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Motor Vehicle MPG and Market Shares Report: First Six Months of Model Year 1984

Patricia S. Hu
David L. Greene
Lynn E. Till

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MOTOR VEHICLE MPG AND MARKET SHARES REPORT:

FIRST SIX MONTHS OF MODEL YEAR 1984

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Users of the Motor Vehicle MPG and Market Shares Report are encouraged to comment on errors, omissions, emphases, and organization of this report to one of the persons listed below.

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Foreword

This mid-year issue has several new features. First, the allocation of yearly MPG changes is now divided among eight actions rather than the four that have existed in the ORNL reports over the past few years. The allocation is done for autos for 1984 (Table 4), for 1983 (Table 5), and for each year from 1978 through 1984 (Table 6). The allocation is also done for trucks for 1984 (Table 26), for 1983 (Table 27), and for each year 1978 through 1984 (Table 28). To illustrate the greater detail this new allocation method provides, the allocation for the 1980 MPG change in cars and light trucks is shown below using the old and new method:

Allocation of MPG Changes Among Actions, 1980*

	Automobiles		Light trucks	
	Old method	New method	Old method	New method
Sales shift	(0.29)	(0.24)	(0.24)	(0.23)
Between classes	−0.07	−0.13	0.18	0.29
Within classes	0.36	0.37	0.06	−0.06
Nameplate introductions and discontinuations	0.55	(0.70)	−0.06	(0.05)
Introductions	NA	0.61	NA	0.05
Discontinuations	NA	0.09	NA	-
Model improvement (Configuration information)	1.26	(1.28)	1.71	(1.62)
Improvement	NA	1.04	NA	1.18
Sales shift	NA	0.05	NA	0.12
Introduction	NA	0.08	NA	0.31
Discontinuation	NA	0.01	NA	0.01
Total	2.09	2.12	1.89	1.89

*Numbers in parentheses are renumerations of other numbers.

Using light trucks as an example, note that what used to be called "model improvement" is now called "configuration information" and that configuration efficiency improvements are the most important item (1.18 out of 1.62 MPG change) while configuration introductions are the second most important item (0.31 out of 1.62). Thus, dividing the model improvement action into four components allows a better understanding of what actions lead to the MPG change.

As can be seen in Table 6, there was only a 0.21 MPG gain for new autos in 1984 and four of the eight actions worked against this small positive improvement. These were between Class Shifts (−0.10), Configuration Efficiency Improvement (−0.13), Configuration Introduction (−0.02), and Model Introduction (−0.03).

Second, the use of engine-transmission detail in estimating MPG has been added to the light truck MPG estimates for 1983 and 1984 model years. This engine-transmission detail was added for autos for the first time in the February 1983 report. The differences that resulted for light trucks are as follows:

Model year	Light truck MPG		
	Old estimating method	New estimating method	NHTSA estimate
1983	21.4	20.61	20.8
1984	NA	19.69	20.5

It can be seen that the new method pulled the ORNL estimate closer to the NHTSA estimate for model year 1983. In 1984, ORNL shows a large decline in light truck MPG of 0.9, whereas the NHTSA estimated decline

is only 0.3. Until the final sales figures for the year are available, it will be difficult to determine which estimate is most accurate. As can be seen in Table 28, the action contributing most to the light truck MPG decline in 1984 is the 0.91 MPG contribution by efficiency improvements. This is due to the fact that many configurations lost MPG in 1984. For example, the four-speed manual six cylinder GMC S-15 small pickup dropped 4 MPG between 1983 and 1984 on the combined EPA cycle.

It is interesting to note in Table 28 that the 0.43 MPG lost by consumers shifting to larger trucks was exactly off-set by these consumers gaining 0.43 MPG by shifting to more efficient models within a size class. Therefore, the net consumer shift impact for between and within classes was zero.

Third, it is becoming clear that auto and light truck fuel economy improvements have stalled over the last two years. The ORNL estimates show that new auto MPG has not reached the 1982 level in the two subsequent years. But the difference in MPG between 1982 and 1984 is only 0.02. In the case of light trucks, the 1984 ORNL estimated MPG is 0.76 lower than that in 1982.

I hope you find other bits of information in this report that will prove useful to you.

Phil Patterson

Philip D. Patterson

Acknowledgements

The authors thank Dr. Philip D. Patterson and other staff of the Office of Vehicle and Engine Research and Development, U.S. Department of Energy for their many contributions and support; Dr. Russell Lee of Oak Ridge National Laboratory for his critical comments and suggestions; and Mr. Fred Westbrook of Camden Corporation for his careful review and criticism. Finally, special thanks goes to Ms. Stephanie Floyd for her skill in typing this report.

Abstract

This issue of the publication reports the sales, market shares, estimated sales-weighted fuel economies, and other estimated sales-weighted vehicle characteristics of automobiles and light trucks for the first six months of model year 1984 and for the previous five model years. Comparisons and observations are made on the trends in these vehicles from one model year to the next. An improved methodology is used to allocate the yearly MPG changes among eight components, rather than the four reported in the previous reports. Sales of automobiles showed an increase of 21.8% from the first half of model year 1983. An even more striking increase was observed in the sales of light trucks: 42.2% from the first half of model year 1983. The first six months of model year 1984 experienced a gain of 0.21 mpg in sales-weighted automobile fuel economy. In contrast, light trucks experienced a loss of 0.83 mpg in fuel economy, from 20.52 mpg in model year 1983 to 19.69 mpg in the first half of model year 1984.

Executive Summary

Sales of automobiles jumped from 4,033,520 units in the first six months of model year 1983 to 4,912,238 units in the same period of model year 1984, an increase of 21.8%. Domestic car sales increased by 29.0% from 2,974,281 units in the first half of model year 1983 to 3,835,694 units in the same period of model year 1984 while the sales of imports only increased by 1.6%. Although import sales increased, their market share dropped from 26.3% to 21.9%. Due to the up-sizing of both Honda's Civic and Prelude from minicompact to subcompact, the market share of minicompacts dropped from 2.7% in the first six months of model year 1983 to 0.4% in the first half of model year 1984.

Sales of light trucks showed a striking increase of 42.2%, from 1,175,443 in the first six months of model year 1983 to 1,671,643 in the same period of model year 1984. Domestic light trucks experienced an increase of 44.2% while imports showed a jump of 32.3%. Small pickup trucks and standard vans lost their shares to mini vans, special purpose vehicles and standard pickup trucks. The first six months of model year 1984 experienced an increase of more than 1.6% in light truck market share from the previous model year. Since model year 1981, it has become a continuing trend for the light trucks to capture a slightly larger part of the market than in the previous model year.

The first six months of model year 1984 experienced a gain of 0.21 mpg in sales-weighted automobile fuel economy, from 26.13 mpg in model year 1983 to 26.34 mpg in the current reporting period. The main reasons for this gain were the discontinuation of less fuel efficient nameplates and a sales shift to more efficient engine and transmission

mixes. In contrast, light trucks experienced a loss of 0.83 mpg in fuel economy, from 20.52 mpg in model year 1983 to 19.69 mpg in this reporting period. This was largely due to the decreased fuel economies in continued engine and transmission configurations.

Introduction

This publication reports the sales, market shares, estimated sales-weighted fuel economies and other estimated sales-weighted vehicle characteristics of automobiles and light trucks for each model year. Comparisons and observations are made on the trends in these variables from one model year to the next.

The definition of model year adopted in this report is different from the model year designated by the manufacturers. The "model year" of a vehicle is determined by the date when its sales occurred. For example, if a new vehicle sold in March 1983, it is considered a 1983 model. However, if the sales occurred in October 1983, it is a 1984 model. Therefore, model year is defined as the period from October to the next September. For most models the manufacturer's model year corresponds to this "calendar" model year. However, a complicating factor is that more and more of the introductions enter the market early, such as two of the manufacturers' 1984 models, Ford's Tempo and Mercury's Topaz, both making their debut in May 1983. However, since the primary intention of this publication is to report and analyze the trends in vehicle sales, market shares, fuel economies and other vehicle attributes, it is appropriate to compare the trends observed in equivalent time frames. Because previous issues of this report is based on the manufacturers' model year, the figures reported in this issue are slightly different from the ones reported earlier.

While there are other sources of new car fuel economy estimates, a unique feature of this report is that it provides monthly estimated fuel economies and other vehicle attributes, such as curb weight, engine

displacement and interior space, all weighted by the monthly vehicle sales (refer to Appendix D for a description of the sales-weighted methodology). These data are thus useful in describing and analyzing trends in the new vehicle fleet.

The reporting period for this issue of the report is the first six months of the model year 1984, from October 1983 to March 1984. Comparisons made on the absolute sales volume and market shares are based on the equivalent time frame, the first six months of model years 1983 and 1984. However, in order to observe the fuel economy changes, figures in the first half of model year 1984 are compared to the ones in the previous full model year. Both sets of statistics, for the first six months of model year 1983 and for the entire model year 1983, are presented.

In the following section, the sales, market shares and sales-weighted fuel economies of automobiles are discussed and analyzed. Section II presents light-duty vehicle (automobiles and light trucks) sales and sales-weighted fuel economies by make and model during this reporting period. Section III discusses the sales, market shares and sales-weighted fuel economies for light trucks. The annual trends in vehicle characteristics and the changes in retail diesel car sales are included in Section IV.

Included in the appendices are the glossary, the data sources of the ORNL MPG and Market Share Data Systems, nameplates by EPA size classes, methodology for sales-weighted estimates, and methodology for analyzing the fuel economy changes.

