Myth Five – Price Signals are Insufficient to Induce Efficient Energy Investments

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When policymakers are pressed to defend government interventions in energy markets, they frequently cite the existence of market failures. And rightly so. Economists are almost uniformly of the opinion that markets should be left alone by government unless market failures are discovered. They go on to caution that government intervention will improve efficiency if – and only if – the prospective intervention remedies one or more of those market failures. And even if market failures exist, actual government policies may not improve market operations because politicians rather than economists design the policies.[1]

Most of those people who concern themselves with federal or state energy policy are convinced that energy markets are riddled with market failures.[2] That's why most energy initiatives forwarded by the Left and Right would have the government more involved in private decisions about energy production and consumption. While liberals and conservatives may disagree about *how* the government should intervene in energy markets, they largely agree about *whether* the government should intervene in energy markets. For instance, environmentalists think market actors will make poor decisions about electricity generation if left to their own devices, so they propose to subsidize or mandate the renewable energy technologies that might otherwise never be employed. Conservatives likewise think market actors will make poor decisions about electricity generation if left to their own devices, but they propose to subsidize nuclear energy rather than wind or solar energy.

[1] For a review of the literature, see Tyler Cowen (1988) and Charles Wolf (1991). We will not discuss so-called "equity" programs designed to assist low income people with their energy bills.

[2] For representative arguments, see Fischer & Rothkopf (1989) and Lovins & Lotspeich (1999).

Five characteristics of energy markets give rise to charges of energy market failure and, thus, provide the justification for government intervention.[3]

- Fossil fuels are a nonrenewable resource. The preferences of future generations are not properly reflected in the decisions made by producers and consumers in energy markets.

- Market actors respond sluggishly to energy price changes. The refusal of producers and consumers to respond quickly to high energy prices can cause inflation and recessions.

- Many residential consumers and commercial enterprises invest suboptimally in energy conservation.

- Consumers do not find the price of the substantial health, environmental, and national security costs reflected in energy prices. Thus, energy prices may be "too low."

- Government interference in energy markets via direct and indirect subsidies, production constraints, and the threat of future intervention distort price signals. Given this backdrop of longstanding and ongoing intervention, many people believe that free energy markets are – and always will be – a myth.

[3] Three issues not discussed are the problem of "capture" in petroleum reservoirs, vertical integration in the oil industry, and natural monopoly issues in oil and gas pipelines. The problem of capture is of historical rather than current significance, and the other two leads to higher rather than lower than efficient oil prices, the opposite of current policy concern.

Those observations have led many to conclude that energy price signals are not accurate reflections of true energy costs and will not produce efficient energy production and consumption decisions. Various remedies have been suggested, ranging from corrective action to "get prices right" to more ambitious intervention to directly control production and consumption decisions.

We believe that the contention that energy markets are riddled with market failures, however, is a myth. While energy markets don't work with textbook efficiency (in fact, few do), energy markets do not exhibit special problems that require government attention. Energy prices are reasonably accurate reflections of true energy costs and the complaints lodged against them are greatly overstated. In those settings in which prices are not accurate reflections of total costs (primarily in electricity and retail gasoline markets), the best remedy is to eliminate government policies that distort prices rather than adopt countervailing interventions to offset the distortions caused by earlier policies.

1. Energy depletion and future generations

Because fossil fuels are exhaustible, some argue that we need to ration production in order to save resources for future generations (Weiss 1989, Barresi 1997). Future generations, after all, have no say in energy markets, but their preferences regarding resource availability in the future must be considered. Markets won't provide that consideration, so government must do so.

Another version of this argument does not emphasize the rights of future generations. Instead, it paints a picture of inevitable future shortages as production declines occur. Fuel shortages will be accompanied by price hikes, recessions, and political struggle. Those unpleasant effects can be avoided if government starts planning now. "Intervention by governments will be required, because the economic and social implications of oil peaking would be otherwise chaotic." (Hirsch, *et al.*, 2005, p. 5).

It's important to note that this alleged market failure applies primarily to transportation rather than to electricity markets. That's because depletion fears are primarily directed at petroleum, and only a trivial amount of petroleum is used to generate electricity in the United States. (Deffeyes, 2005; Simmons, 2005) Recoverable coal and natural gas stocks – our main nonrenewable fuel sources in electricity markets – are generally thought to be quite plentiful. (EIA, 2006; World Energy Council, 2004)

Oil depletion concerns, however, rest on shaky ground. First, they are primarily about the future availability of *conventional* crude oil. Unconventional crude oil deposits – such as those found in heavy bitumen, tar sands, and shale rock – are extremely plentiful and only lightly tapped at the moment because of high extraction costs.[4] Moreover, the technology exists to convert coal and natural gas to synthetic petroleum liquids, which means that other more plentiful fossil fuels could be harnessed to produce vast amounts of petroleum if the economics are favorable.

