BEFORE THE
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Washington, D.C.

In the Matter of: Passenger Automobile Average Fuel Economy Standards Model Year 1987-88	Docket No. FE-85-01

COMMENTS OF THE BUREAUS OF COMPETITION, ECONOMICS AND CONSUMER PROTECTION OF THE FEDERAL TRADE COMMISSION
Washington, D.C. 20580
March 26, 1986

On January 16, 1986, the National Highway Traffic Safety Administration (NHTSA) released a Notice of Proposed Rulemaking ("NPRM") in which it proposed that the Corporate Average Fuel Economy (CAFE) standards for the 1987 and 1988 model years (MY) be reduced from the planned 27.5 miles per gallon (mpg) to as low as 26 mpg, the current CAFE standard.[1] In response to that NPRM, the Bureaus of Consumer Protection, Competition, and Economics of the Federal Trade Commission ("FTC staff") submit the following analysis of the short-term effects on consumer welfare and automobile worker employment if the planned CAFE standard of 27.5 mpg is retained.[2]

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1 In the Matter of Passenger Automobile Average Fuel Economy Standards Model Years, 1987-88, Docket No. FE-85-01, 51 Fed. Reg. 2912-2923 (1986) (hereinafter cited as "NPRM").

2 These comments represent the views of the Bureaus of Competition, Economics, and Consumer Protection and do not necessarily represent the views of the Federal Trade Commission or any individual Commissioner. The Commission has, however, authorized the staff to submit these comments. Inquiries regarding these comments should be directed to Richard Higgins, Bureau of Economics, Federal Trade Commission, Washington, DC, 20580.

This analysis is germane to question #7 in the NHTSA NPRM of January 16.[3] That questions reads: "What would be the likely economic effects, i.e., effects on employment, car sales, restrictions on consumer choice, etc., of alternative MY 1987-1988 passenger car fuel economy standards within the 26 mpg to 27.5 mpg range?" As explained below, we conclude that raising the actual CAFE standard to 27.5 mpg will have an adverse effect on the welfare of American consumers and the U.S. economy. Adoption of the more stringent standard would result in a significant number of consumers purchasing low mileage cars at prices higher than they would otherwise be and would also lower employment in the automobile industry. These effects constitute a cost against which the supposed benefits of the program should be balanced. Because the benefits from the 27.5 mpg standard appear small while the costs appear substantial, the FTC staff urges NHTSA to lower the proposed standard for the 1987-88 model years.

These comments are divided into four sections. Section I reviews the possible benefits that might follow from adoption of the 27.5 mpg standard and concludes that the benefits are relatively small. Section II develops a theoretical framework for estimating the corresponding costs of the higher mileage

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3 NPRM at 2919. The focus of these comments is on the consumer welfare consequences of the proposed change in the CAFE standard, all other factors being equal. We do not address the equitable or other non-economic implications, if any, of different manufacturers' varying degree of preparedness to meet the planned 27.5 mpg standard, or of investment decisions that may have been made in view of the planned standard. While such considerations may or may not be relevant to NHTSA's proposed rulemaking, the affected manufacturers are in the best position to bring to light the relevant facts and analysis.

standard, including its adverse effects on price, output, and employment. Section III applies this theoretical model to the facts of the auto industry and develops concrete estimates of the total costs that will be borne by the public if the 27.5 mpg standard is adopted. Finally, Section IV presents the conclusion of the FTC staff, that the costs of moving to a higher mileage standard will greatly exceed the benefits.

I. The Benefits of a 27.5 mpg CAFE Standard

When it was promulgated by Congress in 1975,[4] the CAFE program had three original rationales, each of which might arguably be further served by increasing the mileage standard to 27.5 mpg. These were (1) to complement price controls,[5] (2) to guard against the risk that consumers would not respond significantly to market forces and conserve fuel even in the absence of price controls,[6] and (3) to improve national security.[7]

Subsequent developments call into question the relevance of these concerns. First, CAFE regulation is no longer necessary as a substitute for market forces because gas prices have been

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4 15 U.S.C. §§1901, 2001-2012.

5 See, for example, the discussion of M. Weidenbaum, "U.S. Should Scrap Law on Fuel Economy," Christian Science Monitor (May 22, 1985) cited in Congressional Record (Senate) (July 29, 1985) at S10239.

6 See, for example, H. Rowan, "Cop-Out on Fuel Efficiency," Washington Post (July 25, 1985) cited in Congressional Record (Senate) (July 29, 1985) at S10233.

7 See, for example, remarks of Senator Durenberger Congressional Record (Senate) (July 29, 1985) at S10235.

decontrolled and market forces reintroduced. Any protection from higher gasoline prices afforded consumers by the domestic price control program came to an end in 1981 with its dismantling. American consumers now purchase gasoline in a deregulated market. Ironically, inflation-adjusted gasoline prices have actually declined since the end of price controls.[8]

Second, there is evidence that consumers in fact purchase more small cars when gasoline prices increase. In Europe and Japan, where gasoline prices are much higher than those in the United States, consumers tend to purchase cars with much higher gas mileage.[9] In addition, U.S. consumers were in fact purchasing more higher mileage cars in response to actual and expected increases in gasoline prices even prior to adoption of CAFE.[10] Further, according to one recent study, the change in average new car mileage between 1970 and 1983 was the same as it would have been without the CAFE program.[11] That is, as gasoline prices rose gradually under the domestic price control program and more rapidly following the end of price controls, consumers responded to the high gasoline prices by purchasing more fuel-efficient cars. The extent of these purchases was great enough to render the CAFE mileage standards redundant.

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8 See D. Henderson, "The Economics of Fuel Economy Standards," Regulation (January 1985) at 45-48 (hereafter "Henderson").

9 See R. Crandall, "Why Should We Regulate Fuel Economy at All?", Brookings Review (Spring 1985) at 4 (hereafter "Crandall").

10 Id.

11 See R. Crandall, T. Keeler, H. Gruenspecht, and L. Lave, Regulating The Automobile, Brookings Institution (forthcoming).

Finally national security may also be a less pressing concern now than when the CAFE rules were first introduced. The considerations here are complex and not entirely consistent. On the one hand, our level of imports is now less than before, and so our national risk exposure is correspondingly less. U.S. oil consumption declined by 16.7 percent between 1978 and 1984, for example, and U.S. oil imports fell by almost 42 percent.[12] On the other hand, our risk exposure may still be undesirably high, particularly inasmuch as a foreign oil cutoff may come about for political as well as economic reasons. In balancing these two considerations, we believe that the use of market-determined gasoline prices will be effective in reducing our exposure to foreign pressure. We therefore believe that stricter CAFE requirements will not be necessary.[13]

In sum, it does not appear that our national security interests would be greatly furthered by adoption of that standard. Further, in the current environment, consumers presumably do not have to be protected from falling gasoline prices by a more stringent CAFE standard. Even during the era of rising gasoline prices, consumers responded by purchasing higher mileage cars to an extent that may have rendered the CAFE program redundant. In the absence of CAFE, the free market choices of

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12 See, R. Shay, "Comments of the Department of Commerce [concerning CAFE]" (letter to the NHTSA Administrator, April 30, 1985) at 3.

