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Are Passenger Vehicles Positional Goods?

Consumer Welfare Implications of More Stringent CAFE Standards

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Are Passenger Vehicles Positional Goods?—Consumer Welfare Implications of More Stringent CAFE Standards[1]

1. Introduction

The following paper examines to what degree vehicles are positional goods, generating consumption externalities that are not currently corrected for by the market, and whether a uniform downward shift in the size of the passenger vehicle fleet will actually result in reduced consumer welfare. Section 2 of this paper briefly reviews the rationale for more stringent fuel efficiency regulations, and how fleet size might be altered by the proposed standards. Section 3 addresses the issues of positional goods and conspicuous consumption. Section 4 summarizes the emergent literature on whether cars are positional goods. Section 5 considers the consumer welfare effects of more stringent automobile fuel efficiency standards and section 6 concludes.

2. CAFE Regulations: Rationale and Potential Effects on the Passenger Vehicle Fleet

Transportation contributes approximately 20 percent of CO_2 emissions in developing countries, and these emissions are increasing (Verhoef and van Wee, 2000). In the United States the transportation sector is responsible for over 30 percent of greenhouse gas emissions (Knittel, 2009). One means of addressing this problem is to make cars more fuel efficient.

In the United States, the Corporate Average Fuel Economy (CAFE) standards were introduced to address the problem of vehicle greenhouse gas emissions and to spur manufacturers to produce more fuel efficient vehicles. CAFE standards for passenger cars have not increased since 1990, and the CAFE standards for light trucks and SUVs have only increased by 10 percent over this period of time. Between 1980 and 2004 the average horsepower and curb weight of new passenger vehicles increased by 80 percent and 12 percent respectively, but the average fuel economy of new passenger vehicles increased by less than 6.5 percent. From 1984 to 2004 the average horsepower and weight of light duty trucks increased by 99 percent and 26 percent respectively, and sales of light duty trucks as a share of all passenger vehicle sales increased from 20 percent in 1980 to 51 percent in 2004. The shift in consumer purchases to SUVs, which are treated as light duty trucks under CAFE, has meant that the sales-weighted CAFE standard has increased minimally since 1983, despite the fact that fuel efficiency increased from 18 mpg to 27.5 mpg for passenger vehicles between 1978 and 1990. While fuel efficiency has not increased, real gasoline prices have declined, with a 30 percent reduction in real gasoline prices occurring between 1980 and 2004 (Knittel, 2009).

Despite the implementation of CAFE standards, research by Decicco and Ross (1996) and Knittel (2009) suggests that technologies available in the United States for improving fuel efficiency of cars have not been fully utilized by manufacturers. Decicco and Ross (1996) found that technologies to improve fuel economy have a pay-back period that is significantly shorter than the

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lifetime of the average vehicle—as little as three years, assuming a 13 percent discount rate. They estimated that fuel efficiency could be increased by 65 percent at the cost of $700 per vehicle. In contrast, Plotkin and Greene (1997) found that a 60 percent increase in fuel efficiency would cost $1,500 per vehicle, on average. In more recent research, Knittel (2009) found that holding the weight, horsepower and torque of vehicles at 1980 levels, fuel economy for both passenger cars and light trucks could have improved by almost 50 percent between 1980 and 2006. In reality, fuel economy only increased by 15 percent during this period. Moreover, according to Knittel (2009), although U.S. manufacturers are above the median in terms of both passenger vehicle and light truck fuel efficiency conditional on weight and power, their relative efficiency has declined over time.