AUTOMOBILE SALES AND FUEL ECONOMY

A total of 4,912,238 automobiles (Table 1) were sold during the first six months of the 1984 model year. This was a 21.8% jump in automobile sales compared to the first six months of the previous model year. Of the six EPA automobile size categories (minicompact, subcompact, compact, midsize, large and two-seaters), the two largest market shares for the first six months of the 1984 model year belonged to midsize and compact automobiles; they accounted for 30.8% and 26.4% of all sales, respectively (Table 1). This compares with 33.3% and 18.6%, respectively, for the same period in the 1983 model year (Table 3). Although the market share of midsize automobiles remained fairly stable, a sales shift occurred among minicompact, subcompact and compact automobiles. Compact cars claimed 26.4% of the market which was an increase of 7.8% from the previous model year's figure of 18.6%. In contrast, subcompact cars showed a 3.5% decrease in the market share (from 28.4% to 24.9%) and minicompact cars an 2.3% decrease (from 2.7% to 0.4%). This suggested that with economic recovery, higher disposable incomes, more stable interest rates, and the stabilizing of fuel price increases, consumers had a stronger tendency to purchase larger cars.

Of the total sales, 78.1% were domestic or domestic-sponsored automobiles, which was a jump of 4.4% (from 73.7%) from the same period in the 1983 model year (Table 3). This was the largest market share for domestic cars since model year 1980. The market share of the domestic compact cars jumped from 19.5% for the first six months in previous model year to 26.6% for the same period this model year, while midsize

cars dropped 6.2% from 45.0% to 38.8% of the market. These trends seem to reflect the combined effects of the recovery of domestic manufacturers and voluntary import restraints by Japanese manufacturers.

Somewhat different trends were observed in import car sales. Although the largest percentage of the import cars sold was still subcompact cars, it dropped from 67.4% to 62.6% for the first six months of model years 1983 and 1984, respectively (Table 3). The market share for minicompact imports dropped from 10.1% for the first six months of model year 1983 to 1.6% for the same period in 1984 model year, a decrease of 8.5%. However, this was largely due to reclassification of automobiles. The scaling up of both Honda's Civic and Prelude from minicompact to subcompact was considered to be one of the major reasons. The most striking change in market share was observed in midsize import cars, with an increase of 2.2% from 0.3% for the previous model year period to 2.5% for this reporting period. This change was mainly due to the introduction of the Audi 5000S to the midsize car category, and the tripling of sales of the Volvo 760 GLE. Mirroring the trends of the domestics, compact import cars showed a 9.3% increase in market share from the same period of the previous model year, from 16.1% to 25.4%.

Automobile fuel economy (refer to Appendix D for a description of the sales-weighted methodology) increased slightly (0.2 mpg) from model year 1983 to the first six months of model year 1984 (Table 1 and Figure 4). The greatest changes in fuel economy since the previous model year were observed in minicompacts and two-seaters. Minicompact cars had a drop of 9.7 mpg, from 36.5 mpg for the previous full model year to 26.8 mpg for this reporting period. This drop in fuel economy can be attributed to the reclassification of both Honda's Civic and Prelude, which

had 38.5 mpg and 31.2 mpg, respectively, and which accounted for a large proportion of minicompact sales in the past. The introduction of more fuel-efficient models, such as the Honda Civic Coupe (43.0 mpg) and Pontiac Fiero (31.5 mpg), contributed to the 2.7 mpg increase in two-seaters.

Domestic cars showed improvement in fuel economy across all of the EPA size classifications, except for midsize domestics which had a decrease of 0.1 mpg (Table 2 and Figure 5). The introduction of more fuel-efficient two-seaters resulted in the increases of 2.6 mpg and 2.1 mpg for domestics and imports, respectively. Except for compacts and two-seaters, import cars experienced drops in sales-weighted fuel economy across the EPA size classification, which resulted in a decrease of 0.7 mpg for the entire import fleet since previous model year (Table 2 and Figure 6).

The changes in fuel economy between two model years can be analyzed based on the methodology described in Appendix E. Tables 4 and 5 present the results of this analysis for model years 1983 and 1984, and 1982 and 1983, respectively. The 0.21 mpg increase from model year 1983 to the first six months of model year 1984 was mainly due to the discontinuation of nameplates, sales shifts toward more fuel-efficient configurations (engine and transmission combinations for a given nameplate), and discontinuation of some less fuel-efficient configurations. The effects of these three factors on fuel economy changes from model year 1983 to this reporting period were 0.15 mpg, 0.12 mpg and 0.11 mpg, respectively. However, these increases in fuel economy were offset by an increased number of larger car purchases (especially a shift from

mini- and subcompacts to compacts), and decreased fuel economy among some continuing configurations. These two factors resulted in a combined drop of 0.23 mpg [(—0.10 mpg) + (—0.13 mpg)]. Consequently, the net effect in the fleet fuel economy was an improvement of 0.21 mpg from the previous model year (Table 4).

The sales-weighted fuel economy of cars sold by Chrysler showed a loss of 0.29 mpg. Based on the analysis, the two major reasons for this loss were: (1) decreased fuel economy of continuing configurations (engine and transmission combinations) and (2) sales shifts away from more efficient configurations. Their effects on the Chrysler fleet's fuel economy were —0.79 mpg and —0.23 mpg, respectively. Although the sales shifts toward more efficient size classes resulted in an improvement of 0.74 mpg, it was not great enough to compensate for the losses associated with the other two factors. As a result, the net change in sales-weighted fuel economy for Chrysler during the first six months of model year 1984 was a 0.29 mpg loss compared to model year 1983.

AMC, Ford and GMC all showed marked improvement in sales-weighted fuel economy from the previous model year to the first six months of this model year, with 1.67 mpg, 0.80 mpg and 0.64 mpg increases, respectively. For AMC, sales shifts, both between and within automobile classes, increased the sales-weighted fuel economy by 0.56 mpg and 1.71 mpg, respectively. This offset the decline in sales-weighted fuel economy due to shifts to less fuel efficient configurations within nameplates, and to decreases in fuel efficiency within configurations.

For Ford, contributing to the net increase in sales-weighted fuel economy were sales shifts to more efficient classes, improvements within

configurations, and discontinuation of less efficient configurations and nameplates, such as Granada and Fairmont. These factors offset the effects of sales shifts to less efficient models within size classes and to less efficient configurations within given nameplates, as well as introduction of nameplates with fuel efficiencies lower than the previous model year's sales-weighted average.

For GMC, contributing to the net increase in sales-weighted fuel economy were sales shifts to more efficient nameplates within size classes, to more efficient configurations within nameplates, and the discontinuation of less efficient configurations. These factors offset the effects of a small shift in sales to less efficient classes, the introduction of slightly less efficient configurations, and a net decrease in the fuel economy of continuing configurations.

Imports experienced a drop in their sales-weighted fuel economy, from 31.78 mpg in model year 1983 to 31.12 mpg in the first six months of model year 1984. The main reason for this drop was due to the sales shift away from the more fuel-efficient size classes and to the introduction of nameplates with fuel economies lower than the previous year's sales-weighted average. Other factors were a decline in fuel economy within configurations, sales shifts to less efficient configurations, and new configurations that were less efficient. The effect of these factors offset the shifts to more efficient nameplates within size classes, and the discontinuation of less efficient configurations and nameplates.

Table 5 presents the analysis of fuel economy changes from model year 1982 to model year 1983. Some interesting comparisons can be drawn

between 1983–1984 when the overall sales-weighted fuel economy increased, and 1982–1983 when it decreased. In both periods, sales shifted to less efficient classes and the efficiency of configurations declined, but less efficient configurations were discontinued. For the other factors, there were differences between the two periods, and these accounted for the increase in overall fuel economy in 1983–1984. These differences were 1983–1984 sales shifts to more efficient configurations and nameplates within size classes, and the discontinuation of less efficient nameplates. Whereas for 1982–1983, these factors had the opposite effect.

Table 6 presents the trend in fleet fuel economy changes since model year 1978. Model year 1983 experienced the only loss in fleet fuel economy from the previous model year since the earliest data available in the MPG Data Base System (model year 1978). During the period 1979–1982, the increases in sales-weighted fuel economies were a result of positive trends in almost all of the components, with improvements in fuel economy within configurations the most important. Whereas both configuration fuel economy improvements and sales shifts accounted for the 1979–1982 trends, fuel economy changes within configurations appeared to reach a plateau in terms of fuel economy for the period 1982–1984; and changes in the overall fuel economy reflected sales shifts between configurations, nameplates, and discontinued and new nameplates.

Table 1
Model Year Sales, Market Shares, and Sales-Weighted Fuel Efficiencies of All Automobiles, Model Years 1979–84[a]

	Domestic and import					
	1979[b]	1980[b]	1981	1982	1983	1984[c]
MINICOMPACT						
Total sales, units	593,639	458,204	296,702	221,699	230,547	17,497
Market share, %	5.5	4.7	3.4	2.9	2.6	0.4
Fuel economy, mpg	27.5	29.4	33.5	36.5	36.5	26.8
SUBCOMPACT						
Total sales, units	3,297,650	3,668,867	2,927,574	2,404,489	2,353,847	1,222,640
Market share, %	30.4	37.2	33.1	31.6	26.9	24.9
Fuel economy, mpg	25.2	27.1	29.1	30.2	30.7	30.6
COMPACT						
Total sales, units	952,095	649,741	1,148,290	1,263,219	1,895,856	1,294,380
Market share, %	8.8	6.6	13.0	16.6	21.7	26.4
Fuel economy, mpg	19.8	22.2	28.2	30.4	30.3	30.6
MIDSIZE						
Total sales, units	3,658,413	3,369,213	3,113,806	2,533,121	2,779,178	1,515,297
Market share, %	33.7	34.2	35.2	33.2	31.8	30.8
Fuel economy, mpg	19.1	21.2	22.8	24.0	24.3	24.1
LARGE						
Total sales, units	2,116,298	1,472,517	1,107,627	995,561	1,275,939	704,719
Market share, %	19.5	14.9	12.5	13.1	14.6	14.3
Fuel economy, mpg	17.1	19.3	20.6	20.6	19.5	20.2
TWO SEATER						
Total sales, units	228,226	234,942	242,934	202,929	203,442	157,705
Market share, %	2.1	2.4	2.7	2.7	2.3	3.2
Fuel economy, mpg	19.3	21.0	24.1	25.1	23.7	26.4
FLEET						
Total sales, units	10,846,321	9,853,484	8,836,933	7,621,018	8,738,809	4,912,238
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0
Fuel economy, mpg	20.5	23.1	25.2	26.4	26.1	26.3

[a]These figures represent only those sales that could be matched to corresponding EPA fuel economy values.