13 In making this judgement, we recognize that there is a necessary delay between a rise in gas prices and a consumer response in terms of fuel savings. That delay would cause some interim harm in the event that there is another oil cutoff.

consumers may well have resulted in a new car mileage virtually identical to that mandated by CAFE. It appears, then, that imposition of the 27.5 mpg standard would generate no substantial benefits to either consumers or our national security interest.

II. A Model for Assessing The Costs of CAFE

Not only do the benefits from a more stringent CAFE standard appear small, but the short-run costs to consumers could be substantial. These costs would be generated by the mismatch in demand and production caused by a CAFE-mandated reduction in the production of low mileage cars and an increase in the production of high-mileage cars. This mismatch between production and demand would result in higher prices for low mileage cars (because fewer of these cars will be produced than the market would otherwise demand) and lower prices for high-mileage cars. Some consumers who would have preferred low-mileage cars in the absence of the CAFE standard may or may not purchase the same car at the higher price induced by the compliance with CAFE. In either event, these consumers will suffer a loss in their well-being. At the same time, the CAFE-induced diversion of resources to the expansion of high-mileage car production would be resources whose value to consumers would be greater in low-mileage car production or elsewhere in the economy. Finally, the effect of the more stringent CAFE standard may be to reduce total domestic automobile production and result in unemployment of displaced automobile workers. This loss to the economy would be measured by the value of goods and services these displaced workers would have produced absent unemployment.

To quantify these costs to consumers of a 27.5 mpg CAFE standard, we have constructed a model to estimate the production shifts, price changes, and employment effects that would result from that standard. Because a complete discussion of our estimation procedure is provided in Appendix I, here we simply describe in general terms the nature of our approach. In the following section we will apply this model in order to produce concrete predictions about the effects of different regulatory changes.

We consider a market in which high mileage (i.e., small) cars and low mileage (i.e., large) cars are produced. Small cars are assumed to be those with an Environmental Protection Agency ("EPA") aggregate mileage (a weighted average of city and highway mileage) that meet or exceed 27 mpg while large cars are those below 27 mpg.[14]

Automobile suppliers are also divided into two groups: those firms that are expected to meet or exceed the proposed CAFE standard of 27.5 mpg and those firms that are unlikely to meet the more stringent standard without altering their present practices and incurring substantial costs. The firms most likely to fall into the latter category are GM and Ford, producers of

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[14] While this mileage criteria is arbitrary, tentative analysis by the FTC staff indicates that modest changes in the criteria would have little effect on our estimates infra. We also note that some "small cars" in our analysis might be popularly considered as large cars and vice versa. This possibility may have implications for our results. See the discussion infra at n. 32. We adopt the mileage-based small-car/large-car terminology for exposition purposes.

both large and small cars. At the end of 1985, GM had attained a CAFE mileage rating of only 25.8 while the corresponding figure for Ford was 26.3[15]

The remaining domestic firms--Chrysler, AMC, Volkswagen, Honda, and Nissan--should have little difficulty in satisfying a more stringent CAFE standard. These firms are primarily small car producers. At the end of 1985, they had all attained a CAFE mileage rating that met or exceeded the proposed 27.5 mpg standard.[16] The great majority of imports is also expected to fall into this second group. In 1983 more than 82 percent of all imported cars consisted of models attaining a mileage rating in excess of 27.5 mpg.[17]

Against that background we construct a model of the demand and supply conditions for the U.S. automobile market.[18] As a convenient benchmark we assume that the consumer demands for large and small cars are distinct so that the demand for small cars is independent of the price of large cars and the demand for large cars is independent of the price of small cars. This assumption is not inconsistent with automobile demand studies which typically fail to detect any significant relationship

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15 These figures were obtained from GM and Ford.

16 For Chrysler, its 1985 CAFE rating was 27.6; for AMC, 32.8; for Volkswagen 30.2; for Honda, 33.9; and for Nissan 29.4 These ratings were obtained directly from the various suppliers.

17 See P. Hu and G. Roberts, "Motor Vehicle MPG and Market Share Report, Model Year 1983," Oak Ridge National Laboratory (1984).

18 A complete discussion of these assumptions and the relevant sources in the economics literature can be found in Appendix I.

between the demand for large cars and the price of small cars (or the demand for small cars and the price for large cars).[19]

Based on past studies of the demand for automobiles we assume that a 10 percent increase in the small-car price will generate a 20 percent decline in the quantity of small cars demanded and that a 10 percent increase in the price of large cars will lower the quantity of large cars demanded by 30 percent.[20] Most studies have found that consumer price sensitivity to large and small-car prices is no greater than that assumed here.[21] The effect of our price sensitivity assumptions on the estimated consumer cost of the more stringent CAFE standard is to understate those costs if in fact price sensitivity is less than assumed.

We assume that GM and Ford, the two producers that would be affected by the 27.5 mpg standard, can, in the short run, increase (up to a capacity constraint) or decrease the production of small and large cars at constant variable unit costs. In

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19 See the discussion in Appendix I. We discuss the sensitivity of our results to this assumption infra. See also n. 14.

20 These sensitivity estimates are those of J. Langenfeld and M. Munger, "The Impact of Federal Automobile Regulations on Auto Demand," unpublished draft, Federal Trade Commission (June 1985).

21 For example, one recent study (among others) provides lower estimates of consumer price sensitivity for a variety of car types. The lowest estimate is for subcompacts, suggesting that a 10 percent increase in price would reduce the number of subcompacts demanded by only 8 percent. The largest estimate is for "luxury" cars, indicating that a ten percent price increase would result in 24 percent fewer luxury cars demanded. See R. Carlson, "Seemingly Unrelated Regression and the Demand for Automobiles of Different Sizes, 1965-75," Journal of Business (1978) at 254-259.

particular, we assume that small-car production cannot be increased during the next two years by more than 30 percent over 1985 production levels. In the short run, GM and Ford can increase the production of small cars by employing more worker shifts and by reconfiguring some large-car plants for small-car production. However, any dramatic increase in output in the short-term is limited by GM's and Ford's ability to so reconfigure large-car production facilities and by their ability to acquire enough of the needed inputs, such as engines and transmissions, to produce more small cars. In light of those limitations, a maximum increase of 30 percent in small-car production over a two-year period seems reasonable.[22] Over a longer time period, GM and Ford would build additional small-car plant capacity and their input suppliers would also expand production capacity to satisfy the input needs of GM and Ford at an even larger small-car production rate. We also assume that the two companies supply cars competitively given the CAFE requirements.

