

# Do Consumers Value Fuel Economy?

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**E**VEN BEFORE THE 2005 HURRICANE season sent gasoline prices to historical highs, rising fuel prices were leading to calls for a political response for relief. Some focused on augmenting supply, renewing the push to open the Arctic National Wildlife Refuge to drilling and to increase offshore drilling. Others focused on decreasing demand by raising fuel economy requirements and encouraging conservation.

Enacted in 1975, the “Energy Policy Conservation Act” established Corporate Average Fuel Economy (CAFE) standards for passenger cars and light trucks, with a stated objective of doubling new car fuel economy by 1985. In 1986–87, average fleet fuel economy reached 25.9 miles per gallon. Since then, fuel economy has slid back somewhat as sport utility vehicles and light trucks, which are subject to lower fuel economy standards, have become popular, constituting more than 50 percent of new vehicle sales in recent years. Still, current average fuel economy is only seven percent below the 1986–87 high, while vehicle weight has increased 24 percent, horsepower has increased 93 percent, and zero-to-60 mph acceleration has improved 29 percent. In other words, today’s vehicle owners enjoy more size and performance while sacrificing only a little in terms of fuel costs.

**CONSUMER CHOICES** But does the lack of ongoing improvement in fuel economy mean consumers do not value fuel savings? Before the recent price increases, I analyzed model year 2001 new car sales to determine if consumers accurately value the savings of improved fuel economy. In theory, new vehicle buyers should be willing to pay for improvements in fuel economy to reflect anticipated savings given the buyers’ expectation of future fuel prices and vehicle miles driven. In an era of relatively stable gasoline prices, buyer expectations about fuel prices would likely be relatively stable, leading to automobile pricing that would reflect fuel savings based on prevailing prices.

Of course, an individual’s choice of automobiles depends on more than just fuel prices. People base their choice of vehicle on a variety of characteristics, such as comfort, size, safety, and performance. Fuel economy is often, although not always,

negatively correlated with those other vehicle characteristics. Thus, consumers balance potential savings in fuel costs from higher fuel efficiency against a preference for larger, safer, or faster vehicles. As technological improvements over time have led to improvements in fuel economy with fewer sacrifices in size, safety, or performance, consumer aversion to more fuel-efficient vehicles has declined.

The price of an automobile is a function of the vehicle’s combination of attributes. Statistical analysis can be used to



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estimate the contribution of each vehicle attribute to the total price of an automobile, and can also be used to estimate the value of an incremental change in a particular attribute such as acceleration or fuel economy.

The data used in this analysis include 130 automobile models, list prices, vehicle attributes, and sales quantities for model year 2001 automobiles. In addition to fuel economy, seven general categories of desirable vehicle attributes were considered: size, power, performance, safety, comfort, reliability, and whether or not the vehicle was classified as a luxury automobile. Because sport utility vehicles, vans, and light trucks are subject to different federal regulations, those vehicles were not included in the analysis.

In addition to desirable vehicle attributes, the negative impact of federal gas guzzler taxes was also taken into consideration. The Energy Act of 1978 established the gas guzzler tax on the sale of new vehicles for which the weighted average fuel economy was less than 22.5 mpg. This tax increases as fuel economy declines for every 1 mpg decrease down to 12.5 miles per gallon, starting at \$1,000 and rising to \$7,000. All else constant, vehicles subject to the gas guzzler tax would be expected to sell for less, as consumers consider the added cost as part

of the total cost of acquiring the vehicle, hence reducing the amount they would be willing to pay for the vehicle.

The U.S. Environmental Protection Agency determines estimated fuel economy for city mileage, highway mileage, and a weighted average based on an assumption of 45 percent highway driving and 55 percent city driving. What an improvement in fuel economy means in terms of actual fuel savings depends on driving conditions as well as total vehicle mileage. The U.S. Department of Transportation reports an average final vehicle mileage of 145,000 miles. Adjusting for actual in-use shortfall, according to EPA estimates, of 90 percent of calculated city mileage and 78 percent of calculated highway mileage, a 1 mpg increase in average fuel economy equates to a 4.8 percent improvement in average fuel economy for the automobiles analyzed in this study. Such an improvement would generate fuel cost savings of about \$560 at the then-prevailing fuel price of \$1.50 per gallon. In comparison, a 1 mpg increase in average highway mileage would produce a three percent average improvement in highway mileage and generate fuel savings of \$110 over the 145,000 mile lifespan of the automobile at fuel prices of \$1.50 per gallon. A 1 mpg increase in average city mileage would be equivalent to a 6.4 percent average improvement, generating \$514 in fuel savings.

Those calculations suggest that at fuel prices of \$1.50 per gallon, automobile buyers should be willing to pay no more than \$560 for a 1 mpg improvement in average fuel economy. To the extent that future fuel savings are discounted, that is, not worth as much as the equivalent dollar amount of fuel savings today, the expected willingness to pay for a 1 mpg improvement would be less than \$560. So, do people actually pay what fuel economy improvements are worth in fuel savings?