[b]Model year 1979 starts from September 1978 to August 1979, and model year 1980 consists of 13 months, September 1979 through September 1980.

[c]Represents sales for the first 6 months of the model year (October through March).

Table 2
Model Year Sales, Market Shares, and Sales-Weighted Fuel Efficiencies of Domestic and Import Automobiles, Model Years 1979–84[a]

	Domestic and domestic-sponsored						Import					
	1979	1980[b]	1981	1982	1983	1984[c]	1979	1980[b]	1981	1982	1983	1984[c]
MINICOMPACT												
Total sales, units	257,670	226,674	34,764				335,969	231,530	261,938	221,699	230,547	17,497
Market share, %	2.9	3.0	0.6				17.6	10.1	12.3	11.1	10.5	1.6
Fuel economy, mpg	24.4	27.1	27.0				30.5	32.1	34.6	36.5	36.5	26.8
SUBCOMPACT												
Total sales, units	2,087,141	1,988,545	1,353,619	999,993	929,861	548,436	1,210,509	1,680,322	1,573,955	1,404,496	1,423,986	674,204
Market share, %	23.4	25.3	20.2	17.8	14.2	14.3	63.3	73.5	73.6	70.1	64.7	62.6
Fuel economy, mpg	24.1	25.6	27.5	28.3	27.3	28.2	27.4	29.2	30.7	31.7	33.5	32.9
COMPACT												
Total sales, units	790,446	484,891	1,000,084	1,010,467	1,496,707	1,020,771	161,649	164,850	148,206	252,752	398,149	273,609
Market share, %	8.8	6.4	14.9	18.0	22.9	26.6	8.5	7.2	6.9	12.6	18.1	25.4
Fuel economy, mpg	19.5	22.1	29.0	31.2	30.5	30.6	21.6	22.5	23.9	27.5	28.6	30.9
MIDSIZE												
Total sales, units	3,643,453	3,362,548	3,113,806	2,530,583	2,772,300	1,488,797	14,960	16,565		2,538	6,878	26,500
Market share, %	40.8	44.3	46.5	45.1	42.4	38.8	0.8	0.7		0.1	0.3	2.5
Fuel economy, mpg	19.1	21.2	22.8	24.0	24.3	24.2	17.9	21.1		19.0	23.0	22.2
LARGE												
Total sales, units	2,116,298	1,472,517	1,107,627	995,561	1,275,939	704,719						
Market share, %	23.7	19.5	16.5	17.7	19.5	18.4						
Fuel economy, mpg	17.1	19.3	20.6	20.6	19.5	20.2						
TWO SEATER												
Total sales, units	39,655	40,708	88,969	79,724	51,309	72,971	188,571	194,234	153,965	123,205	142,133	84,734
Market share, %	0.4	0.5	1.3	1.4	0.9	1.9	9.9	8.5	7.2	6.1	6.5	7.9
Fuel economy, mpg	15.1	16.9	24.4	27.4	25.6	28.2	20.5	22.2	23.9	23.8	22.9	25.0
FLEET												
Total sales, units	8,934,663	7,565,983	6,698,869	5,616,328	6,537,116	3,835,694	1,911,658	2,287,501	2,138,064	2,004,690	2,201,693	1,076,544
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Fuel economy, mpg	19.6	21.9	24.0	25.1	24.7	25.2	26.3	28.0	29.9	30.9	31.8	31.1

[a]These figures represent only those sales that could be matched to corresponding EPA fuel economy values.

[b]Model year 1980 consists of 13 months, September 1979 through September 1980.

[c]Represents sales for the first 6 months of the model year (October through March).

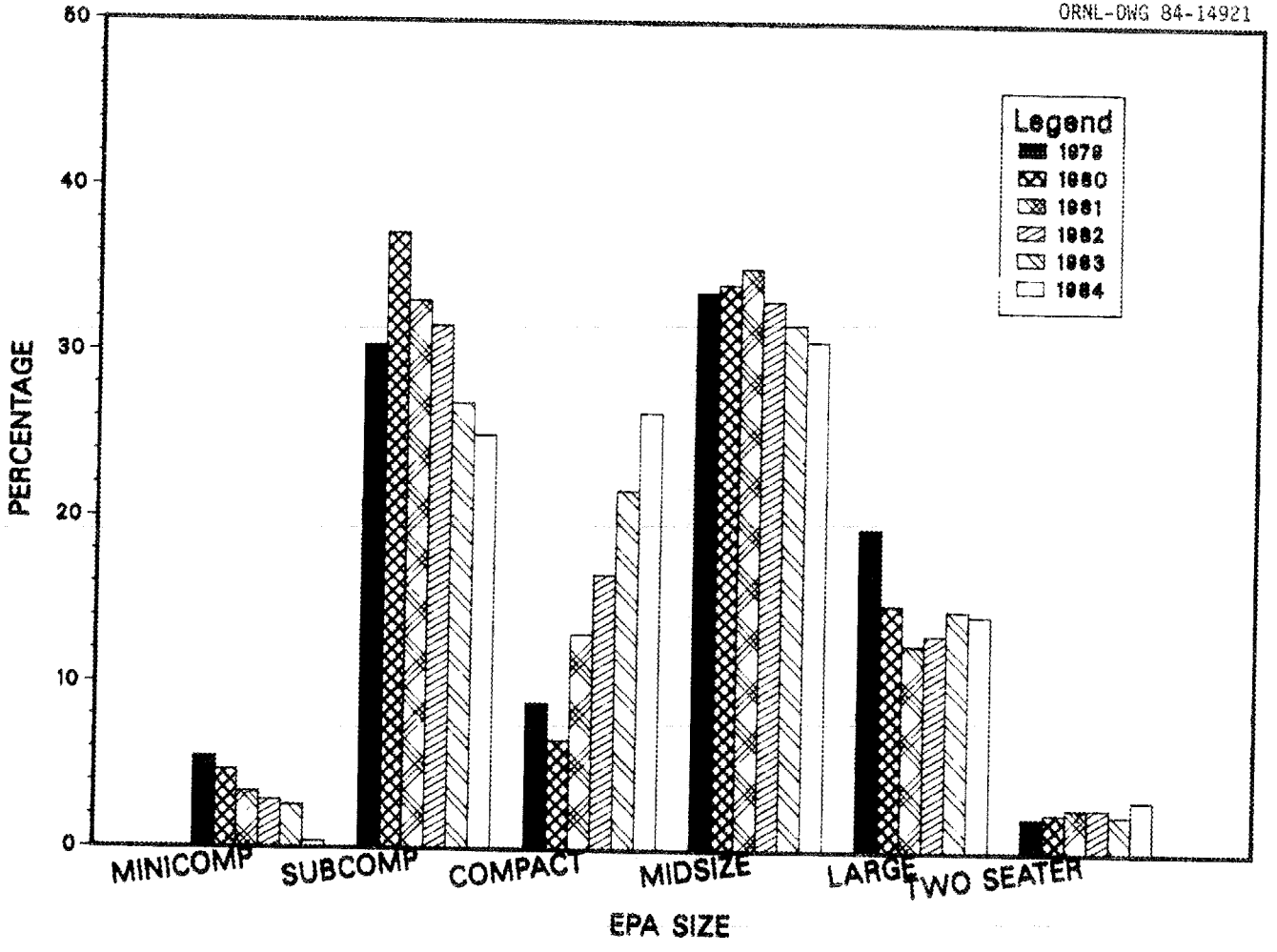

Fig. 1. Market Shares of Domestic and Import Automobiles by EPA Size Classification 1979–1984.