[4] Recoverable oil deposits within heavy bitumen in the Venezuelan Orinoco Belt may be nearly equal to Saudi proved reserves (Forero, 2006, p. C1). Shale rock in the United States are estimated to harbor three times the amount of petroleum found in proved Saudi reserves (Bartis *et al.*, 2005). For an overview of unconventional petroleum resources, see Robert L. Bradley and Richard Fulmer (2004).

Second, concerns that conventional crude oil is becoming scarce in any meaningful sense have not stood up well to serious scrutiny.[5]

If petroleum depletion were to become a genuine problem, would intergenerational equity demand conservation? We think not. The strongest normative argument against conservation is that it transfers resources from the relatively poor to the relatively rich (Landsburg, 1997). That's because today's generation is almost certainly much poorer than future generations. For instance, if per capita income grows at 2 percent a year, people 100 years from now will be approximately 7 times wealthier than we are today. Those concerned about intergenerational equity should worry more about standards of living today than about standards of living tomorrow.

The strongest positive argument against government intervention is that markets are more capable than government of reacting quickly and efficiently to declines in petroleum production. True declines, rather than temporary shocks, will permanently increase oil prices, which will induce investments in alternative energy sources and conservation.

But what about temporary (albeit multiyear) price shocks? If low prices most of the time and high prices some of the time are a problem, is there a market solution? Indeed there is. Long-term oil futures contracts are available to those worried about future price spirals.

[5] For a review of the literature, see Robert Arnott (2002). For a withering critique of worries about near-term depletion of Saudi oil reserves, see Michael Lynch (2006).

The fact that marketers have not tried to offer long-term stable prices to consumers by arbitraging between the futures and retail markets suggests that most consumers believe that they benefit by accepting low prices most of the time in return for unpleasantly high prices some of the time. Said differently, we are "dependent" on oil exported from unstable countries rather than domestic oil or alternative sources of energy – and don't attempt to contract our way out of that instability – because it is cheaper in present value terms to do so.

The "solution" to oil price instability is to accept higher prices most of the time in return for lower prices some of the time. There is nothing wrong with such a trade-off as long as it is achieved through contract. 30-year fixed rate mortgages, for example, allow consumers to shift to others the risk of varying daily spot rates for borrowing (whose mean is lower but accompanied by higher variance) in return for higher mean and no variance (fixed) prices.

We don't, however, see those sorts of contracts in energy markets. Instead, what we see are proposals for European-style taxes on gasoline consumption, mandated alternative energy production, subsidies for the same, and regulations that require energy producers to retain excess production capacity.

Unlike contractual solutions, governmental solutions have the dubious distinction of being more expensive not just most of the time, but all of the time. That is the "alternatives" to fossil fuels are more expensive than conventional fossil fuels even when the latter prices are at peak, which is, of course, why such fuels are not embraced without government subsidy or coercion. For example, we have recently calculated that the federally owned Strategic Petroleum Reserve has

cost the taxpayer between $65-80 per barrel (2004 dollars) to fill, which rivals the highest spot market prices ever recorded in the market (Taylor and Van Doren, 2005).

Market actors are more likely to work in the interests of future generations than are governmental actors. That's because democratically elected governments – and the regulatory agencies established by them – have a tendency to reflect the interests of swing voters in swing voting districts. Accordingly, it's unreasonable to expect governments to be more interested in the well-being of future generations than swing voters in swing districts who have short time horizons and political preferences.

Markets, on the other hand, can reflect longer time horizons. In fact, because the market value of assets is determined by expectations about what others might pay for them in the future, speculators represent future generations' interests in today's markets more effectively than politicians who follow swing voters, who's time horizon rarely spans past the next election.

2. Oil shocks cause recessions and inflation

Energy supply and demand are relatively inflexible in the short run. As a consequence, small changes in either have very large effects on prices.[6] Over a longer time period, however, both supply and demand are very responsive to prices.[7]

[6] Empirical studies of petroleum markets suggest that, in the short run, a 10 percent increase in petroleum prices will reduce petroleum consumption by somewhere between 1 percent and four-tenths of 1 percent. Studies examining the relationship between changes in price and petroleum supply report that a 10 percent increase in petroleum prices will increase petroleum supplies in the short run by six-tenths of 1 percent (Lynch, forthcoming). Also Timothy

The short-run inflexibility of producers or consumers – and the oil price shocks that result from such inflexibility – are alleged to be responsible for inflation and recessions. But not all economists agree. Ben Bernanke and his colleagues (1997), for instance, argue that different ("better") monetary policy would reduce the recessionary effect of oil shocks while Hamilton and Herrera (2004) argue that the potential for monetary policy is much more limited. The current oil price explosion that began in 2003 has caused far less economic harm than conventional wisdom predicted, which adds credence to those economists who have argued that the recessions that followed previous oil shocks were not caused by energy price spikes.[8]

Considine (2004, pp. 21-22). Empirical studies of consumer response in electricity markets are similar. In the short run, a 10 percent increase in electricity prices will reduce residential electricity consumption by somewhere between six-tenths of one percent to 5 percent; commercial electricity consumption by between 1.7 and 2.5 percent, and industrial electricity consumption by somewhere between four-tenths of 1 percent and 2.2 percent (Bohi, 1981). A recent study of price response based on 119 customers from New York State falls within this range; specifically, the surveyed customers had an average price elasticity of 0.11, which means that their combined ratio of peak to off-peak electricity usage declined by 11% in response to a doubling of peak prices (relative to off-peak prices) (Goldman *et al.*, 2005). For a recent update on residential elasticities (-.065 to -.095) from the California demand response experiment see Ahmad Faruqui and Robert Earle (2006, p.26).