Recently the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) jointly proposed more stringent standards for fuel efficiency and greenhouse gas emissions from passenger vehicles. Knittel (2009) argues that there is an opportunity cost of increasing fuel economy in terms of weight and power and that meeting the proposed fuel efficiency standards will result in "non-trivial downsizing" (Knittel, 2009: 1) of the fleet.[2] However, according to the EPA and NHTSA, the footprint-based standard approach that has been used in designing the proposed standards "will not create significant incentives to produce vehicles of particular sizes, and thus there should be no significant effect on the relative availability of different vehicle sizes in the fleet due to the proposed standards, which will help to maintain consumer choice during the rulemaking timeframe. Consumers should still be able to purchase the size of vehicle that meets their needs" (EPA, 2011:74875). NHTSA estimates instead that the standards will result in an increase in average prices for new vehicles from $161 per vehicle in model year 2017 to $1876 per vehicle in model year 2025.

In the short run, manufacturers can comply with fuel efficiency standards either through technological improvements (and associated price increases) or through changed automobile design and downsizing (which may result in consumer welfare declines). In the longer run, the effects of more stringent CAFE regulations on the fleet size and composition and vehicle attributes are uncertain—depending on how manufacturers choose to innovate. EPA and NHTSA performed their calculations under the assumption that all attributes of vehicles remain exactly the same, but fuel economy improves and prices increase because of the adoption of (costly) efficiency technologies by manufacturers. Assuming EPA/NHTSA was correct in estimating the cost of efficiency technologies, it is possible that any downsizing that does occur would have less of an impact on consumer well-being than a price increase. This conclusion can be illustrated by a straightforward example where a manufacturer offers two cars, each with the same fuel efficiency, one slightly smaller, one slightly more expensive. If the consumer chooses the smaller car, there is a revealed preference that the difference in size has a lower welfare impact than the price difference. EPA/NHTSA modeled only attribute preserving technological changes, which presumably will be

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[2] Based on theoretical models, Knittel (2009) shows that compliance with the standard could be attained by shifting back the car to truck ratios to the level of the 1980s and by reversing the weight and power gains of vehicles that have occurred since 1980 by 25 percent or reducing the weight and power of vehicles to 1980 levels. There is no reason to believe this degree of downsizing would occur in fact.

available to manufactures if they believe that consumers prefer to pay higher purchase prices for passenger vehicles to avoid downsizing of the fleet. If manufacturers choose to downsize the fleet rather than raising prices then the implication is that the negative consumer welfare effects of decreases in passenger vehicle size are less in magnitude than reduced welfare from more expensive vehicles.

Furthermore, a review of the literature on positional goods and consumption externalities suggests that where fleet downsizing occurs, consumer welfare loss may be low because the relative position of vehicles does not change in the medium- to long-term. This is the subject of the following section.

3. Positional Goods and Conspicuous Consumption

> "Assume that an agent's status depends on her consumption relative to that of others. Assume further that her utility depends at least in part on her status. Then the choice of levels of consumption is necessarily strategic, because each agent must anticipate the consumption decisions of others in making her optimal consumption decision … [E]veryone increases conspicuous consumption in order to improve status, but any gain in status is cancelled out by the similarly increased expenditure of others" (Hopkins and Kornienko, 2004: 1085).

In the mid-90s Easterlin (1995) observed that for the United States, Europe and Japan substantial increases in real GDP per capita in the latter decades of the 20th century (of at least 25 percent for Europe to 500 percent for Japan) had not resulted in an increase in mean happiness. Easterlin (1995) argued that an increase in income corresponded to a proportional increase in material norms by which well-being is determined, leaving happiness unchanged even though income and consumption of consumer durables, including cars, increased. Although Easterlin's findings have been challenged (e.g. Stevenson and Wolfers, 2008; Diener and Diener, 1995), there is evidence that average wellbeing within a country is not significantly correlated over time with income (Frank, 1997). Further investigation by Alpizar et al. (2005) found that "on average, 45 percent of the utility increase from a small income increase arises from enjoying a higher relative income" (Alpizar et al., 2005: 412), which is counter to the assumption that utility depends only on absolute consumption. Moreover, Andersson (2006) finds that individuals who consume less than the average for society are more concerned about relative consumption than those who are above the average level of consumption. An explanation for these observations is found in the behavioral economics, psychology, sociology and neuroeconomics literatures, which focus on social status and related consumption externalities in the form of positional goods.

