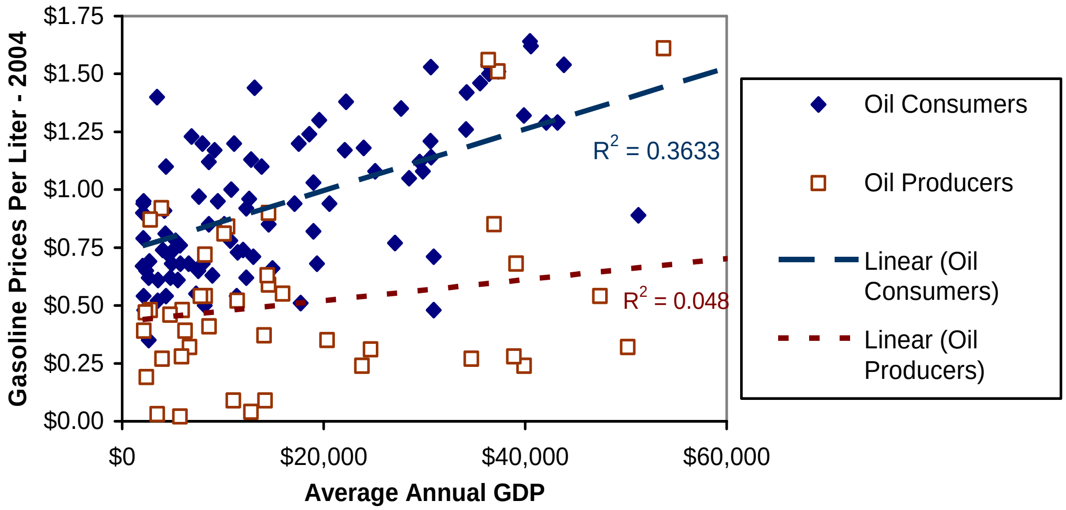
[9] Development economists find that abundant natural resources and an emphasis on low product prices can actually harm economic development overall by discouraging efficiency and other development efforts. This is sometimes called the *resource curse*. It explains why many resource-rich countries have little economic diversity or development besides resource extraction industries, and are frequently worse off after their resources are depleted.

Figure 10 **GDP Versus Fuel Prices, Countries** (Metschies 2005)[10]



Economic productivity tends to increase with higher fuel prices, indicating that high vehicle fees do not reduce overall economic productivity.

Similarly, people often assume that reducing vehicle ownership and use would harm the national economy, but this is not necessarily true. Motor vehicle manufacturing is declining as a portion of the economy and employment, and in profitability, due to increased foreign competition, vehicle quality improvements that extend longevity, and increase costs (Berman 2005). The industry accounted for 3.5% of real GDP in 2004, which is 15% less than the 4.1% in the mid-1980s.

Policies that increase transport system efficiency, such as cost-based pricing of fuel and vehicle travel, support economic development by increasing productivity and minimizing transportation costs such as congestion, road and parking facility costs, accident and pollution damages. High per capita fuel consumption is economically harmful, particularly to regions that import petroleum, because wealth leaves the community. Fuel expenditures provide less employment and business activity than most other consumer goods (Table 5). Energy conservation leaves more money circulating in the economy.

Table 5 **Jobs Created by Transportation Expenditures** (B.C. Treasury Board 1996)

$1 Million Expenditure	Full Time Jobs Created
Petroleum	4.5
General Automobile Expenses	7.5
General Bundle Of Consumer Goods	10-15
Public Transit	21.4

This table shows employment generated by various types of consumer expenditures in British Columbia. Patterns are similar in other regions (REMI, 2005).

[10] Fuel price (www.internationalfuelprices.com), GDP (http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita), petroleum production (http://en.wikipedia.org/wiki/Petroleum); excluding countries with average annual GDP under $2,000.

Policies that stimulate fuel consumption impose large macroeconomic costs. For example, low fuel prices and automobile-oriented transport planning result in high per capita fuel consumption in the U.S., causing the nation to spend about $300 billion on imported petroleum in 2006, representing about a third of the trade deficit, a cost that will increase as international petroleum prices increase (Jackson 2007). If U.S. motorists consumed petroleum at a similar rate as other wealthy countries, the U.S. economy would save approximately $200 billion dollars at current petroleum prices, and more in the future as domestic production declines and petroleum costs increase.

Retail fuel prices include various components with different economic impacts, as summarized in Table 6. Local taxes and a portion of fuel distribution costs stay in the regional economy. Federal and state taxes, domestic production, and refining and distribution costs, stay in the national economy. Money spent to import petroleum leaves the country. Both regional and national economies tend to benefit from energy conservation. Even petroleum producing regions benefit from increased domestic energy efficiency that frees up more product for export.