In response to the reduced production of large cars by GM and Ford, the price of large cars will tend to rise. But as the production of small cars rises, the small-car price will be

[22] The sensitivity of our results to the 30 percent constraint is discussed infra at n. 33.

reduced so that GM and Ford to sell the additional small cars necessary to comply with CAFE.[23]

We expect that the shifts in production by GM and Ford and the consequent change in prices will create incentives for the small-car suppliers in the industry to alter their own production. When the price of small cars declines, these suppliers of small cars will tend to reduce their small-car output. Thus, when the price of small cars declines as a result of GM's and Ford's CAFE-induced production shifts, the reduction in the small-car production of the remaining small-car suppliers will ameliorate this price decline. To calculate the estimates presented below, we assume that a one percent decline in the

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[23] Alternatively, GM and Ford could opt to pay a penalty for any shortfall between the attained CAFE rating and the 27.5 mpg CAFE standard. Under its statutory authority, NHTSA is required to levy financial penalties in the event of a shortfall. _See_ 15 U.S.C. § 2008. To the extent that GM or Ford (or both) do rely on the penalty option, the costs of CAFE presented here may be overstated. However, the payment of the fine would still impose losses on society similar to those in the text. Because the fine is attributable to the sale of cars that do not meet the 27.5 mpg standard, the fine would be similar to a tax on what we have called large cars. Consequently, the price of large cars would still rise and large-car production would fall. But because any additional small-car sales would reduce the fine, small-car output would rise and the small-car price would fall. Thus, a fine payment still induces artificial production shifts similar to those described in the text, although the magnitude of the shifts may be different. These artificial production shifts induced by the payment of the fine would result in social losses identical in kind to those described in the text.

small-car price will result in a ten percent decline in the output of small-car suppliers.[24]

Our analysis treats Chrysler and the imports of Japanese cars somewhat differently from these other small-car suppliers. Chrysler is now virtually in compliance with the proposed 27.5 mpg standard. Nonetheless, Chrysler does produce some low mileage (or what we have called large) cars.[25] If the price of

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24 *See* D. Tarr and M. Morkre, "Aggregate Costs to the United States of Tariffs and Quotas on Imports," (Federal Trade Commission, December 1984) at 63, n. 12. These authors infer the output response of automobile producers to price changes from previous studies assessing the relationship between U.S. automobile prices and the share of domestic car purchases accounted for by foreign imports which largely consist of small cars. While we could have assumed, analogous to GM and Ford, that small-car suppliers can reduce output at constant unit variable costs, this cost behavior would lead to a complete short-run withdrawal of these suppliers from the U.S market if the price of small cars were to fall. In the framework developed here, GM and Ford are willing to incur losses on small-car production to comply with the CAFE standard in order to produce the now higher priced (and thus more profitable) large cars. Consequently, GM and Ford continue to produce small cars in order to sell large cars. Because small car suppliers are not producing large cars, large-car production is not a short-run option for these suppliers. Confronted with a lower small-car price and constant unit variable costs, these suppliers would minimize their short-run losses by market place withdrawal. Because such a withdrawal appears implausible, we instead assume in the text an output response by small-car suppliers to a small-car price reduction that, while large, still permits them to maintain a presence in the U.S. market.

25 While our definition of "large" cars may include some of Chrysler's models conventionally thought of as "small" cars, our large-car/small-car terminology is used only for expositional simplicity. Nonetheless, the mileage-based definition of small and large cars could affect our estimates of the costs of the 27.5 mpg standard. *See* the discussion *infra* at n. 32.

small cars declines, any induced decline in Chrysler's small-car output would result in non-compliance with the 27.5 mpg standard. We instead assume that Chrysler would maintain its large-car and small-car production, remaining in compliance with the 27.5 mpg standard.

With respect to U.S. imports of Japanese cars, we make two alternative assumptions. In what we will refer to as simulation (1), we assume that in the absence of the Voluntary Restraint Agreement ("VRA") Japanese imports would be considerably greater than they are now. Under this assumption any small-car price decline induced by CAFE compliance would have no effect on the imports of small cars from Japan. Thus we are assuming that the pent-up demand for Japanese cars is so strong that even at a lower small-car price, the Japanese will continue to export to the U.S. the maximum number of cars permitted by the VRA. In simulation (2), we assume that the VRA is not an effective constraint and that the CAFE-induced small-car price decline would result in the same percentage reduction in Japanese imports as for other non-Chrysler small-car suppliers. The two simulations provide estimates that would bracket the likely social loss associated with CAFE.

In summary, then, attainment of the more stringent CAFE standard by GM and Ford would result in total large-car output falling and total small-car output increasing. The net effect of these production shifts could be to generate employment losses in the U.S. automobile industry. The decline in large-car output would be accompanied by a higher large-car price while to a lesser extent the price of small cars would tend to decline as total small-car production expands.

As a result of these CAFE-induced changes in output and prices, large-car consumers would experience losses because of the higher large-car price. While small-car consumers would experience some gains because of the somewhat lower small-car price, on balance consumers would tend to experience losses from imposition of the more stringent CAFE standard. Some of these consumer losses would be offset by the higher profits earned by U.S. producers on the sale of large cars. The remaining losses are pure social deadweight losses. These could be avoided by retaining the present 26 mpg CAFE standard.

III. Applying the Theoretical Model

We will now try to quantify the extent of those losses. Based on the framework described above, Table I presents the estimates of the price and output effects that would be generated by a 27.5 mpg standard. In column 1 we report the actual 1985 output and average prices of large and small cars sold in the United States. Column 2 (simulation (1)) contains the output and price estimates that would result from the imposition of the 27.5 mpg standard, assuming that U.S. imports of Japanese small cars do not decrease. Column 3 (simulation (2)) reports the output and price estimates that would result from the imposition of the 27.5 mpg standard, assuming that U.S. imports of Japanese small cars fall when the price of small cars falls.