[7] The price increases of the 1970s, for example, were followed by a dramatic reduction in real oil prices after 1985. In 1981, the average price paid by U.S. refineries for crude oil was $53.74 in constant (2000) dollars. In 1986, the average price paid was $17.56 in constant (2000) dollars (EIA, 2005). Economists estimate that every 1 percent increase in oil prices results in a 1 percent decrease in oil consumption in the long run (Pindyck, 1979; Adelman, 1995).

[8] For a non-technical discussion, see James Surowiecki (2005, p. 46). For a more comprehensive treatment, see Donald Jones *et al.*, (2004) and Robert Barsky and Lutz Kilian (2004).

Even though negative macroeconomic consequences may not follow oil shocks, the lack of supply and demand response in the short run leads to large transfers of wealth from consumers to firms in times of supply decreases (the Saudi and Texas booms of the 1970s and the current oil boom today) and firms to consumers in times of supply increases (the Saudi and Texas busts of the 1980s and late 1990s). While energy policy discussions often invoke macroeconomic or market failure rationales for government action, the most likely source of constituent demands for intervention in energy markets is the distributional concerns of firms and consumers. Both consumers and firms attempt to enlist the assistance of government to prevent those wealth transfers.

Energy market interventions, however, have failed to improve equity and done much to damage efficiency (Kalt, 1981; Van Doren, 1991; Taylor and Van Doren, 2006). The oil price-control system in the 1970s induced shortages and increased reliance upon imports at the time our stated policy was to reduce import dependency. Consumers were made worse off as a consequence (Taylor and Van Doren, 2006).

3. Consumer failure

Claims that consumers fail to invest as much as they should in energy efficiency are legion. Explanations vary as to why consumers act irrationally, but common complaints include lack of information regarding prospective savings, cultural hostility to energy conservation, excessively conservative views about future energy prices, a lack of capital, the demand for irrationally high rates of return, and in some circumstances, the existence of a principal-agent problem (for

instance, when landlords are making decisions about appliances but tenants will be paying the electricity bills that follow).[9]

How irrational are consumers when they make energy decisions? Empirical investigations find that consumers act far more rationally than many analysts believe. Clemson economist Molly Espey (2005), for instance, closely examined sales data from 2001 model automobiles and found that consumers actually *over-valued* the gains possible from buying fuel efficient vehicles. When households with mean incomes or higher purchase residential appliances, they appear to employ rationale discount rates when considering energy efficiency, but lower income households do not (Sutherland, 2003, pp. 8-12). While it's possible that low-income households are low-income for a reason (their time horizons are very short when it comes to trade-offs between well-being today and well-being tomorrow and they accordingly invest little in a whole host of things that economists say they *ought* to invest in, like education), some economists believe that their behavior in energy markets is actually reasonable efficient and perfectly defensible (Hassett and Metcalf, 1993; Metcalf and Rosenthal, 1995; Metcalf, 1994; Dixit and Pindyck, 1994; Nichols, 1992; Johnson and Kaserman, 1983). Finally, there is no evidence we are aware of to suggest that landlords select less energy efficient appliances for their properties than would have been selected by their renters had the decision been their's to make with their own money.[10]

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[9] For representative arguments, see Hirst and Brown (1990) and Brown (2001).

[10] Although the principle-agent problem receives a great deal of attention in the literature, we don't find it to be a market failure even in theory. If renters wanted energy efficient appliances, they would manifest that desire by favoring rental properties with energy efficient appliances, providing all the incentive necessary for landlords to take renter preferences into account.

Businesses might be expected to make more efficient decisions about energy consumption than residential households, but critics are even more convinced that businesses are leaving vast sums of money on the table. The premier example of gross corporate inefficiency marshaled by proponents of this argument is the reluctance of businesses to install high efficiency lighting ballasts. Although proponents argue that returns from such investments range from 37-199 percent (Koomey *et al.*, 1995), closer analysis finds that the returns are wildly exaggerated and that businesses are acting efficiently by largely ignoring this technology (Ballonoff, 1999).

Other claims of market failure are also suspect. For example, many studies have been published that estimate how much energy might be saved from the full adoption of cost-effective energy efficient technology that is commercially available at any given time. Studies published by the Electric Power Research Institute (1993) and Arnold Fickett (Fickett *et al.*, 1990), for example, contend that energy efficiency investments that cost up to the equivalent of 3 cents per kilowatt hour (a cost substantially below the cost of electricity) reduce electricity consumption from 30 to 70 percent respectively. Such findings suggest that many people make inefficient decisions in energy markets.