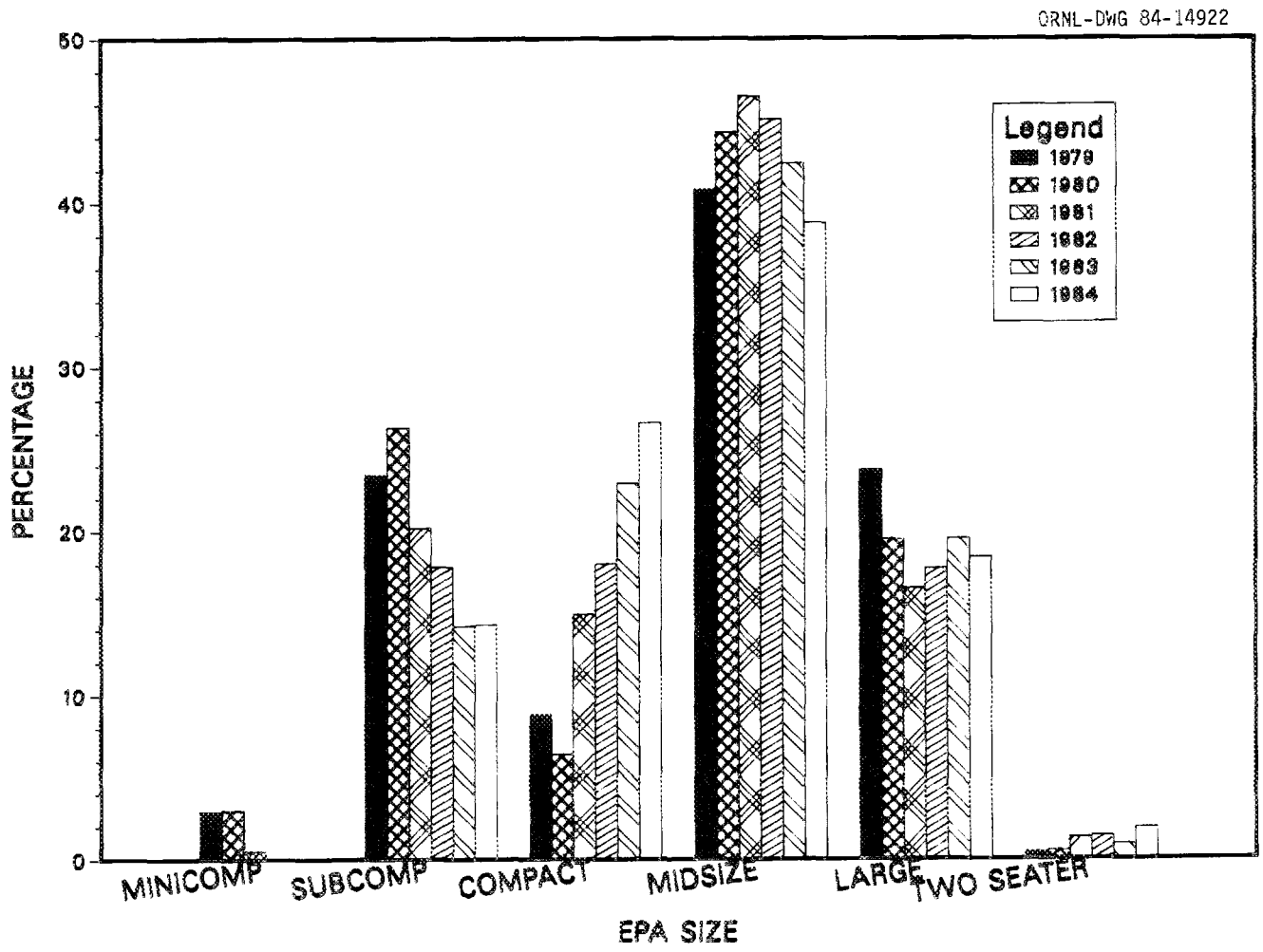

Fig. 2. Market Shares of Domestic Automobiles by EPA Size Classification 1979–1984.

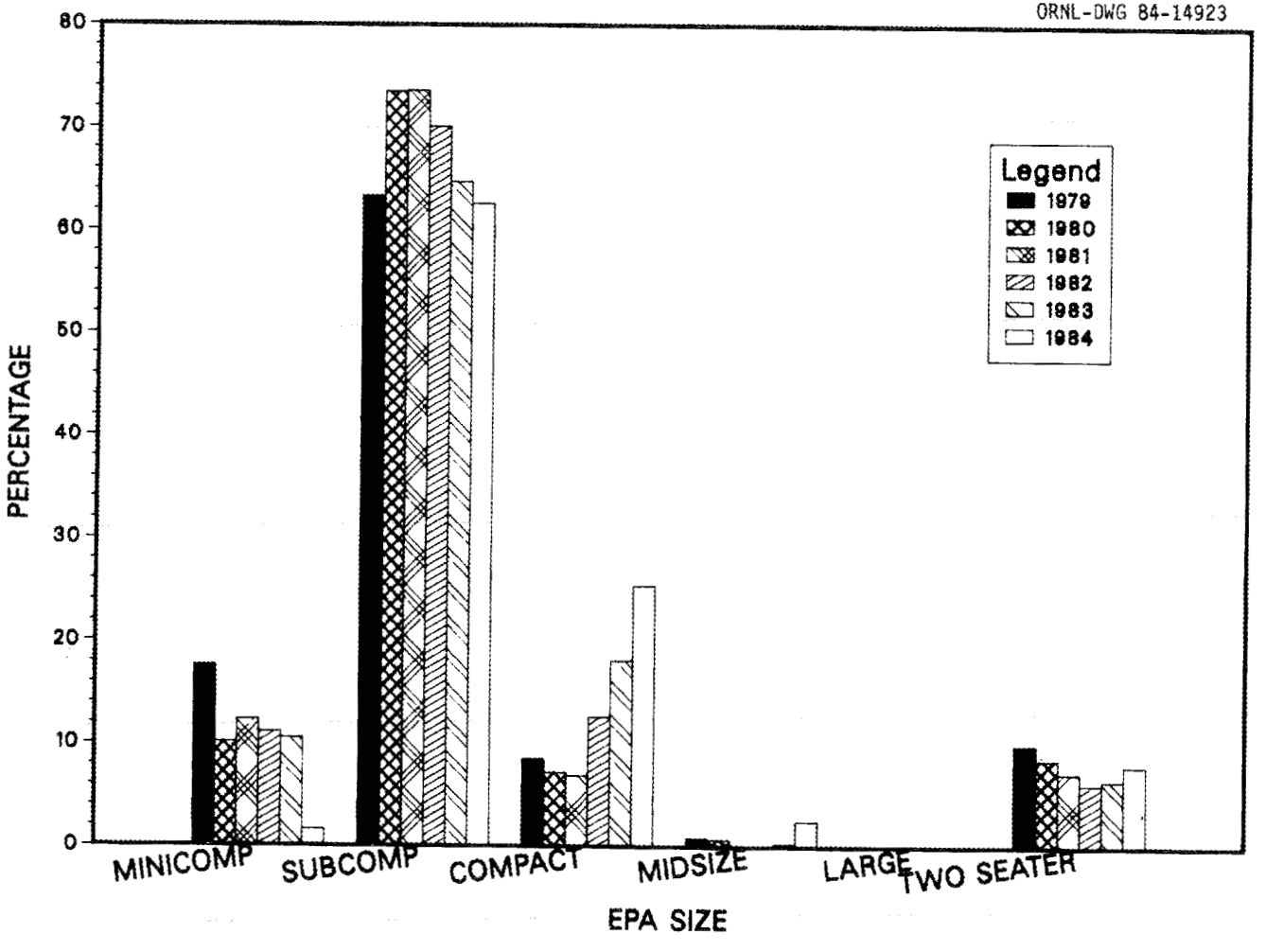

Fig. 3. Market Shares of Import Automobiles by EPA Size Classification 1979–1984.

Table 3
Sales, Market Shares, and Sales-Weighted Fuel Economies of All Automobiles First Six Months of Model Years 1983–1984

	Domestic and import		Domestic		Import	
	1983	1984	1983	1984	1983	1984
MINICOMPACT						
Total sales, units	107,127	17,497			107,127	17,497
Market share, %	2.7	0.4			10.1	1.6
Fuel economy, mpg	37.4	26.8			37.4	26.8
SUBCOMPACT						
Total sales, units	1,144,225	1,222,640	430,065	548,436	714,160	674,204
Market share, %	28.4	24.9	14.5	14.3	67.4	62.6
Fuel economy, mpg	30.8	30.6	26.9	28.2	33.6	32.9
COMPACT						
Total sales, units	750,222	1,294,380	580,511	1,020,771	169,711	273,609
Market share, %	18.6	26.4	19.5	26.6	16.1	25.4
Fuel economy, mpg	30.4	30.6	31.0	30.6	28.5	30.9
MIDSIZE						
Total sales, units	1,343,068	1,515,297	1,339,784	1,488,797	3,284	26,500
Market share, %	33.3	30.8	45.0	38.8	0.3	2.5
Fuel economy, mpg	24.2	24.1	24.2	24.2	22.7	22.2
LARGE						
Total sales, units	597,498	704,719	597,498	704,719		
Market share, %	14.8	14.3	20.1	18.4		
Fuel economy, mpg	19.4	20.2	19.4	20.2		
TWO SEATER						
Total sales, units	91,380	157,705	26,423	72,971	64,957	84,734
Market share, %	2.3	3.2	0.9	1.9	6.1	7.9
Fuel economy, mpg	24.0	26.4	27.0	28.2	22.9	25.0
FLEET						
Total sales, units	4,033,520	4,912,238	2,974,281	3,835,694	1,059,239	1,076,544
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0
Fuel economy, mpg	26.0	26.3	24.2	25.2	32.0	31.1

Table 4
Allocation of Automobile MPG Differences Between Model Years 1983 and 1984

	1983 MPG	Difference in MPG due to:								Total change in MPG	1984[a] MPG
		Sales shift		Configuration information				Model introduction	Model discontinuation		
		Between classes	Within classes	Improvement	Sales shift	Introduction	Discontinuation				
AMC[b]	33.97	0.66	1.71	−0.38	−0.22					1.67	35.64
Chrysler	27.74	0.74	0.07	−0.79	−0.23	−0.07		−0.01		−.29	27.45
Ford	24.64	0.47	−0.24	0.28	−0.12		0.05	−0.12	0.47	.80	25.44
GMC	23.57	−0.05	0.33	−0.12	0.31	−0.02	0.18			.64	24.21
Other Domestic	35.53		−0.03	0.18	−0.45					−.29	35.24
Import	31.78	−0.62	0.28	−0.31	−0.01	−0.01	0.03	−0.55	0.53	−.65	31.12
Fleet	26.13	−0.10	0.10	−0.13	0.12	−0.02	0.11	−0.03	0.15	.21	26.34

[a]Represent fuel economy for the first 6 months of model year 1984 (October through March).