The price of small cars declines in simulation (1) by 4.3 percent and by 2.1 percent in simulation (2). The extent of the

Table I

The Effect of Raising the CAFE Standard
from 26 mpg to 27.5 mpg

	(1) 1985 Actual	(2) Simulation (1)[1]	(3) Simulation (2)[2]
Average Large Car Price :	$10,991	$13,368	$13,368
GM-Ford Large Car Sales :	3,593,711	1,832,317	1,832,317
Total Large Car Sales :	3,965,256	2,203,861	2,203,861
Average Small Car Price:	$9,041	$8,651	$8,851
GM-Ford Small Car Sales :	3,073,819	3,995,965	3,995,965
Total Small Car Sales :	7,067,082	7,717,373	7,374,052
Total Sales (units):	11,032,338	9,921,234	9,577,913
Total Domestic Company Sales (units):	8,194,222	7,221,819	7,288,349

1 U.S. imports of Japanese small cars are unchanged from 1985 levels.

2 U.S. imports of Japanese small cars decline when the small-car price falls.

small-car price decline is less in simulation (2) because in this simulation all non-Chrysler small-car suppliers (including offshore Japanese producers) respond to the lower small-car prices by reducing output of small cars. Thus, to sell any given number of small cars to comply with the CAFE standard, GM and Ford need not experience as sharp a decline in the small-car price. In simulation (1), because U.S. small-car imports from Japan do not fall as the small-car price falls, GM and Ford must further reduce the small-car price to induce the larger consumer purchases of small cars necessary to comply with the 27.5 mpg standard.

In both simulations, GM and Ford increase small-car output until full capacity is reached (3,995,965 small cars). Nonetheless, total small-car output is 4.7 percent higher in simulation (1) than in simulation (2). The difference here is again explained by our assumption in each simulation regarding the output response of offshore Japanese suppliers to the reduction in the small-car price.

In both simulations, compliance with the more stringent CAFE standard leads to a significant decrease in large-car sales. GM and Ford reduce large-car sales by more than 1.7 million units--almost one-half of their current output of large cars. The equality of the large-car reduction in both simulations is explained by the small-car capacity constraint on GM and Ford. In each simulation, Ford and GM increase small-car production as much as capacity permits. Thus, as noted above, they produce the same number of small cars under either scenario. The necessity of complying with the 27.5 mpg standard insures that the number of large cars produced by GM and Ford also is the same in both simulations.[26] As a consequence of the decline in large-car output, the price of large cars increases in both simulations by 21.6 percent.

These simulations indicate that the short-run effect of increasing the CAFE standard to 27.5 mpg would be a decrease in the production of all cars in the United States. In simulation (1), total sales drop by 972,403 units while the corresponding decline in simulation (2) is 910,873 units.[27] The decline in both simulations occurs because capacity constraints on small-car production by GM and Ford limit their short-run ability to respond to the stricter CAFE standard by increasing their production of small cars. Thus, the standard must be met by substantial large-car output reductions.

The decline in U.S. production would lead to the substantial displacement of workers in the automobile and auto parts indus-

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[26] If, given the number of small cars produced by GM and Ford, these two suppliers increased the number of large cars produced beyond that in Table I, GM and Ford would not be in compliance with CAFE. If they instead produced fewer large cars, GM and Ford would not be profit-maximizing because they would not be taking full advantage of the rise in large-car prices.

[27] The decline is greater in simulation (1) because the small-car price decline (and thus the domestic supplier reduction in small-car output) is greater than in simulation (2). Again, the difference is explained by the differing assumptions regarding the output response of offshore Japanese small-car suppliers to small-car price declines.

tries. Employment in simulation (1) declines by 137,147 while that in simulation (2) falls by 130,809.[28]

Clearly, this employment loss is likely to be temporary as these displaced workers find new employment (or auto makers build new small-car capacity). However, while these employees are engaged in seeking new jobs, the loss to the U.S. economy from this temporary unemployment can be estimated by considering the likely duration of unemployment and the value of the output these workers would have produced absent the CAFE-induced unemployment spell. In simulation (1), the output loss to the economy is $2.1 billion while that for simulation (2) is $2.0 billion.[29]

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28 To calculate the unemployment changes we use data from the Congressional Budget Office that provides the additional hours of work required to produce an additional automobile in this country. <u>See</u> <u>Domestic Content Legislation and the U.S. Automobile Industry</u>, Subcommittee on Trade of the House Committee on Ways and Means (August 16, 1982) at 34-48. From these we compute a coefficient that shows the change in the number of jobs that result from a change of a given size in the number of automobiles produced. We have computed such a coefficient for both small and large cars. Multiplying these coefficients by the change in the sales of domestic large and small cars, we arrive at estimates for the employment changes brought about by the adjustment to the new CAFE standards.

The employment effect is greater than might appear based on the change in total automobile production alone because the production of large cars involves more labor than the production of small cars as suggested by the Congressional Budget Office data.

29 These output losses are based upon an unemployment spell in the automobile industry of 20 weeks and an average annual wage (including benefits) of $40,360 per automobile production and parts worker. These 1985 data were provided by the Department of Labor. The unemployment spell used is not the average experienced by all unemployed automobile workers. That average would include workers who are temporarily rather than permanently unemployed in the automobile industry and who, therefore, may experience a relatively brief period of unemployment. Because

(footnote continued)

These output losses are not the only losses society bears as a consequence of the more stringent CAFE standard. Obviously, consumers are made worse off when the price of cars rises, and are made better off when the price of cars falls. One measure of this change in consumer well-being is the change in consumer surplus.[30] The gains or losses in consumer surplus, however, will be offset in part by the losses or gains to producers, measured as profits. The sum of the changes in consumer surplus and the change in producer profits (or producer surplus), when combined with the output losses generated by the CAFE-induced unemployment, represents the total loss imposed on the public as a consequence of the higher CAFE standard.

Our calculations of consumer and producer surplus changes for each of the demand scenarios are presented in Table II.[31]

(footnote continued)

workers who are permanently displaced in the automobile industry may experience a more extended unemployment spell, we sought to minimize the effect of the temporarily unemployed on our duration estimate. We used the unemployment spell experienced by those workers at the 75th percentile of all unemployed workers when arrayed by the duration of unemployment.

30 A decline in consumer surplus is measured as the increase in the price paid by consumers who purchase cars at the old and new prices plus the difference between what consumers who only purchase cars at the lower price would be willing to pay and that lower price. Similarly, an increase in consumer surplus is measured as the decrease in the price paid by car consumers at both the old and new prices plus the difference between what consumers who only purchase cars at the lower price would be willing to pay and that lower price. Thus, a rise in car prices will always result in a consumer surplus decline, and *vice versa*.

31 *See* Appendix II for the details of this calculation.

Table II

The Total Cost to Society of Raising the CAFE Standard from 26 mpg to 27.5 mpg (billions of dollars)

	Simulation (1)[1]	Simulation (2)[2]
A. Output Change Due to Increased Unemployment	-$2.129	-$2.031
B. Deadweight Social Loss (-) or Gain (+)	-$0.925	-$1.422
Consumer Surplus Change	-$4.186	-$5.688
Producer Surplus Change	+$3.261	+$4.266
Total Loss (-) or Gain (+) (A+B)	-$3.054	-$3.453

[1] U.S. imports of Japanese small cars are unchanged from 1985 levels.