A test of this proposition, however, was conducted by the Denmark Institute for Local Government, which had calculated that corporate energy efficiency could be improved by 42 percent if only businesses would fully employ the profitable efficiency technologies available to them. After several years of extensive, on-site analysis, the institute concluded that only a 3.1 percent gain in energy efficiency could be realized through profitable energy efficiency

investments – a figure so small that "the cost of finding electricity conservation projects is higher than the savings due to the realized investment." The authors concluded that although "the background is experience from Danish industry; we judge the results as general for most industry" (Togeby and Larsen, 1995).

Even if consumers fail to make what might appear to be cost-effective conservation investments, it does not necessarily follow that governmental decisions will deliver net improvements in efficiency (Jaffe and Stavins, 1994). One study, for instance, found that federal energy efficiency standards for residential appliances actually increase consumers' net costs by $46-52 billion through 2050 (Sutherland, 2003).[11] RAND economists David Loughran and Jonathan Kulick (2004) calculate that the $14.7 billion spent by electric power companies to subsidize ratepayer conservation investments between 1989-1999 (undertaken primarily at the behest of – and under the supervision of – state utility regulators) reduced mean electricity sales by only 0.2 and 0.4 percent at an average cost of 14-22 cents per kilowatt hour (much greater than the cost of additional electricity during that period).[12]

[11] Some studies – most notably Meyers et al. (2003) – find substantial net savings from those programs. Sutherland argues that those studies (i) overestimate energy savings due to the regulations because much of those gains would have occurred endogenously in markets, and (ii) employ artificially low discount rates and should instead use the discount rates observed in the appliance market.

[12] Most of the literature reports net savings from the programs negatively evaluated by Loughran and Kulick. For a representative example of this literature, see Brown and Mihlmester (1995). Those studies, however, typically rely heavily on data and reports from the utilities themselves regarding program success (Brown and Mihlmester, for instance, rely totally on such studies and accept their findings at face value). Unfortunately, the methodologies employed by utility-sponsored reports vary a great deal, so meta-analysis is impossible. Regardless, a close reading of the utility-sponsored reports reveals that they are typically rife with serious analytical errors – such as relying on

4. Externalities

Analysts frequently argue that energy use causes environmental and human health damage whose costs are not reflected in energy prices. Economists describe such costs as "externalities" because they impose costs on others that are external to the prices that govern the transaction between buyer and seller. Because consumer prices don't include the full costs of energy, too much energy is consumed and government must intervene to achieve efficiency.

Economists' remedy for externalities is a tax that would quantify the cost of the externalities associated with each energy source in dollar terms. The tax would force consumers to pay the

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engineering estimates of energy savings rather than observed changes in energy consumption (which ignores possible "rebound effects" induced by reductions in the marginal cost of electricity services), insufficient controls for "free riders" (economic jargon for those who would have invested in energy efficiency even without the program) and lack of attention to moral hazard problems (for instance, the fact that consumers might put-off private energy efficiency investments in hopes of gaining subsidy from utility-sponsored programs at some later date) – and those errors are rarely corrected in secondary studies (Wirl 1997, pp. 119-142, Loughran and Kulick 2004, pp. 22-25). Moreover, few of the studies in the literature that rely on the data reported by the utilities acknowledge that the utilities have both the means and motive to favor programs that lead to less – not more –conservation and to inflate reported net benefits. Instead, they tend to accept utility reported data and analysis at face value (Wirl 2000, pp. 173-183). What distinguishes Loughran and Kulick's study from the rest is that the authors reach outside of the utility-sponsored studies to ascertain whether utility-sponsored energy conservation programs actually reduce energy intensity once all other variables are controlled for and, if so, at what cost.

total social cost for their energy (which would "internalize the externality").[13] Revenues from energy taxes would be used to compensate those who are harmed by the energy consumed by others.

The underlying objective of energy taxes is to approximate the market that would arise if polluters had to compensate those harmed by pollution.[14] Polluters would then have to factor those payments into the prices they charged for goods and services. Pollution taxes are thus an attempt to mimic the market that would arise if third parties could hold producers liable for the damages caused by their pollution.

To "get prices right," the first step is to monetarize the health and environmental externalities associated with energy consumption. Unfortunately, we run into a serious problem here: The range of health and environmental externality estimates for each and every energy source that

[13] This argument was first and most forcefully made by A.C. Pigou (1920). Later, many economists came to believe that pollution taxes have an additional benefit besides improving the environment: the revenue from pollution taxes can replace revenue from existing, more distortionary taxes, thus reducing the deadweight losses from those taxes (Tullock, 1967). Accordingly, many economists believe that optimal externality taxes are somewhat greater than what a simple calculation of negative externality costs might otherwise suggest. Sarah West and Roberton Williams (2004), for example, argue that an optimal externality tax should be about 35 percent higher than marginal external damages. Other economists believe that pollution taxes compound the distortions caused by other preexisting taxes.