[b]Since AMC Renault Encore begins its sales in September 1983, it is considered a 1983 model.

Table 5
Allocation of Automobile MPG Differences Between Model Years 1982 and 1983

	1982 MPG	Difference in MPG due to:								Total change in MPG	1983 MPG
		Sales shift		Configuration information				Model introduction	Model discontinuation		
		Between classes	Within classes	Improvement	Sales shift	Introduction	Discontinuation				
AMC	24.17	−0.02		0.09	−0.03		−0.05	9.81		9.80	33.97
Chrysler	27.64	−0.18	−0.12	0.46	−0.14	0.21	−0.01	−0.12		.10	27.74
Ford	25.00	1.18	−1.16	−0.28	−0.04	0.06	0.04	−0.16		−.36	24.64
GMC	24.31	−0.08	−0.04	−0.43	−0.23	−0.06	0.10			−.74	23.57
Other Domestic	37.27			−2.00	−0.09			−0.78	1.14	−1.74	35.53
Import	30.89	−0.35	0.10	0.94	0.11	0.06	0.12	0.05	−0.14	.89	31.78
Fleet	26.36	−0.06	−0.12	−0.09	−0.12	0.01	0.08	0.12	−0.05	−.24	26.13

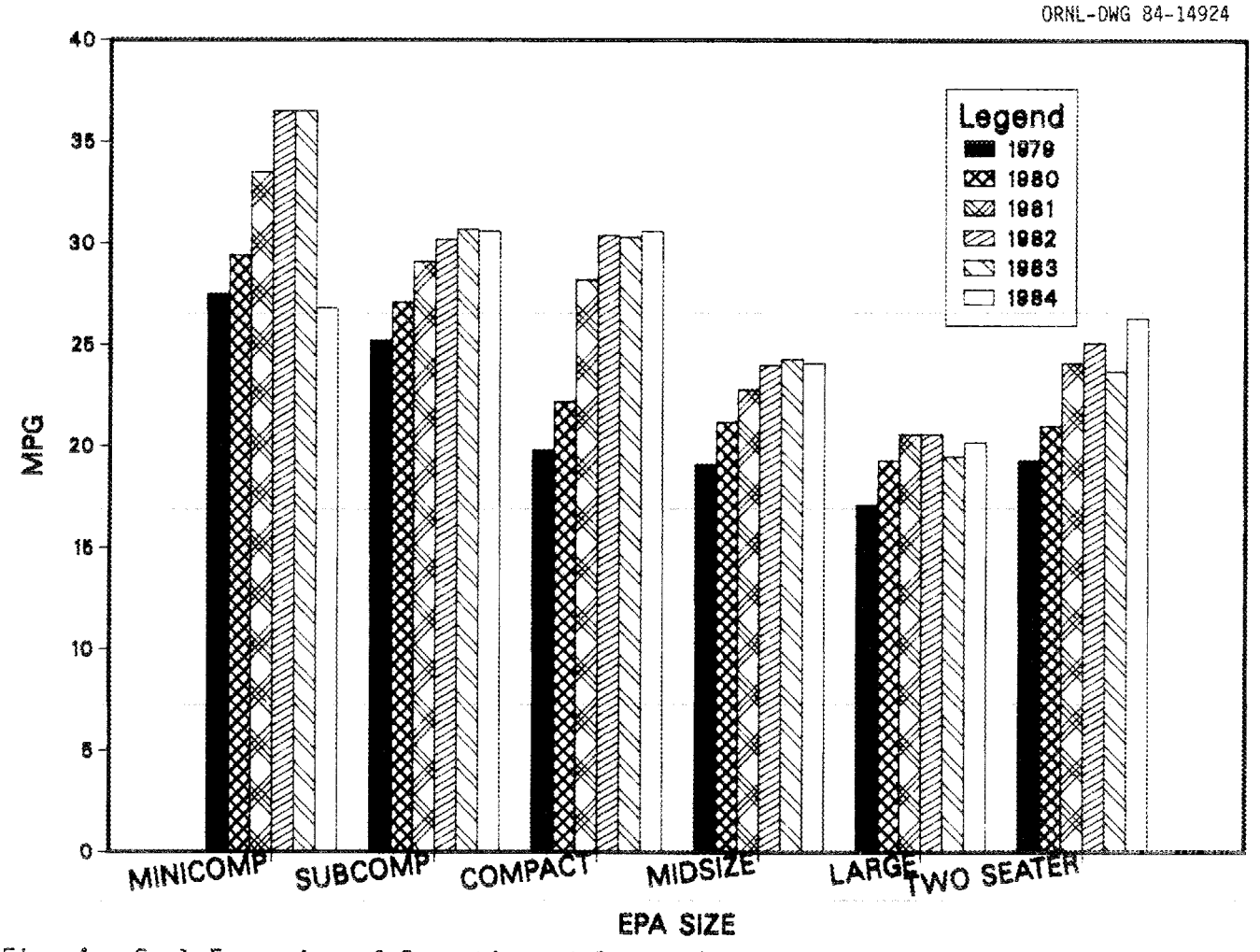

Fig. 4. Fuel Economies of Domestic and Import Automobiles by EPA Size Classification 1979–1984.

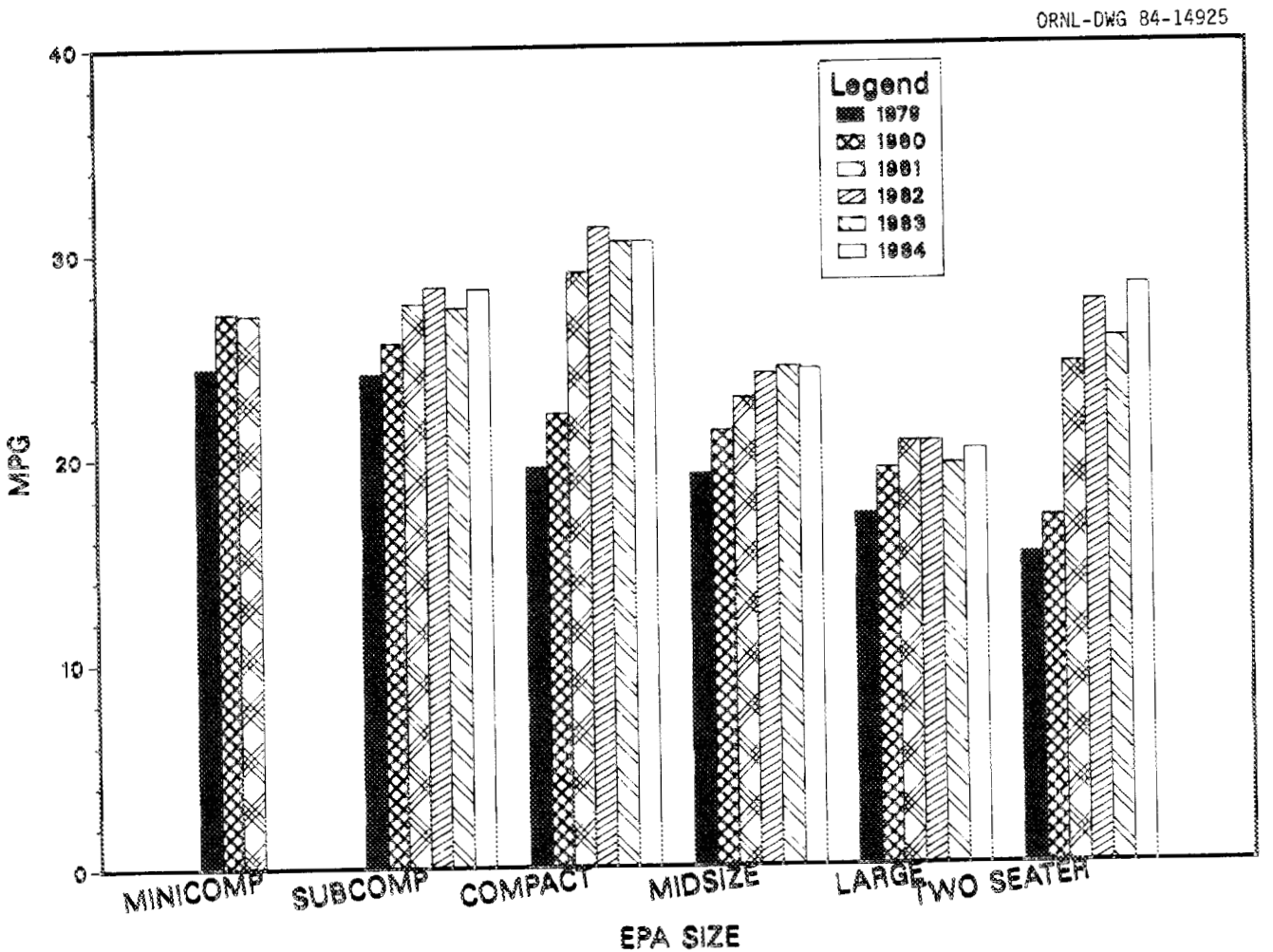

Fig. 5. Fuel Economies of Domestic Automobiles by EPA Size Classification 1979–1984.