This emerging literature focuses on the issue of how utility is affected by relative position in society (e.g. Solnick and Hemenway, 1998), typically referred to as social status. "Social status is a ranking of individuals (or groups of individuals) in a given society, based on their traits, assets and actions" (Weiss and Fershtman, 1998: 802). Empirical evidence suggests that social status is an incentive mechanism, which affects individuals' behavior. Individuals with high social status expect favorable treatment in social and economic interactions. Accordingly, individuals seek to increase their social status through group affiliation, investment in assets, and actions that enhance their status—including conspicuous consumption. Moreover, status is characterized by a collective good aspect, i.e. the actions or traits of individuals within a status group affect the social status of all other members of the group. Social status is also used as an instrument to restrict entry to the group through costly actions such as conspicuous consumption (Weiss and Fershtman, 1998).

The role of conspicuous consumption in signaling social status was first posited by Veblen (1899). Subsequently Duesenberry (1949) used the concept of the "demonstration effect" to explain that a household's consumption is affected by the consumption patterns of neighbors especially when they make an upward social comparison, a claim that Andersson (2006) examined using survey evidence. Galbraith (1958) argued that consumer demands are determined in large part by society. Hirsch (1976) contributed to this literature by arguing that relative status rankings create social scarcity, and the need to retain social rankings results in increased demand and competition for positional goods. "A good is considered 'positional' to the extent that people are affected by how their consumption compares to that of others" (Solnick and Hemenway, 2009: 568). Survey research has demonstrated that conspicuous items, including cars, jewelry and houses, are more positional than non-conspicuous items, including health and leisure (e.g. Solnick and Hemenway, 2005; Solnick et al., 2007; Carlsson et al., 2007; Frank, 1997). Conspicuous consumption facilitates a situation whereby utility depends on relative consumption of positional goods. Moreover, according to Solnick and Hemenway (2009), individuals will adjust their expenditures on visible goods, in order to conform to social norms and to ensure that their expenditures are above the average, rather than below the average. Competition for positional goods is a zero sum game, whereby resources are socially wasted, people's relative position remains unchanged, and economic growth is reduced (Weiss and Fershtman, 1998). This phenomenon was referred to by Frank (1985) as the "positional treadmill," which results in U.S. consumers engaging in an inefficient pattern of consumption (Frank 1999; see also Hopkins and Kornienko, 2004, for a discussion of how conspicuous consumption results in a non-Pareto equilibrium). Accordingly, researchers have suggested the possibility of positional externalities (e.g. Frank, 1997; Hopkins and Kornienko, 2004; Solnick and Hemenway, 2009). The idea is that when highly ranked positional goods are consumed, they reduce the value of lower ranked positional goods. (For example, the claim would go that if a new, faster smartphone is placed on the market and purchased, it reduces welfare for consumers with the older model.) The bounds on this externality could be quite large or could be very limited, and empirical research has only begun to study the existence and extent of this effect.

4. Are Cars Positional Goods?

Although cars do meet an absolute need for mobility, especially in rural areas or areas with limited public transport, there is increasing evidence that cars are to some degree positional goods. As stated by General Motors' Vice Chairman Bob Lutz, "aspirational aspects overwhelm the functional differences" when consumers select cars for purchase (Heffner et al., 2005: 1). Verhoef and van Wee (2000) posited that the purchase of high performance, luxurious cars rather than less-expensive models is likely driven by relative rather than absolute needs, i.e. by the desire to increase one's status rather than to meet a transport need. They argue that people are willing to pay a premium for additional engine power, expensive accessories and vehicle size, in order to increase their relative status. Their argument is supported by literature from the psychological sciences that shows that social comparison influences people's choice of car to purchase (e.g. Steg et al., 1998; Erickson, 1996; Sirgy, 1985; Grub and Stern, 1971; Jacobson and Kossoff, 1963). It should be noted that this literature is also consistent with social comparison having informational value for consumers.[3] It is likely that even if positionality is important, people derive utility from higher performance vehicles, which is not founded on social comparison. It is possible that utility that people derive from larger, faster cars is an aggregate of direct utility from these car features and additional utility derived from the positionality of the car.