[14] Some economists have argued that if government were to acknowledge and enforce private property rights over environmental resources, most environmental regulations would be unnecessary and that the resulting legal regime would be more efficient than the current regulatory regime (Rothbard, 1982). Most economists, however, believe that the costs associated with policing private environmental rights ("transaction costs" in economic parlance) are so steep that a legal regime of that sort would be unworkable (Coase, 1960).

has appeared in the peer-reviewed literature are all over the map (Sundqvist and Soderholm, 2002). Estimates vary widely because experts do not agree about the relationship between small exposures to various substances and human health effects that result from those exposures.

The second step is to modify energy consumption decisions to take the health effects into account. Policymakers, however, prefer direct regulatory intervention rather than taxation to address externality issues for several reasons:

- Voters resist energy taxes but are more tolerant of direct environmental regulation because taxes impose visible costs while regulation imposes less visible costs;
- Energy taxes can yield uncertain amounts of pollution; regulation determines emission rates directly. Lawyers and environmentalists prefer the latter and are suspicious of pollution taxes, which are criticized as allowing firms to pay to pollute (Weitzman, 1974)[15];
- Regulation allows lawmakers to intervene on behalf of constituents in ways not possible with externality taxation (Schoenbrod, 1993); and
- Political preferences about the "right" degree of pollution for this or that substance or protecting the public health regardless of cost are more compelling to voters and thus lawmakers than market preferences.

[15] Weitzman demonstrated that uncertainty about pollution quantities and certainty about pollution abatement costs is optimal when the marginal benefits of additional pollution control are low and the marginal costs of additional abatement are high – the stylized facts for "normal" pollutants. Certainty about exposure or emissions and uncertainty about costs is optimal when the opposite is true – marginal benefits of pollution abatement are high relative to marginal costs – the stylized facts for very "toxic" pollution (Milliman, 1982).

Given that current law relies upon regulation rather than taxation to address the external costs of energy consumption, do external costs remain even after the effects of environmental regulation are taken into account? Figure 1 suggests that it is impossible to answer that question satisfactorily. But if one accepts EPA's assessment of human health risks from pollution as a starting point, Harvard law professor W. Kipp Viscusi concludes that no unpriced environmental externalities exist from natural gas or oil consumption, but that some unpriced environmental externalities arise from coal consumption (Viscusi *et al.*, 1994).[16]

A more recent assessment by economists Ian Parry and Kenneth Small considers only the externalities associated with gasoline consumption (Parry and Small, 2005, Table 1). Their review of the literature concludes that the optimal *second-best* gasoline tax in the United States would be $1.01 per gallon.[17] That $1.01 per gallon figure is broken down as follows: 16 cents to pay for cost of conventional pollution; 5 cents to pay for the costs of greenhouse gas emissions; 30 cents to pay for the costs associated with traffic congestion; and 24 cents to pay for costs associated with traffic accidents.

[16] The authors did not consider the costs associated with global warming.

[17] The tax is second-best because it taxes gasoline rather than the directly offending behavior (emissions, congestion, and accidents).

Ideally, however, the costs associated with traffic congestion are internalized by tolls that vary depending upon roadway congestion.[18] The costs associated with traffic accidents are also best internalized by automobile insurance premiums. Gasoline taxes are a rather imperfect means to address those externalities because, in the first case, they are imposed regardless of whether the motorist is contributing to congestion and, in the latter case, regardless of the propensity to cause accidents or indemnify injured parties.

Accordingly, Parry and Small's study (2005) suggests that a "first-best" gasoline tax would address externalities that total 25 cents per gallon – the sum of the environmental damages caused by gasoline consumption.[19] Current gasoline taxes in the United States, however, average 38 cents per gallon, which suggests that the environmental externality associated with gasoline is internalized by existing taxes.[20]

One might recall, however, that gasoline taxes in the United States are designed as user fees to pay for road construction and maintenance. This suggests that the 25 cent environmental

[18] Variable toll congestion pricing now exists in state route 91 in Orange County California, I-15 in San Diego, I-394 in Minneapolis, and I-25 in Denver (Egan, 2005). For a discussion of optimal congestion pricing see Small *et al.*, (1989; 2006).

[19] A true first-best tax would be on actual emissions. In addition, 26 cents of the $1.01 second best tax is described as a "Ramsey" tax arising from the correct observation that efficient taxes are higher on goods whose demand and supply are less elastic (gasoline) and less on goods whose demand and supply are more elastic (labor). If total spending could be kept constant and gas taxes increased and taxes on labor decreased, we agree.