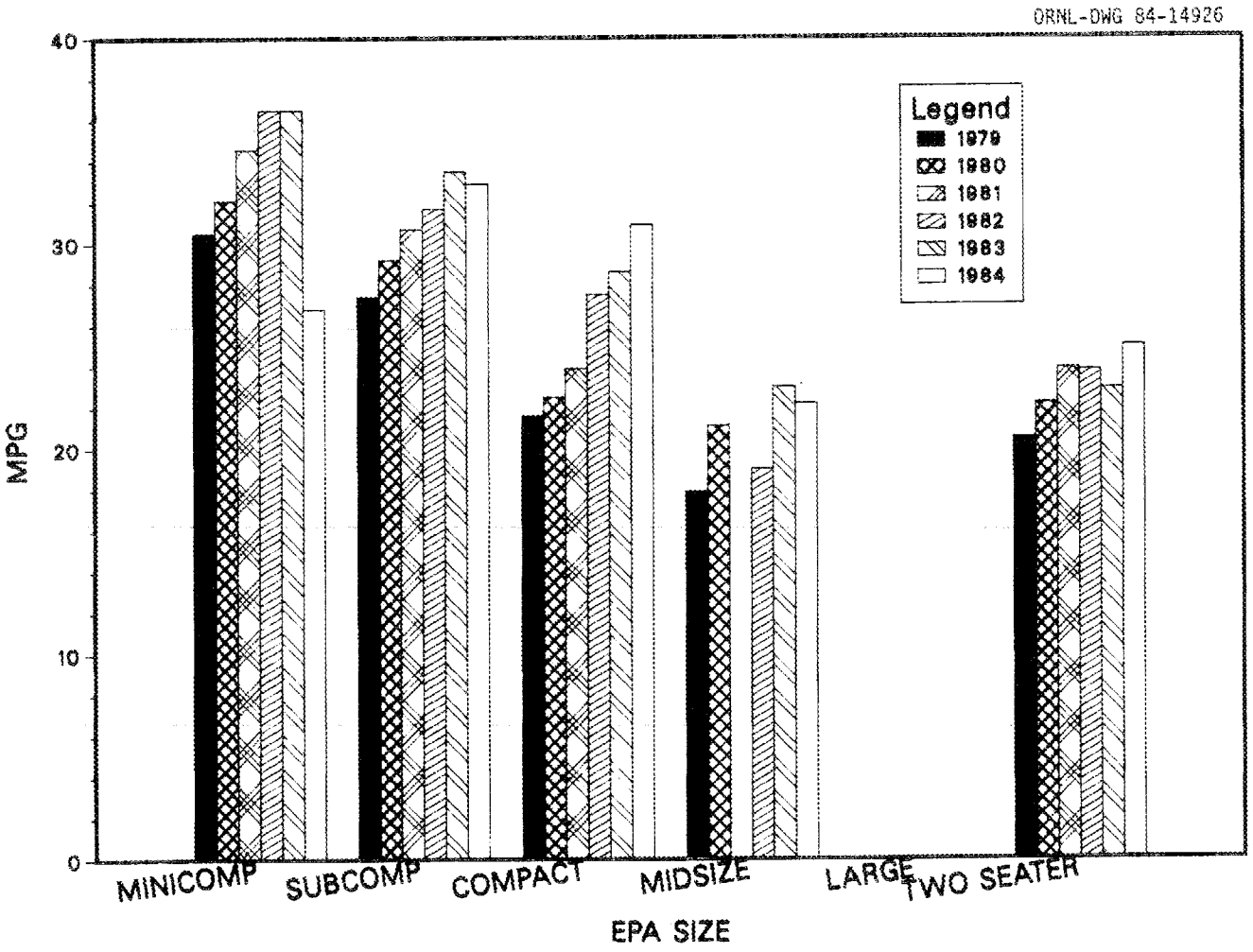

Fig. 6. Fuel Economies of Import Automobiles by EPA Size Classification 1979–1984.

Table 5
Allocation of Automobile MPG Differences Between Consecutive Model Years 1978–1984

Beginning model year	Beginning MPG[a]	Difference in MPG due to:								Total change in MPG	Ending MPG[b]	Ending model year
		Sales shift		Configuration information				Model introduction	Model discontinuation			
		Between classes	Within classes	Efficiency improvement	Sales shift	Introduction	Discontinuation					
1978	19.67	0.22	0.29	−0.08	0.14	−0.03	−0.01	0.28	0.07	0.87	20.54	1979
1979	20.54	0.40	0.57	0.79	0.24	0.30	0.03	0.10	0.13	2.56	23.11	1980
1980	23.11	−0.13	0.37	1.04	0.05	0.08	0.01	0.61	0.09	2.12	25.23	1981
1981	25.23	0.15	−0.21	0.66	−0.01	0.38	0.02	0.07	0.07	1.14	26.36	1982
1982	26.36	−0.06	−0.12	−0.09	−0.12	0.01	0.08	0.12	−0.05	−0.24	26.13	1983
1983	26.13	−0.10	0.10	−0.13	0.12	−0.02	0.11	−0.03	0.15	0.21	26.34	1984[c]

[a]Fuel economy of the beginning model year.

[b]Fuel economy of the ending model year.

[c]Represents fuel economy for first the 6 months of the model year (October through March).

LIGHT-DUTY VEHICLE SALES AND SALES-WEIGHTED FUEL ECONOMIES BY MAKE AND MODEL, MODEL YEAR 1984

The twenty most popular automobiles for the first six months of model year 1984 are listed in Table 7. Compact and midsize automobiles accounted for 60% of the top twenty.

Tables 8 through 13 list all of the automobile nameplates in the same EPA size class, ranked by fuel economy. Separate tables are given for each size class. Tables 14 through 18 list all of the light truck nameplates belonging to the same gross vehicle weight class. They are also ranked within their class according to the fuel economy. A new approach for classifying the light trucks was used in this report. The "van" category was split into two size classes: "standard van" and "mini van." Included in the "mini van" class were Plymouth Voyager, Dodge Mini Ram Van, Toyota Van and Volkswagen Vanagon. All other vans were classified as standard vans.

Tables 19 through 21 summarize the market shares, model year sales and sales-weighted fuel economies of light-duty vehicles from model year 1979 to the first six months of model year 1984.

Table 19 is for domestic and import automobiles combined, Table 20 is for domestic and domestic-sponsored automobiles, and Table 21 is for imports. The first six months of model year 1984 experienced an increase in light truck market share, from 23.7% of combined light truck and automobile sales in model year 1983 to 25.4% in this reporting period, a jump of 1.7% from the previous model year. Since model year 1981 it has become a continuing trend for the light trucks to capture a slightly larger part of the market than in the previous model year.

Table 7
20 Most Popular Cars for the First Six Months of Model Year 84

	Model year sales	Percent total sales	Sales weighted MPG	EPA size class	Ranking of previous model year[a]
1) Oldsmobile Supreme	184,944	3.76	23.7	Midsize	2
2) Ford Escort	164,707	3.35	34.2	Compact	1
3) Chevrolet Cavalier	159,856	3.25	32.2	Compact	15
4) Chevrolet Celebrity	138,882	2.83	26.0	Midsize	
5) Ford Tempo	131,213	2.67	31.3	Compact	
6) Chevrolet	125,427	2.55	20.2	Large	4
7) Oldsmobile Ciera	123,989	2.52	26.7	Midsize	17
8) Oldsmobile 88	122,136	2.49	20.7	Large	5
9) Buick Regal	107,293	2.18	22.4	Midsize	11
10) Buick Century	99,252	2.02	25.8	Midsize	8
11) Ford LTD 83	97,945	1.99	24.0	Midsize	
12) Chevrolet Chevette	94,931	1.93	34.7	Subcompact	7
13) Chevrolet Camaro	94,451	1.92	22.6	Subcompact	10
14) Cadillac DeVille	93,847	1.91	20.1	Large	9
15) Nissan Sentra	91,589	1.86	37.4	Subcompact	3
16) Ford Thunderbird	84,010	1.71	23.3	Compact	
17) Honda Accord	81,158	1.65	35.3	Subcompact	6
18) Buick Le Sabre	80,576	1.64	20.7	Large	
19) Toyota Corolla	74,875	1.52	37.6	Compact	14
20) Plymouth Reliant	72,708	1.48	27.6	Midsize	13
	2,223,789	45.25	26.2		

[a]Represents ranking of first six months of model year 1983 (October 82 through March 83).