In order to answer that question, I estimated two models: one focused on average fuel economy and the other explicitly separated out the effect of changes in listed city and highway fuel economy. Both models controlled for variation across automobiles in terms of size, power, performance, safety, comfort, reliability, luxury classification, and gas guzzler taxes. The results indicate that for 2001 model year automobiles, consumers valued a 1 mpg improvement in listed city fuel economy at \$440, listed highway fuel economy at \$242, and average fuel economy at \$613. In comparison to the actual undiscounted fuel savings of each of those improvements, it appears that consumers overestimate improvements in highway and average fuel economy while city fuel economy is valued fairly accurately at a relatively low discount rate based on the prevailing fuel prices at the time.

It is possible that consumers do not have an accurate idea of the potential fuel savings associated with improvements in fuel economy. Most proponents of fuel economy improvements cite fuel cost savings, while most opponents focus on safety and freedom of choice issues rather than the declining marginal value of fuel economy improvements as average fuel economy increases. If automobile consumers anticipated rising fuel prices at the time of their vehicle purchase, then they may not have overpaid for improvements in fuel economy. Regardless, they certainly did not underpay based on prevailing price trends at the time. Note that at today's fuel



prices, which are close to twice what they were in 2001, the expected willingness to pay for improvements in fuel economy would be twice as much. How much average fuel economy will increase depends on tradeoffs with other desired vehicle characteristics.

This analysis of actual purchase decisions of 2001 model year vehicles suggests that automobile consumers in the United States do not disregard fuel economy or the potential savings from higher fuel economy. To the extent that the variability in fuel prices has increased since 2001, determining the actual fuel savings to expect from improvements in fuel economy is more difficult for consumers today. However, to the extent that fuel prices have been consistently higher since 2001, rational automobile buyers would be expected to increase their purchases of more fuel-efficient vehicles. In fact, according to a recent Department of Transportation report, new car fuel economy for 2005 is 5 percent above the 2001 figure. Overall, fleet fuel economy for 2005, including SUVs, vans, and light trucks, is about 3 percent higher than in 2001.

Between 1960 and 2001, highway travel in the United States grew about 3.4 percent a year, a 139 percent increase overall—an increase that many attribute to low fuel prices. Improvements in fuel economy of automobiles have nearly offset that increase in terms of overall fuel consumption. Yet, many con-

tinue to push for higher fuel economy standards and higher gasoline taxes. Based on the increasing percentage of total passenger vehicles constituted by SUVs, vans, and light trucks, however, federal CAFE standards seem to require automobile manufacturers to produce more fuel efficient cars than a significant portion of the public wants.

Mandating higher fuel economy limits consumers' choices in the marketplace and, many argue, costs lives in terms of reduced vehicle safety. If there are externalities associated with current levels of fuel consumption that are not adequately addressed by existing regulations and taxes, then further increasing the price of fuel would give consumers the incentive to improve fuel economy and drive less while retaining choice of vehicles in the marketplace.

Consumers appear to fully internalize the value of fuel savings associated with increases in fuel economy of conventional automobiles at low discount rates, making rational purchasing decisions in terms of fuel expenditures. Of course, other benefits such as reduced pollution, reduced global warming, or reduced energy dependency may also be associated with improved fuel economy. While this research cannot determine why people value fuel economy, it has nonetheless found that they do positively value it and pay for it via higher automobile prices. **R**

# What to Do about Bad Patents?

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**C**ONGRESS IS CURRENTLY CONSIDERING the most significant reform to the patent system in nearly half a century. And no wonder. Bad patents are everywhere: covering obvious inventions like the crustless peanut butter and jelly sandwich, ridiculous ideas like a method of exercising a cat with a laser pointer, and impossible concepts like traveling faster than the speed of light. More troubling, countless patents that seem reasonable to a lay audience overreach in technical fields as blatantly as that peanut butter sandwich overreaches in a familiar one.

What to do? The obvious solution would be to throw money at the problem. After all, additional resources would make it possible for the Patent Office to hire more patent examiners and allocate more time to the evaluation of each patent application,

and in that way weed out bad patents more effectively.

Admittedly, that would help. It is shocking how little time patent examiners spend evaluating the average patent: approximately 18 hours spread over a three-year period. That is just 18 hours to read the original application, gather information about related inventions, interact with the inventor and his attorney, and ultimately evaluate both the supposed invention and its accompanying legal documentation. Ironically, the average American will spend more time watching television this week than the federal government likely spent reviewing any of the patents that made television possible. No wonder more than three-fourths of all patent applications ultimately result in successfully issued patents. The bigger surprise is that any bad patents get stopped.

Despite its intuitive appeal, however, the “more money” approach has an important flaw: most of any additional resources would be wasted. Why? Think back to the examples we gave in the first paragraph. Yes, there really is a patent on a method of cat exercise and another on a machine that allows for communication at a speed faster than light. But who cares? No one is ever going to be sued for putting Whiskers through her paces. And it is even less likely that anyone will ever be sued for exceeding the speed of light.