[2] U.S. imports of Japanese small cars fall when the small-car price declines.

In both simulations, the rise in the price of large cars will tend to reduce consumer surplus while the fall in the price of small cars will tend to increase consumer surplus. The net effect is a decline in consumer surplus of $4.2 billion in simulation (1) and $5.7 billion in simulation (2). Because the large-car price increase is identical in both scenarios, the decline in consumer surplus is the same for each set of large-car consumers. However, because the small-car price decline is greater in simulation (1), small-car consumers in this simulation experience a larger gain in consumer surplus than those in simulation (2). As a consequence, the net consumer surplus loss in simulation (1) is less than that in simulation (2).

United States producers in both scenarios experience a rise in profits or producer surplus on large-car sales because the large-car price rises. However, they experience a decline on the surplus they receive on small-car sales because the price of these cars falls. Because the rise in large-car price is the same in both simulations while the small-car price decline is greater in simulation (1), the U.S. suppliers in simulation (1) gain $3.3 billion while in simulation (2) they gain $4.3 billion. In simulation (1), the difference between the consumer loss and the domestic producer gain is $0.9 billion while that in simulation (2) is $1.4 billion. In each simulation, this difference is the "deadweight" loss to society from imposition of the more stringent CAFE standard. The deadweight loss--which is the consumer loss not captured by domestic producers in the form of higher profits[32]--represents a cost to society that could be avoided by lowering the proposed CAFE standard. When the deadweight loss is combined with the unemployment-related losses, the total cost of the 27.5 mpg standard to society is $3.0 billion in simulation (1) and $3.5 billion in simulation (2).[33]

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[32] These calculations exclude the changes in profits earned by non-U.S. producers because those changes will be borne largely by non-U.S. citizens. Because any profits earned by foreign suppliers are not included in the deadweight loss calculation, this loss would be higher if contrary to what we assumed the demand for small cars depends on the price of large cars and vice versa. As a result of the CAFE-induced increase in the large-car price, some would-be large-car consumers will opt instead for small cars, assuming this demand interdependency. Consequently, the price of small cars would rise and the profits of U.S. and foreign small-car suppliers would increase. Because of the high share of small-car sales accounted for by foreign suppliers and because the increase in foreign supplier profits is not included as an offset to the consumer losses experienced as a result of the higher prices, the deadweight losses if there is a demand interdependence would be greater than those in Table II. Because we have defined small and large cars solely in terms of gas mileage, low mileage (high mileage) cars may in fact be viewed by consumers as small (large) cars. Thus, our definition of large cars may in fact include cars that consumers consider as small. When the price of our mileage-defined large cars increases, consumers (who consider those low mileage cars as small) may opt to purchase our mileage-defined small cars (many of which consumers may also regard as small). Thus, if our mileage-based definition of small and large cars does not correspond to what consumers consider small and large, our car demands would be interdependent and our deadweight loss estimates would be understated. Because our consumer price sensitivity estimates appear to be based on more conventional definitions of large and small cars (see note 21), we believe these possibilities are likely.

[33] The total losses to U.S. producers and consumers would be smaller if GM and Ford could in the short-term expand small-car production by more than the assumed 30 percent increase over 1985 levels. For example, if we had assumed that the GM's and Ford's small-car output could rise by as much as 40 percent over 1985 levels, the total loss to U.S. producers and consumers in simulation (1) would have been $1.8 billion while the corresponding loss in simulation (2) would have been $2.3 billion. While lower than the losses in Table II, the CAFE-induced losses still remain substantial.

IV. Conclusion and Recommendations

The preceding analysis indicates that in the short-term, the costs borne by society if the 27.5 mpg standard is imposed would be substantial. The price of large cars may rise by as much as 22 percent as large-car production drops by 1.7 million units. While small-car production may rise by an amount between 350,000 and 670,000 units, total domestic car production nonetheless may fall by more than 900,000 units. The short-term employment effects are substantial: over 130,000 jobs in the domestic automobile industry will disappear. Overall, the sum of the deadweight loss to consumers and producers and the output losses caused by the temporary unemployment generated by the higher CAFE standard would range between a low of $3.0 billion and a high of $3.5 billion.[34] Because these losses appear substantial and because the benefits from a more stringent CAFE standard appear non-existent, the FTC staff urges the NHTSA to retain the current standard of 26 mpg.

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[34] In the longer term, GM and Ford may adapt to the more stringent standard by altering the construction of their large and small cars so as to attain the 27.5 mpg standard in a less costly fashion. Consequently, the price of large cars may fall somewhat and the price of small cars may increase somewhat from their projected levels in Table I. As a result, the costs to U.S. consumers and U.S producers of the CAFE standard in the longer term may abate but may not disappear. The mix and characteristics of both large and small cars that in the longer term would be induced by the 27.5 mpg standard may still differ from those which consumers would have selected absent the more stringent standard. If this were the case, the full loss to U.S. consumers and producers would be the short-term losses in Table II plus these continuing long-term losses. Alternatively, if the longer-term mix and characteristics of large and small cars are identical to those which consumers would have chosen absent the 27.5 mpg standard, then the short-term losses in Table II are the full losses from the higher CAFE mileage standard.

Appendix I

Estimating the Price and Output Effects of CAFE[1]

In this appendix, we describe the model used to determine the price and output effects of raising the actual CAFE standard to 27.5 mpg. We first describe the various supply and demand relationships assumed, and then describe the sources for the parameters used to make the necessary calculations.

A. The Derivation of the Model

As stated in the text of the comment, we begin with demand curves for the two types of cars (large and small). Consistent with recent research,[2] we assume a constant elasticity specification for each demand:

(A1) $Q_L = a_1 \; P_L^{\,f1} \; P_S^{\,b1}$

(A2) $Q_S = a_2 \; P_S^{\,f2} \; P_L^{\,b2}$

where Q_L = the total sales of large cars in the U. S.,

P_L = the average price of large cars in the U. S.,

Q_S = the total sales of small cars in the U. S.,

P_S = the average price of small cars in the U. S.,

f1 = the own price elasticity of demand for large cars, e_{LL},

b1 = the cross-elasticity of demand for large car quantity with respect to small car price e_{LS},

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1 The primary author of this and the following Appendix is Robert P. Rogers.

2 See J. Langenfeld, "Federal Automobile Regulation," Ph.D. dissertation (Washington University, St. Louis (May 1983)) and J. Langenfeld and M. Munger, "The Impact of Federal Automobile Regulations on Auto Demand" (Unpublished draft, Federal Trade Commission, (June 1985)).

f2 = the own price elasticity of demand for small cars, e_{SS},

b2 = the cross-elasticity of demand for small car quantity with respect to large car price e_{SL}.