Table 8
Minicompact Cars Ranked by Sales Weighted MPG
October 83—March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Toyota Starlet	1,225	7.00	48.0
2) Renault Le Car	417	2.38	37.0
3) Volkswagen Rabbit-Convertible	4,576	26.15	29.7
4) Porsche 944	7,128	40.74	25.8
5) Porsche 911	2,832	16.19	24.0
6) Porsche 928	1,319	7.54	20.0
	17,497	100.00	26.8

Table 9
Subcompact Cars Ranked by Sales Weighted MPG
October 83—March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Audi 4000 (Diesel)	52		44.0
2) Toyota Tercel	55,486	4.54	38.7
3) Honda Civic	57,063	4.67	38.5
4) Plymouth Arrow Champ	17,002	1.39	37.9
5) Dodge Colt Hatchback	19,430	1.59	37.8
6) Mazda GLC	22,587	1.85	37.8
7) Nissan Pulsar NX	22,071	1.81	37.5
8) Nissan Sentra	91,589	7.49	37.4
9) Nissan Pulsar	389	.03	37.0
10) Isuzu	2,929	.24	35.4
11) Honda Accord	81,158	6.64	35.3
12) Volkswagen Rabbit-American	42,326	3.46	35.2
13) Honda Accord-American	47,100	3.85	35.2
14) Chevrolet Chevette	94,931	7.76	34.7
15) Pontiac T1000	14,265	1.17	34.7
16) Mercedes Benz 190 D 2.2	4,088	.33	33.7
17) Subaru	71,504	5.85	33.4
18) Nissan 200SX	13,987	1.14	33.0
19) Volkswagen Jetta	19,522	1.60	32.1
20) Mitsubishi Tredia	7,968	.65	31.4
21) Audi 4000	6,929	.57	31.3
22) Mitsubishi Cordia	7,743	.63	31.3
23) Honda Prelude	32,964	2.70	31.2
24) Plymouth Turismo (TC3)	19,984	1.63	30.8
25) Dodge Charger 024	23,869	1.95	30.7
26) Mercedes Benz 190 E 2.3	6,040	.49	30.6
27) BMW 320 I	16,437	1.34	30.5
28) Volkswagen Scirocco	8,073	.66	30.0
29) BMW 325	420	.03	30.0
30) Toyota Celica	44,994	3.68	29.7
31) Renault Fuego	8,203	.67	29.5
32) Renault 18I	1,451	.12	28.8
33) Isuzu Impulse	5,714	.47	27.7
34) Dodge Daytona	19,126	1.56	27.2
35) Dodge Challenger	1,239	.10	27.0
36) Nissan Maxima	35,329	2.89	27.0
37) Chrysler Laser	23,441	1.92	26.9
38) Audi Coupe	1,658	.14	25.1
39) Mitsubishi Starion	3,732	.31	25.0
40) Dodge Conquest	1,718	.14	25.0
41) Plymouth Conqeust (Sapporo)	2,644	.22	25.0
42) Toyota Cressida	18,517	1.51	24.9
43) AMC Spirit	336	.03	24.5
44) Toyota Supra	13,715	1.12	24.4
45) Mercury Capri	11,460	.94	24.2
46) Audi 4000S Quattro	1,332	.11	24.0
47) Ford Mustang	65,161	5.33	23.8
48) BMW 633 CSI	1,771	.14	22.1
49) Chevrolet Camaro	94,451	7.73	22.6
50) Pontiac Firebird	49,953	4.09	22.6
51) Lancia Beta	105	.01	22.0
52) Audi Quatro	240	.02	21.0
53) Jaguar XJ/XJS	8,444	.69	18.4
	1,222,640	100.00	30.6

Table 10
Compact Cars Ranked by Sales Weighted MPG
October 83—March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Toyota Corolla	74,875	5.78	37.6
2) AMC Renault Encore	34,451	2.66	36.1
3) AMC Renault Alliance	50,618	3.91	35.6
4) Mazda 626	31,655	2.44	34.7
5) Toyota Camry	35,371	2.73	34.7
6) Mercury Lynx	33,797	2.61	34.3
7) Ford Escort	164,707	12.72	34.2
8) Nissan Stanza	24,619	1.90	32.3
9) Chevrolet Cavalier	159,856	12.35	32.2
10) Pontiac J2000	51,228	3.96	31.9
11) Buick Skyhawk	42,415	3.28	31.7
12) Oldsmobile Firenza	24,942	1.93	31.7
13) Dodge Omni	31,990	2.47	31.6
14) Plymouth Horizon	37,829	2.92	31.5
15) Ford Tempo	131,213	10.14	31.3
16) Mercury Topaz	39,029	3.02	30.5
17) Volvo Diesel Sedan	1,445	.11	30.1
18) Mercedes Benz 240 D	61		29.8
19) Peugeot 505 (Diesel/Turbo)	2,074	.16	29.6
20) Peugeot 604	101	.01	29.4
21) Mercedes Benz 300 D/300 CD	10,711	.83	29.0
22) Cadillac Cimarron	9,768	.75	28.3
23) Oldsmobile Omega (X-Car)	20,450	1.58	27.5
24) Volvo DL	22,658	1.75	26.6
25) Buick Skylark (X-Car)	49,224	3.80	26.4
26) Volkswagen Quantum	7,741	.60	26.3
27) Mercedes Benz 300 SD	8,336	.64	26.1
28) Volvo GL	12,245	.95	26.0
29) Saab 900	14,788	1.14	25.8
30) Mercedes 380 SE	2,872	.22	25.2
31) BMW 528 I	7,515	.58	24.3
32) Audi 5000 (Diesel/Turbo)	43		24.1
33) AMC Concord	386	.03	24.0
34) Peugeot 505 (Gas)	6,689	.52	23.6
35) Ford Thunderbird	84,010	6.49	23.3
36) Mercury Cougar XR-7	54,858	4.24	23.3
37) BMW 733 I	3,860	.30	23.0
38) Volvo GLT	4,949	.38	22.4
39) Mercedes 500 SEC	1,001	.08	17.0
	1,294,380	100.00	30.6

Table 11
Midsize Cars Ranked by Sales Weighted MPG
October 83–March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Dodge Aries	57,616	3.80	27.6
2) Plymouth Reliant	72,708	4.80	27.6
3) Dodge 400	10,125	.67	27.5
4) Chevrolet Citation (X-Car)	45,026	2.97	27.4
5) Pontiac Phoenix (X-Car)	7,953	.52	27.1
6) Dodge 600	18,015	1.19	27.0
7) Chrysler Le Baron	42,451	2.80	26.7
8) Oldsmobile Ciera	123,989	8.18	26.7
9) Pontiac A6000	60,819	4.01	26.2
10) Chrysler New Yorker-E Class	46,047	3.04	26.1
11) Chevrolet Celebrity	138,882	9.17	26.0
12) Buick Century	99,252	6.55	25.8
13) Volvo 760 GLE	4,246	.28	24.7
14) Ford LTD 83	97,945	6.46	24.0
15) Mercury Marquis	43,116	2.85	24.0
16) Oldsmobile Supreme	184,944	12.21	23.7
17) Pontiac Bonneville	39,862	2.63	22.8
18) Pontiac Grand Prix	40,605	2.68	22.6
19) Audi 5000S	19,993	1.32	22.5
20) Chevrolet Malibu	4,567	.30	22.5
21) Buick Regal	107,293	7.08	22.4
22) Chevrolet Monte Carlo	67,672	4.47	21.7
23) Cadillac Seville	19,874	1.31	21.0
24) Cadillac Eldorado	38,234	2.52	21.0
25) Dodge Mirada	706	.05	20.2
26) Oldsmobile Toronado	22,636	1.49	20.1
27) Buick Riviera	31,162	2.06	20.0
28) Chrysler Cordoba	567	.04	20.0
29) Lincoln Continental	8,976	0.59	20.0
30) Lincoln Mercury Mark VII	17,734	1.17	20.0
31) Chrysler New Yorker 5th Ave	30,023	1.98	19.0
32) Chrysler Imperial	84	.01	19.0
33) Plymouth Gran Fury	4,077	.27	17.6
34) Dodge Diplomat	5,837	.39	17.6
35) Mercedes Benz 380 SEL	2,261	.15	17.0
	1,515,297	100.00	24.2

Table 12
Large Cars Ranked by Sales Weighted MPG
October 83–March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Pontiac	25,613	3.63	21.5
2) Oldsmobile 98	60,003	8.51	21.1
3) Buick LeSabre	80,576	11.43	20.7
4) Oldsmobile 88	122,136	17.33	20.7
5) Chevrolet	125,427	17.80	20.2
6) Cadillac DeVille	93,847	13.32	20.1
7) Buick Electra	40,660	5.77	20.0
8) Mercury Grand Marquis	55,668	7.90	20.0
9) Lincoln Town Car	33,826	4.80	20.0
10) Ford LTD Crown Victoria	66,963	9.50	18.4
	704,719	100.00	20.2

Table 13
Two Seater Cars Ranked by Sales Weighted MPG
October 83–March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Honda Civic Coupe	17,805	11.29	43.0
2) Mercury LN7	543	.34	32.3
3) Ford Exp	8,019	5.08	31.8
4) Pontiac Fiero	49,627	31.47	31.5
5) Fiat X 1/9	441	.28	30.0
6) Fiat Spider	460	.29	28.5
7) Alfa Romeo	1,245	.79	27.0
8) Nissan 300ZX	33,672	21.35	23.5
9) Mazda RX-7	26,471	16.79	21.5
10) Mercedes Benz 380 SL	4,640	2.94	20.0
11) Chevrolet Corvette	14,782	9.37	20.0
	157,705	100.00	26.4

Table 14
Small Pickup Trucks Ranked by Sales Weighted MPG
October 83—March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Volkswagen Pickup — Diesel	303	.08	44.0
2) Isuzu Pickup	14,239	3.96	35.4
3) Nissan Pickup	51,558	14.34	31.9
4) Plymouth Scamp	572	.16	31.8
5) Volkswagen Pickup — Gasoline	493	.14	30.0
6) Mazda Pickup	54,695	15.21	29.6
7) Dodge Rampage	4,499	1.25	28.9
8) Chevrolet LUV	1,049	.29	28.9
9) Mitsubishi	5,104	1.42	28.6
10) Dodge Ram 50	19,422	5.40	27.7
11) Jeep Scrambler	2,009	.56	27.0
12) Ford Ranger	98,489	27.38	24.5
13) GMC S-15	19,754	5.49	24.3
14) Chevrolet S-10	87,462	24.32	24.2
	359,648	100.00	26.6