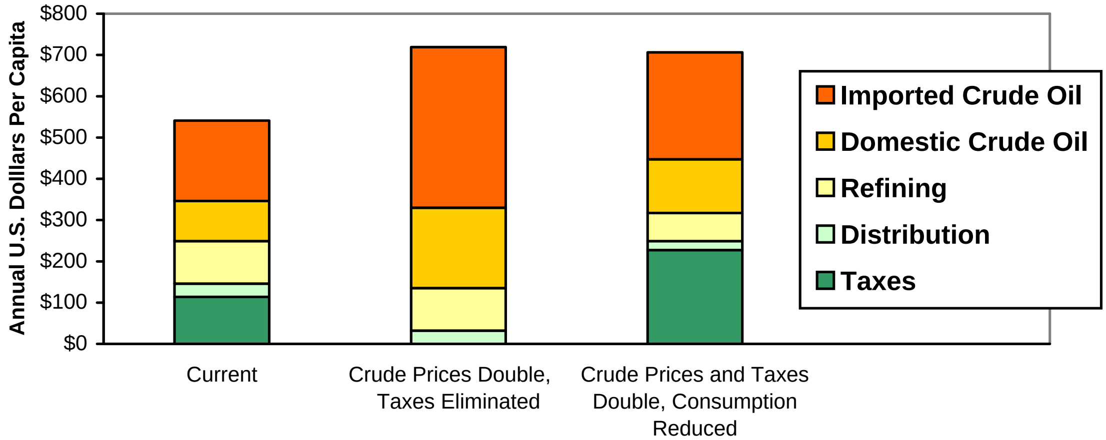
Table 6 **Economic Impacts of Fuel Price Components** (EIA 2005)

Price Component	Portion	Economic Impacts
Taxes	21%	Stays in jurisdiction (regional/state/provincial/national). Fuel taxes are relatively efficient and less harmful to the economy than most other taxes.
Distribution & Marketing	6%	A portion stays in the regional economy through distribution and retail jobs.
Refining	19%	Capital intensive. Provides economic activity where refining occurs.
Domestic Crude Oil	18%	Capital intensive. Provides some royalties and economic activity where production occurs.
Imported Crude Oil	36%	Leaves the economy. Provides virtually no domestic economic activity.

This table indicates the size and economic impacts of fuel price components. A portion of taxes and distribution costs stay in the regional economy. Other components provide little employment or economic benefit in the region or country where consumption occurs.

Figure 11 compares per capita annual vehicle fuel expenditures by these components. With current fuel prices the U.S. spends about $200 annually per capita to import petroleum. If petroleum prices double as projected during the next decade and taxes are reduced to allow current consumption patterns to continue, import costs double to $400. If petroleum prices and taxes double, resulting in a 33% reduction in per capita fuel consumption, import expenditures are reduced to just $260 and far more money is retained in regional and national economies, providing economic benefits.

Figure 11 **Annual Fuel Expenditures**



This graph compares per capita fuel expenditures under different pricing policies. Reducing taxes increases fuel consumption and future import costs, which is harmful to the economy.

People sometimes claim that fuel price increases are a burden to industrial production, but for most expanding industries (computers, software, entertainment, retail, services), vehicle operation is a relatively small portion of total costs. Even shipping companies spend more on labor than fuel. For most industries transport represents 5-15% of total costs and fuel represents 10-20% of transport costs, so fuel only represents 1-3% of total costs. Doubling fuel prices would cause a relatively small increase in total production costs if industries respond by improving logistical efficiency. As a result, fuel price increases have a relatively small impact on overall economic activity, if the increases are gradual and predictable so industries can respond.

Economic efficiency is maximized when prices (what consumers pay) reflect production costs. Reducing fuel prices with subsidies or tax reductions are economic transfers that shift costs to other economic sector and groups. This tends to be unfair and encourages inefficiency. Fuel tax are considered a road user fee, but are inadequate to fund total roadway costs in the U.S. (Puentes and Prince 2003; Wachs 2003). Fuel prices would need to increase more than 40% to cover current roadway expenditures, and much more to cover costs for traffic services, fuel production externalities, and other costs imposed by motor vehicle use ("Fuel Taxes," VTPI 2006; UNEA 2003).