[20] The figure is a weighted average of existing state taxes plus the federal fuels tax (U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information, 2005).

externality tax would properly be an addition to the current levy. But current road construction and maintenance programs are incredibly inefficient, which means that the gasoline tax is almost certainly "too high" at present for passenger vehicles.[21]

There are two fundamental problems with the current regime. First, because pavement is typically laid far too thinly, maintenance costs are excessive. Second, even though trucks cause almost all the damage to existing roadways, they pay only about 29 percent of the maintenance costs through their fuel taxes and user fees (Small *et al.*, 1989, p.59). Accordingly, passenger vehicles pay far higher gasoline taxes than is warranted by efficient road design and operation. Efficient road charges would not have any fuel taxes at all. Instead, roads would be paid for with road-use damage charges and congestion charges. Such charges would induce investment in thicker roads and multi-axle trucks. Because damage is the result not of gross weight but weight per axle, efficient charges on a fully loaded 5-axle intercity semi-trailer would be less than two-thirds of their current charges, but charges on 33,000 pound two-axle delivery truck would triple (Small *et al.*, 1989, p. 117).

The upshot is that the internalization of environmental costs related to gasoline consumption would increase the price of gasoline relative to the current tax, but not by the full 25 cents per gallon calculated by Parry and Small (2005). In addition, because emissions in Los Angeles, for example, have a far greater environmental impact – and thus, far greater monetary costs – than

[21] Another complication is that a portion of the gasoline tax is diverted to transit and other programs. In 2003 $21 billion was diverted to transit. But highway user fees were less than highway expenditures by $36 billion resulting in a net subsidy of roads by general taxpayers (O'Toole, 2005).

equivalent emissions in Sioux City, Iowa, a gasoline tax designed at the national level will almost certainly be "wrong" all the time – too high in rural areas and too low in urban areas.

A perfectly efficient gasoline tax, then, would (i) be levied by local governments, not by the federal government; (ii) be largely about internalizing environmental externalities, not internalizing congestion or road construction and maintenance costs (which should be addressed by different charges, fees, and funding mechanisms). Environmental externalities certainly exist, but it's unclear to what extent gasoline prices are "too low" as a consequence. All we can say is that gasoline prices are likely "too high" in some areas and for some consumers and "too low" in other areas and for other consumers. Raising gasoline prices via an environment externality tax at the federal level would therefore not necessarily improve economic efficiency.

5. Government intervention and prices

Many politicians and policy activists argue that government interference in energy markets is so extensive that energy prices are political constructs. Accordingly, leaving energy decisions to market actors – guided as they are by defective, politically created price signals – will not produce efficient outcomes.

While one might expect this argument to be made by those who favor reduced government intervention in energy markets, the opposite is true. This argument is generally employed by those who support even greater involvement in energy markets. Only by more extensive (and presumably, better) government intervention can energy markets be made more efficient.

The most obvious problem with this argument is that it assumes that the political dynamics that have led to inefficient policies in the past (interventions provide concentrated benefits to some but diffuse costs to a larger group of "others") will end. Such wishful thinking has no theoretical or empirical basis. A more defensible argument calls for elimination of laws and regulations that distort energy prices.

A second problem is that the argument overstates the extent and effect of subsidies in energy markets. According to the Energy Information Administration (EIA, 2000), energy subsidies only amounted to $6.2 billion in 1999, or 1 percent of total energy expenditures, although other analysts have argued that EIA's estimates are too low.[22] While that estimate pre-dates passage of the Energy Policy Act of 2005, the expanded interventions contained in that Act were expected to cost the treasury $14.6 billion over 10 years – not enough to substantially alter EIA's 1999 finding that energy subsidies were very small in terms of the overall size of the energy economy.

For our purposes, however, the size of the subsidies is less important than the nature of the subsidies. Subsidies that do not affect marginal costs of production cannot affect market prices. Taxpayers are poorer and owners of subsidized companies are richer, but as long as marginal costs are not altered, prices are not altered, and efficiency is unaffected.

[22] Douglas Koplow and John Dernbach (2001) argue that EIA did not accurately account for a number of direct energy subsidies and was wrong to "exclude provisions on the basis that they were available to more than just the energy sector, did not therefore constitute subsidies solely to energy, and were therefore beyond the research mandate they had been given" (Koplow, 2006).

Even if marginal costs of some producers are altered, market prices may not be affected. Subsidies to the nuclear and renewable energy industries may reduce their respective marginal costs, but both nuclear and renewable energy generators are typically infra-marginal supply sources.[23] So those subsidies – however objectionable – do not affect prices and thus final demand for electricity.[24]

Regulatory interventions affect prices far more dramatically than do tax preferences or subsidies. A good example is the ethanol production mandate in the 2005 Energy Policy Act, which requires gasoline to contain 4 billion gallons of ethanol in 2006 and more thereafter. This mandate clearly affects retail fuel prices,[25] but a detailed assessment of costs and benefits is very hard to construct.[26] Despite the difficulties involved in quantifying costs, the EIA believes that:

[23] Natural gas-fired electricity is the marginal source of electricity at most times and places and thus the cost of gas-fired electricity establishes wholesale electricity prices for all electricity sources during most periods. The EIA finds that subsidies to the natural gas industry are negligible. In the transportation sector, the only industry worth examining is the oil industry, and subsidies to oil companies are both negligible and irrelevant to marginal production costs (Sutherland, 2001).