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Nor are those isolated examples. Most patents do not matter. They claim technologies that ultimately fail in the marketplace. They protect firms from competitors who for other reasons fail to materialize. They were acquired so as to signal investors that the relevant firm has intellectual assets. Or they were lottery tickets filed on the speculation that a given industry or invention would take off. Those patents will never be licensed, never be asserted in negotiation

or litigation, and thus spending additional resources to examine them would yield few benefits.

Some bad patents, however, are more pernicious. They award legal rights that are far broader than what their relevant inventors actually invented, and they do so with respect to technologies that turn out to be economically significant. Many Internet patents fall into this category. Rarely a month goes by that some unknown patent holder does not surface and claim to be the true inventor of eBay or the first to come up with now-familiar concepts like hyperlinking and e-commerce. (A particularly notorious example along these lines is the previously unknown technology firm Acacia, which as of this writing claims that its patent portfolio covers just about every known technique for transmitting and receiving digital audio and video content.)

While some such Internet patents may be valid—someone did invent these things, after all—more often the people asserting the patents actually invented something much more modest. But they persuaded the Patent Office to give them rights that are broader than what they deserve, imposing an implicit tax on consumers and thwarting truly innovative companies who do or would pioneer those fields.

Compounding the problem, patents are extremely hard to overturn because courts require a defendant to provide “clear and convincing evidence” to invalidate an issued patent. In essence, courts presume that the Patent Office has already done a good job of screening out bad patents. Given what we know about patents in force today, that is almost certainly a bad assumption.

**IDENTIFYING IMPORTANT PATENTS** The problem, then, is not that the Patent Office issues a large number of bad patents. Rather, it is that the Patent Office issues a small but worrisome number of economically significant bad patents and those patents enjoy a strong, but undeserved, presumption of validity.



Framed this way, the solution naturally follows: The Patent Office should focus its examination resources on important patents and pay little attention to the rest. But it is difficult for the government to know ahead of time which patents are likely to be important.

There are two groups, however, that have better information about the likely technological and commercial value of inventions: patent applicants and competitors. The patent system currently does little to elicit that information. Changing this is the key to reforming the system.

Our proposal therefore comes in three specific parts. First, we would weaken the presumption of validity for issued patents. A presumption like that embraced by the “clear and convincing” standard must be earned, and under current rules patent applicants do not earn it. Why not replace that high hurdle with a more appropriate level of deference such as the “preponderance of the evidence” presumption currently given trademarks and copyrights? (And, while we are at it, we should apply the presumption with some eye toward reality. The current presumption is so wooden that courts today assume a patent is valid even as against evidence that the patent examiner never saw, much less considered. What is the logic there?)

Second, because legitimate inventors need as much certainty as the law can give them, we would give applicants the option of earning a presumption of validity by paying for a thorough examination of their inventions. Put differently, applicants should be allowed to “gold-plate” their patents by paying for the kind of searching review that would merit a presumption of validity. An applicant who chooses not to pay could still get a patent. That patent, however, would be subject to serious—maybe even *de novo*—review in the event of litigation. Most likely, applicants would pay for serious review with respect to their most important patents but conserve resources on their more speculative entries. That would allow the Patent Office to focus its resources, thus benefiting from the signal

given by the applicant's own self-interested choice.

Third, because competitors also have useful information about which patents worry them and which do not, we support instituting a post-grant opposition system, a process by which parties other than the applicant would have the opportunity to request and fund a thorough examination of a recently issued patent. A patent that survives collateral attack would earn a presumption of validity similar to the one available through gold-plating. The core difference is that the post-grant opposition would be triggered by competitors—presumably competitors looking to invalidate a patent that threatens their industry. Like gold-plating, post-grant opposition is attractive because it harnesses private information; this time, information in the hands of competitors. It thus helps the Patent Office to identify patents that warrant serious review, and it also makes that review less expensive by creating a mechanism by which competitors can share critical information directly with the Patent Office.

Admittedly, there are administrative and strategic issues to work out in this proposal. Post-grant opposition, for example, introduces some risk of collusion: If an applicant can get a

buddy to raise a straw man challenge to his patent and, through that, walk away with a stronger presumption of validity, the whole process will collapse. But any legal system can be gamed, and thus the question here is not whether a two-tiered patent system is perfect—it is not—but whether it is better than what we have now. By subjecting important patents to greater scrutiny, a two-tiered patent system would dramatically improve the quality of economically significant patents. At the same time, the vast majority of patents would undergo the current level of review, at no additional cost to the Patent Office or to society. Moreover, lowering the presumption of validity for most patents would reduce the volume of purely speculative filings, freeing up Patent Office resources for more important inquiries.

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### **A two-tiered patent system would dramatically improve the quality of economically significant patents.**

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Our approach would not completely eliminate bad patents. No matter how the patent system is configured, the occasional peanut butter and jelly sandwich will slip through. But the two-tiered approach would arm the Patent Office with one key weapon it lacks today: information about which patents matter. That would help the Patent Office focus its resources, giving its most careful review to the economically significant patents that should be its bread and butter. **R**