Our calculations can be best handled by using the inverses of these functions:

(A3) $P_L = g0 \ Q_L^{g1} \ Q_S^{g2}$

(A4) $P_S = h0 \ Q_S^{h1} \ Q_L^{h2}$

where $g0 = a_1^{((-e_{SS}) / M)} \ a_2^{(e_{LS} / M)}$

$g1 = (e_{SS}) / M$

$g2 = (-e_{LS}) / M$

$h0 = a_2^{((-e_{LL}) / M)} \ a_1^{(e_{SL} / M)}$

$h1 = (e_{LL}) / M$

$h2 = (-e_{SL}) / M$

and $M = (e_{SS} * e_{LL} - e_{LS} * e_{SL})$.

The two largest American companies, GM and Ford, are assumed to maximize profits subject to the product mix determined by the CAFE regulation and to a long-run zero economic profit constraint imposed by the possibility of entry. We assume that in 1985 such a zero profit equilibrium was reached. Further, we assume GM and Ford are prevented from increasing small car output beyond a capacity limit which is 30 per cent greater than 1985 output. The position of these two firms, then, can be summarized by the following equation system:[3]

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[3] For analytical ease, we treat GM and Ford as if they were a single firm (GM-Ford).

$$(A5) \quad L(P_L - C_L) + S(P_S - C_S) = 0.$$

$$(A6) \quad L = R*S$$

$$(A7) \quad S \leq SC,$$

where L = the GM-Ford sales of large cars

S = the GM-Ford sales of small cars,

C_L = the GM-Ford average (and marginal) cost of producing large cars (assumed equal to the 1985 price of large cars),

C_S = the GM-Ford average (and marginal) cost of producing small cars (assumed equal to the 1985 price of small cars),

R = the CAFE determined large car-small car ratio, and

SC = the small car capacity limit (at 1.3 times 1985 sales).

Equation (A5) is the profit function; equation (A6) is the CAFE constraint; and inequality (A7) describes the capacity limit. The prices in equation (A5), P_L and P_S, are determined by the above-described inverse demand equations (A3) and (A4). The ratio, R, in equation (A6) is a function of the CAFE regulation and the mpg's of the cars in the GM-Ford fleet. The CAFE regulation requires that the composite mileage (K) of all the cars that a company sells be calculated in the following fashion:

$$K = (L + S)/((L / M_L) + (S / M_S)),$$

where M_L and M_S = the actual average miles per gallon respectively of large and small cars.

The right-hand side of this equation is the weighted harmonic mean of actual fleet mileage and must meet or exceed the 27.5 mpg standard. Following Kwoka,[4] this equation can be expressed in terms of the CAFE required ratio between small and large car sales represented by R in equation (A6) by letting K = 27.5.

(A6) $L = R*S$ where

(A6a) $R = ((M_S - K)*M_L)/((K - M_L)*M_S)$.

We also assume that the cost functions for GM-Ford are of the constant returns type. This means that regardless of output, unit costs remain at the same level, C_S and C_L. Therefore the firms can increase output without changing their average per unit cost.[5]

With respect to the remaining suppliers (the fringe), we represent their supply response functions for the outputs of large and small cars as follows:

(A8) FL = FL(.),

(A9) FS = FS(.),

where FL and FS = the fringe sales of large and small cars respectively.

The fringe consists of domestic car suppliers (Chrysler, AMC Volkswagen, Honda, and Nissan) and suppliers of imports to the United States. With the exception of Chrysler, these suppliers

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4 *See* J. Kwoka, "The Limits of Market-Oriented Regulatory Techniques: The Case of Automotive Fuel Economy," *Quarterly Journal of Economics*, (November 1983) at 695-704.

5 There is some empirical work that supports making this assumption. *See* A. Friedlaender, A. Winston, and K. Wang, "Costs, Technology, and Productivity in the U. S. Automobile Industry," *Bell Journal of Economics*, (Winter 1982) at 1-20 .

are predominantly small car suppliers.[6] While Chrysler does produce a greater proportion of large cars than the other fringe suppliers, Chrysler as noted in the text is now virtually in compliance with the 27.5 mpg standard. For purposes of this analysis, we assume that Chrysler maintains its output of both small and large cars at 1985 levels in order to continue complying with the CAFE standard. Thus, FL in equation (A8) is a constant ($= \overline{FL}$).

With respect to U.S. imports of Japanese small cars, we make two different assumptions, as described in the text. In simulation (1), we assume offshore Japanese small car suppliers maintain their U.S. exports at 1985 levels, while the remaining members of the non-Chrysler fringe respond to small car price changes with changes in small car production. In simulation (2), we allow offshore Japanese suppliers as well as all other non-Chrysler members of the small car fringe to alter output as the small car price changes.

The assumed specification of this supply response is of the constant-elasticity of supply variety:

(A9a) $FS = C_0 \, P_S^{\,C1}$,

where C_0 and C1 are parameters.

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6 AMC does produce one large car, the Eagle, but in 1985 only 12,000 of these were sold. Because AMC's Eagle production is so small, we assume for simplicity that AMC would simply maintain Eagle sales at 1985 levels. While imports do consist of large and small cars, 82 percent of all imports fall into the small-car class, as noted in the text. Again for simplicity, we assume that all imports are small cars.

Our simulations assume the elasticity of fringe supply with respect to price (C1) is 10.[7] We use the 1985 values of FS and P_S to solve for C_0.

With these fringe output response functions, the above-described inverse demand equations, and equation (A6), we can transform equation (A5) into the following:

$$\text{(A5a)} \quad R*S\ (\ g0\ (R*S + \overline{FL})^{g1}\ \ ((S + FS(.))^{g2} - C_L\ ) + S\ (\ h0\ (S + FS(.))^{h1})\ \ ((R*S + \overline{FL})^{h2} - C_S\ ) = 0$$

With equation (A5a) and constraints (A6) and (A7), we can solve for S under the new CAFE constraint that would be reflected in the value of R. With this apparatus, we can determine the changes in quantity and price that would result from increasing the effective CAFE standard to 27.5.[8]

To calculate the post-CAFE values of output for the domestic producers in the fringe, we assume that each member of the non-Chrysler fringe maintains the same share of the total variable output fringe production that they had in 1985.[9] With this assumption, we can estimate the effect of the CAFE change on domestic production for not only the total but also the small and large car sectors. With these figures, we can use labor-output

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7 _See_ D. Tarr and M. Morkre, "Aggregate Costs to the United States of Tariffs and Quotas on Imports" (Federal Trade Commission (December (1984)) at 63, n. 12.