Currently, there is incomplete evidence on the positionality of cars. Three studies argue that cars are positional goods, although these findings are contradicted by other research (e.g. Grinblatt, 2004). Using survey evidence, Alpizar et al. (2005) found that the mean degree of positionality for cars is between 0.5 and 0.75 (on a scale of zero to one, where one indicates that a good is completely positional). Carlsson et al. (2007) found that 50 to 75 percent of a car's purchase price is related to the positionality of the car, whereas vehicle safety only accounts for 25 percent of the purchase price. In more recent work, Hoen and Geurs (2011) used stated choice experiment data from the Netherlands to suggest both that cars are positional goods and that the attributes of size, engine capacity and interior increase the positionality of cars.

In contrast to the previous findings, Grinblatt et al. (2004) use to Finnish data to demonstrate that households' vehicle purchases are strongly correlated with purchases by neighbors, especially recent purchases or purchases by close neighbors, but that this is the result of information sharing about the quality of the vehicle and the cost of owning it. Grinblatt et al. (2004) argue that there is no evidence that this purchasing behavior was driven by desire to conform or by envy. While they caution that their results do not negate the claim that cars are positional goods, they argue that information barriers are as, or more, important than behavioral influences in explaining car purchasing behavior.

By applying spatio-temporal models to the adoption of the Toyota Prius Hybrid in California from 2001 to 2007, Narayanan and Nair (2011) found that a one percent increase in the adoption of the Prius in the zip code of an individual increases the probability that the individual will purchase a Prius by 5.3 percent. However, like Grinblatt et al. (2004), Narayanan and Nair (2011) caution that this result may be driven by several social factors, including: word-of-mouth, network effects[4],

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[3] The evidence that social comparison drives car choice is strong. But social comparison may have multiple underlying motivations including green envy (in the case of hybrid vehicles) and information asymmetries. As noted by Narayanan and Nair (2011) in their analysis of hybrid car purchasing behavior, "[a]gents may care about the adoption behavior of other users [i.e. car purchase decisions] because others' actions or welfare directly affects their utility (social preferences); because adoption by others updates the users' beliefs about existence or attributes (observational learning); because feedback from others affects beliefs directly (word-of-mouth); because adoption by others affects the users' value of the product (network effects); or because some combination of these are at play" (Narayanan and Nair, 2011: 2). The inference is that, although positional goods do play a role in social comparison, positionality is not the sole determinant of social comparison.

[4] A network effect (also referred to as a network externality or demand-side economies of scale) refers to instances in which the value of a product or service is dependent on the number of other agents that use that

herd behavior[5], observational learning and exclusivity/snobbery. Again, the findings do not preclude the existence of positionality in car purchasing behavior, but multiple factors may determine car purchasing decisions.

Image may lead consumers to choose more fuel-efficient gasoline-hybrid electric vehicles, in order to signal that they are 'green' consumers or that they are socially responsible, even if this results in functional compromises (Heffner et al., 2005). It then follows that successful marketing of more fuel-efficient vehicles would depend on finding the right mix of functional benefits and image associated with the car.