[24] States that regulate retail electricity rates based on a weighted average of the production costs from all electricity generation will indeed produce lower rates as a consequence of those subsidies. But that pricing methodology introduces more inefficiencies than are introduced by the subsidies themselves: unregulated markets do not work that way.

[25] Industry analysts in the spring of 2006 believe that the ethanol mandate in the 2005 Energy Policy Act increased gasoline prices by between 8-60 cents per gallon (McKay, 2006).

[26] The most ambitious attempt to account for all energy subsidies in the United States can be found in Douglas Koplow's (2004), "Federal Subsidies for Energy in 2003 – A First Look." Koplow estimates that energy subsidies

> It is regulation and not subsidization that has the greatest impact on energy markets... The economic impact of just those energy regulatory programs considered in this [pre-1992 Energy Policy Act] report total at least 5 times that amount [of direct fiscal subsidy] (EIA, 1992).[27]

Three regulatory interventions are thought to be responsible for the bulk of the price distortions. First, the government uses tax dollars to ensure that domestic markets have safe, reliable, and low-cost access to foreign oil and gas, but those public expenditures are not reflected in the cost of imported energy. Second, government policies abroad restrict oil and gas production and thus produce prices that are "too high" given underlying geological realities and global market demand. Third, retail electricity prices are regulated by the state and regulated prices deviate from market prices.

5.1. NATIONAL SECURITY COSTS OF ENERGY

Quantifying the national security costs associated with energy consumption is difficult. The Institute for the Analysis of Global Security (2004), for instance, estimated that the current price

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in the United States (to the extent to which they can be quantified) range from $37-64 billion annually, but only $25-37 billion if national defense costs associated with protecting Persian Gulf oil shipments are subtracted out of the total (as they probably should be). Koplow's calculations thus comport well with EIA's estimate that regulatory interventions are about 5 times as significant as direct tax subsidies.

[27] The EIA's 1999 report on energy subsidies – which updated the 1992 report – unfortunately ignored regulatory subsidies (EIA, 2000).

of securing American access to Middle East oil was more than $50 billion annually. Greenpeace says those costs are substantially less; between $12 billion and $26.7 billion a year (Koplow and Martin, 1998).[28] The Congressional Research Service, on the other hand, says they are only $500 million a year (Congressional Research Service, 1992). None of those estimates, of course, include the cost of "Operation Iraqi Freedom," which may or may not have an oil mission component attached thereto (Taylor, 2003).

Agreement about national security externalities is hard to reach because military and foreign policy expenditures are generally tasked with multiple missions and objectives, and oil security is simply one mission of many. Analysts disagree about how to divide those missions into budgetary terms.

Debate about the size of the U.S. military's "oil mission" and related foreign policy expenses is interesting but not particularly relevant to a conversation about energy prices. From an economic perspective, the key question is whether an elimination of U.S. military and foreign aid expenditures dedicated to "the oil mission" would result in an increase in the price of oil, and, if so, how much? That is the true measure of the national security externality if it exists. Measuring the externality by the amount of money government spends on the oil mission is at best a measure of how much politicians *believe* the externality might be. Political assessments may or may not be accurate.

[28] 1998 published estimate updated by Koplow and Martin to 2003 dollars.

To be sure, if the termination of the American "oil mission" implied the termination of all military, police, and court services in the region, petroleum extraction investments would become more risky and oil from that region presumably more expensive. But remember that oil companies in the region are creatures of government. So the question is really whether Middle-East governments would produce less oil because the United States ended its oil-related military mission and foreign aid. Or would oil producing states provide – or pay others to provide – military services to replace those previously provided by the United States?

We believe that a cessation of U.S. security assistance would be replaced by security expenditures from other parties. First, oil producers will provide for their own security needs as long as the cost of doing so results in greater profits than equivalent investments could yield. Because Middle-Eastern governments typically have nothing of value to trade except oil, they must secure and sell oil to remain viable. Second, given that their economies are so heavily dependent upon oil revenues, Middle-Eastern governments have even more incentive than we do to worry about the security of production facilities, ports, and sea lanes. Third, even if producing countries provide inadequate security in the eyes of consuming countries, consuming countries can pay producers to augment it.

In short, whatever security our presence provides (and many analysts think that our presence actually *reduces* security) could be provided by other parties were the United States to withdraw (Jervis, 2005). The fact that the Saudi Arabia and Kuwait paid for 55 percent of the cost of Operation Dessert Storm suggests that keeping the Straights of Hormuz free of trouble is

certainly within their means.[29] The same argument applies to Al Qaeda threats to oil production facilities.

If oil regimes paid for their own military protection and the protection of their own shipping lanes, would U.S. Middle-East military expenditures really go down? The answer might very well be "no" for two very different reasons. First, the U.S. Middle-East military presence stems from our implicit commitment to defend Israel as well as the region from Islamic fundamentalism, and those missions would not likely end simply because Arab oil regimes paid for their own economic security needs. Second, bureaucratic and congressional inertia might leave military expenditures constant regardless of Israeli or petroleum defense needs because of the pork barrel aspects of defense expenditures. In this admittedly cynical view, military expenditures are undertaken not just to enhance security, but also to provide jobs and economic wellbeing in congressional districts.