8 Equation (A5a) cannot be directly solved for S; therefore, once the values of the parameters are determined, we use an iterative search procedure to find the S-value that solves the equation.

9 However, recall the different responses of the Japanese offshore small car suppliers in simulations (1) and (2).

ratios to estimate the effect of the CAFE changes on automobile industry employment.

A2. The Parameters Used in the Model.

The starting values for our model for the small and large car outputs of the GM-Ford sector and the combined domestic-foreign fringe sector were those for the calendar year 1985. For small and large car prices, we use the 1985 average price for the total industry for each type of car.[10] These initial quantity and price figures are as follows:[11]

L = 3,593,711 (1985 actual),

S = 3,073,819 (1985 actual),

Q_L = 3,965,256 (1985 actual),

Q_S = 7,067,082 (1985 actual),

FL = 371,545 (1985 actual),

FS = 3,993,263 (1985 actual),[12]

P_L = \$10991,

P_S = \$9041.

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10 There are considerable differences among the average prices of small and large cars sold by the various suppliers, differences that reflect different model mixes produced. Classifying cars by a larger number of categories than the two used here would have made it much more difficult if not impossible to estimate the social loss from the imposition of CAFE. Thus we follow recent practice by adopting the simplifying assumption of only two car types, large and small. *See* the sources in note 1 *supra*.

11 The source of these data is *Automotive News* (January 14, 1986) at 46. The 1985 prices are based on standard models without options.

12 As previously noted, all imports are treated as small cars. In 1985, imports totalled 2,838,116 units according to *Automotive News* (January 14, 1986) at 46.

Because we assume that in 1985 no supplier was earning excess profits, $P_S = C_S$ and $P_L = C_L$. In addition to initial quantities and prices, we require parameters for the demand models. The most important of those parameters are estimates of the price elasticities of demand. The study closest in methodology to the present work suggests that the own-price elasticity figures for large and small cars are as follows:[13]

$e_{LL} = -3$

$e_{SS} = -2.$

Unfortunately, there exist no comparable estimates for the demand cross elasticities. A large number of econometric studies have divided the automobile market into segments, some with divisions similar to our distinction between large and small cars, and none have found a statistically significant coefficient for parameters measuring the demand cross-elasticity between the two products.[14] Therefore we assume zero cross elasticities. From that assumption and the above-mentioned own price elasticity estimates, we arrive at the following inverse demand parameters:

$g0 = 17{,}396{,}646.3$,

$g1 = -0.333$,

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13 See J. Langenfeld, and M. Munger, "The Impact of Federal Automobile Regulations on Auto Demand," (Unpublished draft, Federal Trade Commission, (June 1985)).

14 For discussions of this issue, see J. Langenfeld, "Federal Automobile Regulation," Ph.D. dissertation, Washington University, St. Louis, May 1983 and J. Langenfeld and M. Munger, "The Impact of Federal Automobile Regulations on Auto Demand," (Unpublished draft, Federal Trade Commission, (June 1985)).

g2 = 0.0,

h0 = 24,034,579.9

h1 = -0.500,

h2 = 0.0.

Finally, to calculate R, we note that the average fleet mpg attained by GM-Ford in MY 1985 was 25.9, while the small car mpg (M_S) attained by GM-Ford in MY 1985 was 30.103.[15] Based on these two figures, the estimated 1985 large car mpg (M_L) for GM-Ford was 23.137. Using these figures for M_L and M_S, letting K = 27.5, and substituting into (A6a) provides an estimate of R = .4585.

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15 _See_ R. Heavenrich, T. Murrell, J. Chang and S. Loos, _Light Duty Automotive Fuel Economy Trends Thru 1985_, Environmental Protection Agency (1985).

Appendix II

Deadweight Loss Calculation

Here we detail a method of measuring the deadweight losses to the economy imposed by raising the CAFE standard. These deadweight losses result from devoting resources to other than their highest-valued use, and this kind of distortion can be induced by the imposition of a 27.5 mpg CAFE standard. The standard would induce an increase in the output of small cars and a decrease the output of large cars from what it would be in a free market equilibrium. The losses would consist of the changes in consumer and producer surplus that result from the adjustments to the higher standard.

The exact nature of the CAFE-induced changes in producer and consumer surpluses in the large car market differs from that in the small car sector. The CAFE situation in the large car market is depicted graphically in Figure A1. In this figure, price is measured on the vertical axis, and quantity is represented on the horizontal axis. D represents the demand curve for large cars, while S is a horizontal large-car supply curve with unit average and a marginal costs equal to C_L. The initial equilibrium position for the market is at point c with price equal to C_L and volume at Q_{L1}. As a result of raising the CAFE standard to 27.5 mpg, the output of large cars is reduced from Q_{L1} to Q_{L2}, and price is raised along the demand curve from C_L to P_L.

The deadweight loss is the difference between the gains to producers and losses by consumers. To compute this difference, we first examine what the producer lost or gained. With the given price increase, producers gain a profit equal to the difference between the new price and unit costs (P_L - C_L) times the new output, Q_{L2}. In figure A1, this would consist of area A. The change in consumer surplus consists of the additional expenditures incurred by the consumers of large cars who pay a higher price plus the loss in consumer surplus of those customers priced out of the market. The additional expenditure of consumers who continue to purchase large cars, also depicted by area A in figure A1, is the price difference (P_L - C_L) times Q_{L2}. The loss by consumers priced out of the market is depicted by the triangle B which shows the value these consumers would have received had the price remained at C_L. Total consumer loss then is the sum of areas A and B (A+B). The deadweight loss would be the difference between this sum and the producer gain, area A, which happens to be B. For our models with their non-linear demand curves, this figure can be found by integrating the demand curve with respect to price over the distance between the old price, C_L and the new price, P_L. That integration yields the loss in consumer surplus. After offsetting that loss with the increase in producer profits, the remaining loss is the deadweight loss.

The calculations of consumer and producer surplus changes for the small car market is somewhat more complicated because of certain characteristics of the supply side of the market. The situation is depicted in figure A2. The demand curve for small cars is D. On the supply side, there are essentially three sectors; the first consists of GM and Ford and the second is made up of the firms in the fringe that do not alter their output. The latter would be the offshore Japanese suppliers and Chrysler in simulation (1) and just Chrysler in simulation (2). The third sector includes all other suppliers. GM and Ford are assumed to face a flat cost curve with the average and marginal costs equaling C_S. The cost curves of the second sector are irrelevant to this analysis because the firms in this sector do not change their output in response to the CAFE adjustments. For the third sector, we assume the upward sloping supply curve depicted by F. At the original equilibrium position, the first sector and second sector firms produce output, S_1, and the third sector produces an output of FS_1 where its marginal cost equals price (C_S).