Put in a more positive way, cost-based pricing (prices that reflect full production costs) offers consumers an opportunity to save money if they use resources more efficiently. For example, consumers shielded from petroleum cost increases by tax reductions or subsidies must bear these indirect costs, but if cost increases are incorporated directly into prices, consumers can avoid some or all of the additional costs by conserving fuel. Similarly, price increases motivate businesses to increase their fuel efficiently. As a result, efforts to avoid price increases through subsidies and tax reductions are more economically harmful than passing the additional cost onto consumers.

Many studies show that fuel tax increases can help the economy overall by encouraging efficiency, provided that revenues are invested in efficient projects or used to reduce more economically harmful taxes (Metschies 2001; CBO 2003). Fuel taxes are less economically harmful and burdensome than most other taxes (CBO 2003). Therefore, fuel subsidies based on general taxes tend to be economically harmful while tax shifts that increase fuel taxes to reduce other taxes provide overall economic benefits (Durning and Bauman 1998; Norland and Ninassi 1998). In the late 1990s, 40 leading US economist representing diverse ideologies were surveyed concerning various tax and regulatory reforms. The only policy they agreed on was the desirability of a 25¢ per gallon fuel tax increase (Fuchs, Krueger, and Poterba 1998).

Policies that stimulate more dispersed, automobile-dependent home location by lower-income households puts them at financial risk (Dodson and Sipe 2006). To the degree that lower current fuel prices encourage sprawl development patterns and sprawled housing choices by lower-income households it reduces their future affordability.

Because vehicle and land use decisions are durable, current fuel prices affect future energy efficiency. It therefore makes sense to begin raising fuel taxes now, to increase efficiency as a precaution against future petroleum cost increases. Otherwise, the future economy will loose wealth as international energy prices rise. Gradual and predictable tax increases allow consumers and industries to take higher future prices into account when making vehicle purchase and location decisions.

Equity Impacts

Equity can be evaluated in a variety of ways ("Equity Evaluation," VTPI 2006). *Horizontal equity* refers to whether people with equal needs and abilities are treated equally. Economic transfers tend to violate the principle of horizontal equity. For example, there is no particular reason that automobile travel should be underpriced and subsidized, for example, by financing roads through general taxes rather than user taxes, or by subsidizing fuel production; doing so benefits high energy consuming consumers and industries at the expense of energy efficient consumers and industries.

Vertical equity assumes that physically, economically or socially disadvantaged people should receive extra support. As described earlier, vehicle fuel costs are considered regressive when measured as expenditures by vehicle-owning households, but not when measured as expenditures by all households. This indicates that equity objectives can be achieved either by lowering fuel prices for lower-income households, or by improving affordable transport options. Improving transportation options is more progressive overall than subsidizing fuel since it provides greater total savings (it reduces other vehicle costs besides fuel) and benefits non-drivers in addition to motorists (T&E 2006; Litman 2007b).

Some policies can provide financial benefits to lower-income households. For example, *parking cash out* (allowing commuters to choose cash instead of parking subsidies) typically provides $500 to $1,000 annual benefits to people who use alternative modes. *Location efficient housing* with unbundled parking typically provides $600 to $1,200 annual savings to households that own fewer than average automobiles. Since lower-income households tend to own fewer vehicles, drive fewer annual vehicle-miles and rely more on alternative modes than higher income households, they are likely to capture these savings (VTPI 2006).

Even if fuel is considered regressive, broad fuel subsidies are an in inefficient way to achieve equity objectives, since their primary effect is to allow middle- and high-income motorists to purchase larger vehicles and drive more miles. The lowest-income quintile consumes only 9% of total fuel. The subsidy needed to half the fuel price increases that occurred between 2003 and 2005 would provide $154 to the lowest quintile household and $521 to the highest quintile household. It is far better to provide a targeted subsidy to low-income households that can be used for any travel mode. This provides benefits to low-income people who use alternative modes, lets individual consumers decide what option works best for them, and helps increase overall transport system efficiency.

Summary

The main point of this paper is to illustrate the broad range of impacts that result from different fuel policies, and therefore the need for comprehensive analysis when selecting policies. For example, low fuel prices may increase motorists' affordability, but they stimulate fuel consumption and vehicle travel, which increases various economic, social and environmental costs. Decision-makers should consider all of these impacts when evaluating potential responses to rising fuel prices.

For purposes of analysis various impacts are defined as *planning objectives*, which indicate the desired direction of each impact. Table 7 indicates how potential responses to rising fuel prices affect these objectives. For example, all strategies help increase consumer affordability, but minimizing fuel prices through subsidies and reduced fuel taxes tends to contradict other planning objectives. Increased vehicle fuel efficiency tends to increase consumer affordability, energy security and pollution reductions, but because it increases total vehicle travel, it contradicts other objectives. Mobility management tends to provide the greatest total benefits by increasing transportation system efficiency.