Thus, U.S. Persian Gulf expenditures should not be viewed as a subsidy that lowers oil prices below what they otherwise would be. Instead, the expenditures should be thought of as a taxpayer financed gift to oil regimes and the Israeli government. The gift has no effect on oil prices.

5.2 GOVERNMENT INTERFERENCE IN OIL PRODUCTION

[29] Saudi Arabia and Kuwait paid approximately $33 billion (55 percent) toward the total cost of Desert Storm and Desert Shield, which was $60 billion. The U.S. share was only $6 billion (10 percent). Defense Department press release 125-M, May 5, 1992.

Many politicians and policy advocates argue that it's absurd to talk about free energy markets in a world in which the OPEC cartel restricts oil supply (EIA, 2006, pp. 25-35). The economics literature is divided on the issue of OPEC's influence on world crude oil prices.[30] Francisco Parra, a former Secretary-General of the OPEC cartel, believes that production costs are so low in the Persian Gulf and the reserves there are so large that world crude oil prices would average under $5.00 per barrel if countries did not collude to restrain output (Parra, 2004, p. 337). Other economists believe that only Saudi Arabia restricts output while the other countries produce as much as they can (Alhajji and Huettner, 2000, pp. 31-60). Still others argue that producer states did not constrain supply from 1974-1980 and, accordingly, may not be doing so now (Loderer, 1985).

Even if OPEC or Saudi Arabia restrict output, markets do allocate the oil that is produced efficiently among consumers. And if producers aren't producing as much as they might, the consequence is higher rather than lower than appropriate gas prices, the opposite of the goal of those who make externality arguments.

If the federal government were to set about "correcting" that problem, what might it do? It could compel production, but it's hard to imagine how the United States could reasonably compel Venezuela, Saudi Arabia, Iran, or Russia to increase production. It could subsidize domestic production, but that would lead to additional inefficiency and misallocation of capital. It could lower prices to consumers, but that would force prices to tell a story that reflected political

[30] For an orthodox answer to the question and a good literature review on the subject, see James Smith (2005).

wishes rather than economic reality. Such interventions have not worked well in the past (Taylor and Van Doren, 2006).

OPEC behavior may result in oil and gasoline prices that are much higher than if production decisions were made by private companies. But practical remedies are hard to imagine. And all would reduce rather than increase the price of oil.

5.3 INEFFICIENT ELECTRICITY REGULATION

Retail electricity prices – for most consumers, at most times, and in most places – are dictated by government regulation. Prices in wholesale markets are the product of market forces, but those prices are only indirectly and partially reflected in retail rates.

Retail electricity prices are "wrong" all the time because they do not vary to reflect supply and demand fundamentals. They are backwards looking cost-recovery mechanisms rather than forward looking resource-allocation devices. Prices are too high during off-peak and too low during peak consumption hours. Regulation also frequently requires some user groups pay higher prices so that others can pay lower prices (a phenomenon economists describe as "cross-subsidy").

The remedy according to most economists is "real-time pricing;" retail electricity prices would reflect minute-by-minute changes in supply and demand (Faruqui *et al.*, 2001). Based on the California Demand Response experiment, Pacific Gas and Electric has estimated that real-time

pricing would yield a savings in present value of $338 million (Faruqui and Earle, 2006, p. 27). The bulk of the savings from the installation of advanced meters, however, does not arise from the demand response but the reduction in meter reading costs ($2 billion in present value) that is possible with advanced meters (Faruqui and Earle, 2006, p. 26).

The lesson is that real-time pricing does not have to be mandated. If it really saves money then utilities will adopt it voluntarily. The remedy to this problem is to simply free retail prices from political regulation.

6. Conclusion

Energy is like any other commodity in the marketplace, and there is little reason to believe that energy decisions cannot be directed efficiently by market price signals. The proper corrective for price distortions is not to give up reliance on prices but to eliminate the policies that cause the distortions. That implies internalizing externalities, to the extent possible, and eliminating government interventions that send incorrect signals to producers and consumers about energy supply and demand.

Happily, concerns that energy prices are substantially "wrong" in the United States today are overblown. Energy prices are reasonable reflections of total producer costs and consumer demand. There are certainly exceptions to this rule. For example, most renewable energy and nuclear power facilities would disappear without government support (Taylor and Van Doren,

2002 and 2001; Heyes, 2002-2003). And there are easy correctives for policy makers to employ should government decide to end those price distortions.

Most government interventions in energy markets, however, are undertaken for distributional rather than efficiency concerns. Neither firms nor consumers like energy markets and politicians are willing to accommodate that dislike.

While this chapter has not addressed the case for intervention on equity grounds, it argues that efficiency-based arguments for intervention – which are often employed as rationales for intervention actually driven primarily by equity concerns – have little intellectual support. Our advice to those concerned with equity is to address those concerns outside of the context of energy markets and in a manner that distorts price information the least.

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