Raising the CAFE standard forces the first sector firms, GM and Ford, to increase small car sales up to the capacity constraint; as a result the total volume for the first and second sectors increases from S_1 to S_2.[1] This output increase forces price to fall along the demand curve (D), from C_S to P_S which leads to the firms in the third sector to decrease their output along fringe supply curve, F, from FS_1 to FS_2. The new market output is Q_2 (equal to S_2 plus FS_2).

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1 For expositional ease, the capacity constraint is not depicted in this diagram.

As a result of this adjustment, the producers in the first and second sectors lose an amount of money equaling the price difference (C_S - P_S) times the new output, S_2.[2] This would consist of the areas A+B in figure A2. The firms in the third sector contracting output along their supply curve would lose an amount of money equal to the area, B. If one moves area B to a position adjacent and just to the right of area A, we have a clear picture of the total producer loss; it is equal to the area, A+B+C+D+E, where C+D+E=B.

In contrast to producers, the consumers of small cars gain by the lower price. First the people who would have bought a car at the old price gain an amount equal to the difference in price times the old small car volume or (C_S - P_S) times Q_1; it is equal to area A+B+C. In addition, the lower price brings new consumers into the market, and they gain an amount of consumer surplus equal to area D. So the consumers gain an amount of money equal to areas, A+B+C+D.

When the producer loss is subtracted from this consumer gain, we arrive at the total deadweight loss which is depicted by area E in figure A2. For our calculation, however, we consider only the producer loss that born by American firms, and that

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2 Because GM and Ford were initially earning no profits on the sales of small cars, the lower small-car price resulting from the 27.5 mpg standard results in losses on GM-Ford's small car production. However, because the higher CAFE standard also raises the large-car price, GM-Ford earn profits on large-car sales. In order for GM-Ford to sell large cars, and comply with the 27.5 mpg standard, GM-Ford must also produce small cars. In effect, the profits from large-car sales of GM-Ford subsidize the losses from small-car sales.

would be only a portion of the total producer loss, A+B+C+D+E. For convenience, we will represent this portion by the term, M*(A+B+C+D+E) where M is the proportion of the total loss born by domestic firms. For the small car market, then, the deadweight loss of American consumers and producers would be as follows:

Deadweight loss for small cars = (A+B+C+D)- M*(A+B+C+D+E).

Using the estimates developed in Appendix I, we can calculate the above deadweight loss for each of our two simulations by combining the deadweight loss in the large car market with that in the small car market:

Total deadweight loss = Deadweight loss for small cars
+ Deadweight loss for large cars.

The components of these figures, consisting of (1) the producer surplus change in both the large and small car markets, and (2) the consumer surplus change in the two car markets are displayed in Table II in the text.

Figure A1. The Large Car Market

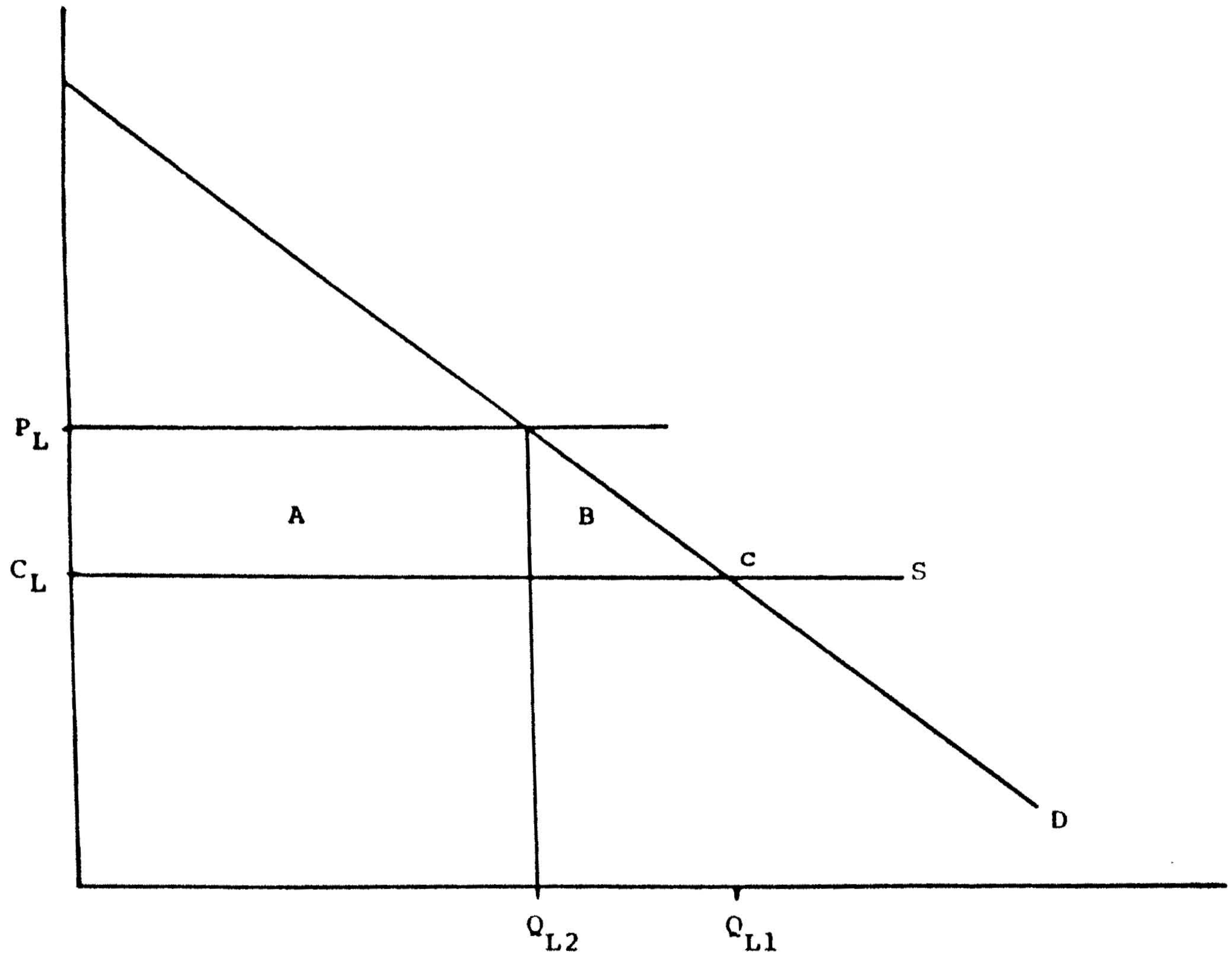

Figure A2. The Small Car Market