Table 7 **Comparing Benefits** (Litman 2007b)

Planning Objectives	Minimize Fuel Prices	Alternative Fuels	Efficient Vehicles	Mobility Management
Vehicle Travel Impacts	*Increased*	*Mixed*	*Increased*	*Reduced*
Consumer affordability	✓	✓	✓	✓
Minimize tax subsidies	✗			✗
Energy security	✗		✓	✓
Pollution reduction	✗		✓	✓
Congestion reduction	✗		✗	✓
Road and parking cost savings	✗		✗	✓
Traffic safety	✗		✗	✓
Improved mobility options for nondrivers	✗			✓
Physical fitness & health (exercise)				✓
Land use objectives (reduces sprawl)	✗		✗	✓

Subsidizing fuel reduces consumer fuel costs but increases other consumer costs by raising taxes and stimulating additional driving which exacerbates problems such as congestion, accidents and sprawl. Increasing vehicle fuel efficiency provides consumer savings but also tends to increase total vehicle travel and mileage-related costs. Mobility management strategies provide the greatest total benefits. (✓ = supports objective; ✗ = contradicts objective)

Appropriate Responses To Rising Fuel Prices

This section describes the most overall beneficial responses to rising fuel prices.

Although there are many possible responses to rising fuel prices, some are better overall than others. The best responses reduce *total costs* by increasing vehicle fuel economy and transport system efficiency rather than shielding consumers from fuel price increases (Donovan, et al. 2008). As much as possible, individual, short-term policy decisions should be consistent with this strategic goal. This requires a comprehensive evaluation framework that takes into account all significant impacts.

The most beneficial policy responses are considered *Win-Win Transportation Solutions*, which are market reforms based on economic principles that increase overall transport system efficiency (Litman 2007b). One of the most appropriate is to gradually and predictably increase fuel taxes. At a minimum, fuel taxes should increase to reflect all public expenditures on roadways and traffic services (Metschies 2005). Additional taxes may be justified to internalize petroleum production externalities, pollution emission costs, and as an energy conservation strategy ("Fuel Tax Increases," VTPI 2006). The most effective energy conservation and emission reduction strategy is a *carbon tax*, a tax based on fossil fuel carbon content, and therefore a tax on carbon dioxide emissions (Litman 2008b). This can be a revenue-neutral tax shift, with higher fuel prices offset by reductions in other taxes. These increases should be gradual, typically about 10% annual real (inflation adjusted) growth in tax rates.

Other Win-Win Solutions help increase transport system efficiency by improving mobility options, correcting market distortions that encourage economically excessive motor vehicle travel, and encouraging more accessible land use development. These include (Leotta 2007: Litman 2007b; Donovan, et al. 2008; Dodson and Sipe 2006):

- *Pay-As-You-Drive Pricing* - Convert fixed vehicle charges into mileage-based fees.
- *Parking Cash-Out* - Offer commuters financial incentives for using alternative modes.
- *Efficient Parking Pricing* - Charge users directly for parking facility use.
- *Road Pricing* - Charge users directly for road use, with rates that reflect costs imposed.
- *Carbon Taxes* – Special taxes on fossil fuels based on carbon content, to encourage conservation and emission reductions.
- *Transportation Demand Management Programs* - Local and regional programs that support and encourage use of alternative modes.
- *Transit and Rideshare Improvements* - Improve transit and rideshare services.
- *Walking and Cycling Improvements* - Create more walkable and bikeable communities.
- *Smart Growth Policies* - More accessible, multi-modal land use development patterns.
- *Freight Transport Management* - Encourage more efficient freight transport activity.
- *Carsharing* - Vehicle rental services that substitute for private automobile ownership.
- *Planning Reforms* - More comprehensive and neutral planning and investment practices.

Policies that encourage fuel efficient vehicle purchases are justified now to prepare for higher future fuel prices, and to reduce the relative disadvantage of driving efficient vehicles (if the entire fleet becomes more efficient there is less stigma and risk to smaller vehicle users). These include vehicle *fuel efficiency standards* (or carbon emission limits), *feebates* (surcharges on less efficient vehicles with revenues used to rebate efficient vehicle purchases), and *efficiency-based vehicle taxes and fees*. To minimize rebound effects and maximize total benefits it will be important to implement fuel tax increases and mobility management strategies in conjunction with efficient vehicle policies.