5. The Consumer Welfare Effects of Mandating Increased Fuel Efficiency for Cars

Car manufacturers can respond to the proposed CAFE standards in four ways: (1) adding fuel-efficient technologies, thereby increasing vehicle prices; (2) changing vehicle design (in particular the size and power of vehicles) to increase fuel efficiency; (3) raising prices of fuel-inefficient models; or (4) exploiting a loophole in the CAFE standards that grants automakers the ability to overstate the fuel efficiency of vehicles with "flexible-fuel capacity"[6] (Anderson and Sallee, 2011). Anderson and Sallee (2011) determined that, owing to this loophole, increasing fuel economy standards by one mile per gallon reduces profit per vehicle by $9 to $27. The estimated reduction in profit per vehicle is considerably less than the noncompliance penalty of $55 per vehicle and compliance costs estimated by Gramlich(2009) (marginal compliance cost of $347 per vehicle) and Jacobsen (2010) (marginal compliance costs range from $52 to $438 per car and from $157 to $264 per truck). According to Anderson and Sallee (2011), it is reasonable to assume that the noncompliance penalty of $55 is the upper limit on CAFE compliance costs. If compliance costs are relatively low then increased stringency of the CAFE standards may not result in significant changes in fleet size and composition. Accordingly, consumers may face either increased vehicle purchase prices or different vehicle design features (or some combination thereof) – or the fleet may remain fairly similar in size and composition to the current fleet. Whether consumers experience lost welfare depends on (1) if the value they place on cars depends on vehicle size, power and features other than fuel efficiency, and (2) if there are significant changes in the fleet.

Assuming that the fleet is downsized, both Hoen and Geurs (2011) and Verhoef and van Wee (2000) point out that consumer welfare effects are overestimated when the positionality of cars is not taken into consideration. According to Verhoef and van Wee (2000), a shift to a more fuel-efficient fleet with smaller, lighter, less powerful cars will generate only a small reduction in welfare, owing to the fact that the relative status of cars will remain unchanged and mobility needs

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product or service. For example, as diffusion of telephones increased the benefits of owning a telephone, in terms of ability to communicate with others, increased.

[5] Herd behavior was a term coined to describe unplanned behavior by individuals in a group. The term, which stems from the behavior of animals in herds, flocks and schools, is typically applied to human behavior during times of stress, e.g. stock market bubbles and crashes, but may also be applied to daily decision-making, judgment and formation of opinions.

[6] Flexible-fuel vehicles burn ethanol.

will still be met, albeit at a slightly lower level. Hoen and Geurs (2011) qualify this finding somewhat by pointing out that car buyers tend to choose vehicles from a narrow pre-selected set of cars that are similar in size, and so there will be some utility loss from downsizing vehicles.

Market failure prevents optimal investment in fuel economy. Based on the positional goods argument, consumers will not take into account the negative externalities they impose on other consumers by purchasing higher-status vehicles and will not move themselves down the status scale voluntarily on visible, positional vehicle features such as size and horsepower to the efficient level. However, if consumers could maintain their relative economic position, they might be more willing to pay for non-positional goods (Frank and Sunstein, 2000).

Fuel economy standards that affect the entire fleet should allow consumers to achieve an increase in fuel efficiency without losing position in the status hierarchy. Similarly, these standards should permit consumers to select fuel efficiency without falling behind in the safety/size rankings in the medium- to long-run, since with time the average fleet size will shift. To summarize, the positional goods effect suggests that shifting from less to more fuel efficient vehicles should result in small reductions in consumer surplus. More particularly, the proposed standards may have the following effects:

- In the short-run, to the extent that the fleet is downsized or manufacturers increase vehicle prices, consumer welfare will be adversely affected. However, there is no consensus that downsizing will occur, especially given the new footprint-based standards. Nonetheless, to the degree that downsizing takes place and the average vehicle size and power decrease over time as the size of the fleet decreases, relative car status should be reestablished, and consumer impacts should lessen.
- In the long-term, consumers will simply rank themselves around a new status distribution for positional vehicle attributes such as size and power. The first wave of buyers who initially experience some status loss may be restored to their original status position.

6. Conclusions

Based on the existing literature, there is some evidence that cars are positional goods and that the purchase of passenger vehicles to obtain social status imposes consumption externalities. Fuel efficiency standards may partially correct consumption externalities, although potentially at higher cost than fuel taxes or differentiated taxes for cars based on their fuel economy or positional features. Nonetheless, if, as suggested by the literature, vehicles are positional goods then any decrease in the size of the fleet to meet more stringent standards would not result in significant reductions in the welfare of consumers.

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