Increases in conventional fuel prices provide the best incentive for alternative fuels. Some alternative fuels may deserve public support, particularly for basic development, but these should be evaluated critically to insure they are justified, taking into account all economic, social and environmental costs. Fuels based on waste products, such as used vegetable oils and cellulitic ethanol, probably deserve support, provided they are environmentally benign and economically efficient. Corn-based ethanol is costly and overall environmentally harmful (air pollution reduction benefits are offset by increased agricultural pollution), and so should receive no public subsidy (Bourne 2007).

Electric vehicle development should be encouraged, but their production and use should not be subsidized since their overall benefits are modest; they reduce tailpipe emissions but increase electric generation emissions, and already receive about 2.5¢ per vehicle-mile subsidy because they pay no road use taxes. Electric vehicle benefits are too small to justify other incentives such as free parking or use of High Occupancy Vehicle lanes. Propane and LPG also provide only modest benefits and so deserve only modest support. Synthetic fuels from tar sands, oil shales and coal are too environmentally harmful to be justified and so should receive no public support. Alternative fuel vehicles should no longer be considered fuel efficient for CAFE standards.[11]

Any subsidy or tax reduction to increase fuel affordability should be targeted at economically disadvantaged people and suitable for any transport mode. For example, low income people could receive an annual subsidy that may be used for fuel, public transit, taxi fares or to help pay for location-efficient affordable housing.

Economic development policies should encourage resource efficient industries, particularly those that increase transport system efficiency. Support for vehicle and petroleum industries should be evaluated critically to determine whether they are cost effective compared with other industrial development investments, and whether they are consistent with strategic objectives and future consumer demands. Businesses that depend on energy intensive transport (manufacturing of fuel inefficient automobiles, recreational vehicles and motorized sports equipment) should be encouraged to diversify and develop alternative products that will be profitable if fuel prices increase.

[11] The CAFE fuel economy calculation offers alternative fuel vehicles an extra 0.15 *Fuel Content Factor*, so a 15 mpg dual-fuel E85 vehicle is rated as 40 mpg regardless of whether E85 is ever actually used.

Conclusions: Raise My Fuel Prices, Please!

Fuel prices are likely to increase in the future. Motorists are accustomed to low fuel prices and often demand price minimization policies. But such policies impose significant economic, social and environmental costs, by requiring subsidies and increasing total fuel consumption, vehicle travel and land use dispersion. This increases the economic costs of importing petroleum, pollution emissions, congestion, road and parking facility costs, accidents and sprawl. Rather than trying to minimize fuel prices it is better to allow prices to rise and help consumers, businesses and communities reduce total fuel costs by increasing vehicle and transport system efficiency. These solutions provide far larger total benefits.

The real problem of higher fuel prices occurs if we fail to change. Vehicle purchase and housing location decisions last years or decades, and consumers tend to apply a high discount rate when evaluating energy savings. As a result, they purchase less efficient vehicles and choose more automobile-dependent locations than what will be optimal during much of these products' operating life. The key to avoiding a future crisis is to begin increasing efficiency now. If we treat high current energy prices as a temporary anomaly and try to shield consumers from price increases we encourage inefficiency and exacerbate future problems. If we begin raising prices now with increased fuel taxes, and work to make our transport system more efficient, we can avert future problems.

The current transport system is inefficient. Large efficiency gains can be achieved in cost effective ways that provide multiple benefits. Harm to consumers and the economy can be minimized by making fuel price increases gradual and predictable, and matching them with policies that improve vehicle efficiency and transport options. There is no equity justification to subsidize fuel since their primary effect would be to allow middle- and upper-income motorists to purchase less efficient vehicles and drive more. Targeted subsidies and policies that improve affordable transport options can do far more to help disadvantaged people while also helping to solve other transport problems.

With these recommended policy changes, petroleum prices could double and consumers would spend less on transport than they do now. Consumers would still be able to access work, school and services, they would still take holidays, businesses would still produce and distribute products, and economic activity could still increase, but these activities would consume less energy. These policies would change lifestyles and industries, more children would walk and bicycle to school rather than be driven, communities would be more compact, and industrial production would be more resource efficient. These changes can provide significant additional benefits besides just energy cost savings.

A well-developed vocabulary exists for describing prices considered too high. People say that they are *gouged*, *cheated*, or *fleeced*. There is no comparable vocabulary to describe prices that are too low, although underpricing is equally harmful to the economy and ultimately to consumers. It is difficult to imagine consumers demonstrating with signs that say, "Raise My Fuel Prices!", but it actually makes sense. The best response to rising fuel prices is to let them increase and create a more efficient transport system.

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