Table 15
Standard Pickup Trucks Ranked by Sales Weighted MPG
October 83—March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Toyota Pickup	98,128	14.86	27.2
2) GMC Caballero	1,308	.20	20.9
3) Chevrolet El Camino	12,698	1.92	20.8
4) GMC C-15	18,622	2.82	19.3
5) Chevrolet C-10	75,550	11.44	19.2
6) GMC C-25	6,909	1.05	18.7
7) Chevrolet C-20	24,898	3.77	18.4
8) Chevrolet K-10	75,551	11.44	18.2
9) GMC K-15	18,625	2.82	18.2
10) Ford F100/F150	176,455	26.71	17.0
11) Dodge D150	34,712	5.26	16.7
12) GMC K-25	6,909	1.05	16.1
13) Chevrolet K-20	24,898	3.77	15.7
14) Jeep J10	1,041	.16	15.7
15) Ford F250	67,759	10.26	15.5
16) Dodge D250	5,588	.85	14.3
17) Dodge W150	6,767	1.02	13.7
18) Dodge W250	3,060	.46	13.2
19) Jeep J20	1,040	.16	13.0
	660,518	100.00	18.3

Table 16
Standard Vans Ranked by Sales Weighted MPG
October 83—March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Chevrolet Van	77,952	28.73	18.8
2) GMC Vandura/Rally	22,622	8.34	17.0
3) Chevrolet Sport Van	10,329	3.81	16.7
4) Ford Econoline	87,910	32.40	15.9
5) Ford Club Wagon	16,931	6.24	15.5
6) Plymouth Voyager	284	0.10	15.2
7) Dodge Ram Van	35,302	13.01	15.2
8) Dodge Ram Wagon	20,039	7.38	14.1
	271,369	100.00	16.5

Table 17
Mini Vans Ranked by Sales Weighted MPG
October 83–March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Toyota Van	15,924	21.09	27.0
2) Dodge Mini Ram Van	1,799	2.38	25.8
3) Dodge Caravan	24,847	32.92	24.9
4) Plymouth Voyager (FWD)	23,555	31.20	24.8
5) Volkswagen Vanagon	9,363	12.40	20.7
	75,488	100.00	24.7

Table 18
Special Purpose Vehicles Ranked by Sales Weighted MPG
October 83–March 84

	Model year sales	Percent total sales	Sales weighted MPG
1) Subaru Brat	2,980	.98	29.3
2) Chevrolet Blazer "S"	65,353	21.45	24.0
3) Jeep Cherokee XJ	22,049	7.24	24.0
4) Jeep CJ	17,499	5.74	24.0
5) GMC Jimmy "S"	15,662	5.14	23.4
6) Jeep Wagoneer XJ	9,672	3.18	22.7
7) AMC Eagle	13,996	4.59	22.5
8) Ford Bronco II	44,545	14.62	21.6
9) Mitsubishi Montero	1,750	.57	21.5
10) Chevrolet Blazer	22,182	7.28	18.4
11) GMC Suburban	7,072	2.32	17.4
12) Chevrolet Suburban	22,510	7.39	16.8
13) GMC Jimmy	4,521	1.48	15.7
14) Ford Bronco	23,956	7.86	14.6
15) Toyota Land Cruiser	2,085	.68	14.0
16) Dodge Ram Charger	13,714	4.50	13.6
17) Jeep Cherokee/Wagoneer	15,074	4.95	13.3
	304,620	100.00	19.6

Table 19
Light Duty Vehicle Sales, Market Shares, and Sales-Weighted Fuel Efficiencies, Domestic and Import

Model year	Automobile			Light trucks			Fleet		
	Sales	Mkt shr	MPG	Sales	Mkt shr	MPG	Sales	Mkt shr	MPG
1979	10,846,321	79.7	20.5	2,756,166	20.3	17.2	13,602,487	100.0	19.8
1980	9,853,484	80.3	23.1	2,412,824	19.7	17.9	12,266,308	100.0	21.9
1981	8,836,933	81.7	25.2	1,978,320	18.3	19.8	10,815,253	100.0	24.0
1982	7,621,018	77.8	26.4	2,169,993	22.2	20.4	9,791,011	100.0	24.8
1983	8,738,809	76.3	26.1	2,718,832	23.7	20.6	11,457,641	100.0	24.6
1984[a]	4,912,238	74.6	26.3	1,671,643	25.4	19.7	6,583,881	100.0	24.3

[a]Represents sales for the first 6 months of the model year (October through March).

Table 20
Light Duty Vehicle Sales, Market Shares, and Sales-Weighted Fuel Efficiencies, Domestic and Domestic-Sponsored

Model year	Automobile			Light trucks			Fleet		
	Sales	Mkt shr	MPG	Sales	Mkt shr	MPG	Sales	Mkt shr	MPG
1979	8,934,663	78.1	19.6	2,512,049	21.9	16.9	11,446,712	100.0	19.0
1980	7,565,983	78.2	21.9	2,106,462	21.8	17.3	9,672,445	100.0	20.7
1981	6,698,869	80.0	24.0	1,670,701	20.0	18.9	8,369,570	100.0	22.8
1982	5,616,328	75.2	25.1	1,852,478	24.8	19.5	7,468,806	100.0	23.4
1983	6,537,116	74.1	24.7	2,282,336	25.9	19.6	8,819,452	100.0	23.1
1984[a]	3,835,694	73.1	25.2	1,415,021	26.9	18.7	5,250,715	100.0	23.1

[a]Represents sales for the first 6 months of the model year (October through March).

Table 21
Light Duty Vehicle Sales, Market Shares, and Sales-Weighted Fuel Efficiencies, Import

Model year	Automobile			Light trucks			Fleet		
	Sales	Mkt shr	MPG	Sales	Mkt shr	MPG	Sales	Mkt shr	MPG
1979	1,911,658	88.7	26.3	244,117	11.3	21.7	2,155,775	100.0	25.7
1980	2,287,501	88.2	28.0	306,362	11.8	24.4	2,593,863	100.0	27.5
1981	2,138,064	87.4	29.9	307,619	12.6	27.6	2,445,683	100.0	29.6
1982	2,004,690	86.3	30.9	317,515	13.7	28.3	2,322,205	100.0	30.5
1983	2,201,693	83.5	31.8	436,496	16.5	27.8	2,638,189	100.0	31.0
1984[a]	1,076,544	80.8	31.1	256,622	19.2	28.4	1,333,166	100.0	30.5

[a]Represents sales for the first 6 months of the model year (October through March).

LIGHT TRUCK SALES AND FUEL ECONOMY

Light trucks showed a dramatic jump in sales of 42.2%, from 1,175,443 units in the first six months of model year 1983 to 1,671,643 units in the same period of model year 1984. Except for small pickup trucks, every light truck size class increased its sales volume by no less than 25%. Sales of mini vans increased 1,025% from 6,713 units in the first months of model year 1983 to 75,488 units in the same period of model year 1984. This increase was largely a result of the introduction of the Dodge's Mini Ram Van and Caravan and the reduced size of the Plymouth Voyager from standard van to mini van. Special purpose vehicles showed equally impressive gains of 121% in sales, from 148,998 units in the first six months of model year 1983 to 304,620 units in the same period of model year 1984. If sales continued at this rate, light trucks will have the highest sales volume since model year 1979 (Table 22). In addition to the striking increases in sales volume, the composition of light-truck market shares changed significantly. Although standard pickup trucks and small pickup trucks were still the two largest share components in the light-truck market with 39.5% and 21.5%, respectively, small pickup trucks had their share reduced by 12.3% from model year 1983. In contrast, special purpose vehicles gained an additional 5.5% of the market share, from 12.7% in the first six months of model year 1983 to 18.2% in the same period of model year 1984; and mini vans increased their market shares from 0.6% in the first six months of model year 1983 to 4.5% in this reporting period (Table 25).

Comparing the first half of model year 1983 and 1984, all domestic light-truck size classes showed increased in sales volume; special purpose vehicles increased by 108%, standard pickup trucks by 37.2%, standard vans by 28% and small pickup trucks by 7.9%. This resulted in an overall 44.2% increase for the entire fleet of domestic light trucks. Although the import light trucks also experienced an increase of 32.3% in sales, the sales volume in import small pickup trucks dropped 30.3%, from 181,452 units in the first half of model year 1983 to 126,392 units in the same period of model year 1984 (Table 25). Apparently, the import small pickup trucks have lost much of their market share to both standard pickup trucks and mini vans (a new category). For the first time, import manufacturers started to produce a standard pickup truck, the Toyota Pickup which was increased in size from the small pickup to the standard pickup truck category.

The sales-weighted fuel economy of light trucks dropped 0.8 mpg from 20.5 mpg in the model year 1983 to 19.7 mpg in the first six months of model year 1984 (Table 22). The main reason for the 0.8 mpg drop in this reporting period was the decreased fuel economy in the continuing configurations — a 0.91 mpg drop (Table 26). Except for mini vans and standard pickups, every light truck size class showed drops in fuel economy. The greatest drop in fuel economy was in small pickups, from 27.9 mpg in the model year 1983 to 26.6 mpg in the first half of model year 1984. This reversed the trend of increasing light truck fuel economy since model year 1979.

Domestic light trucks showed a drop of 0.9 mpg from model year 1983 to the first half of model year 1984 (Table 23). Domestic small pickup

trucks dropped 2.8 mpg, and domestic standard vans 0.7 mpg. In contrast, the sales-weighted fuel economy of import light trucks improved by 0.6 mpg, from 27.8 mpg in the model year 1983 to 28.4 mpg in the first half of model year 1984. Every size class improved its fuel economy, except for special purpose vehicles which dropped 0.1 mpg (Table 24).

Tables 26 to 28 present the results of the analysis which identifies the components of the fuel economy changes. (Note that the light truck fuel economies before model year 1983 are not adjusted by the monthly sales.) Comparing model year 1983 and the first half of model year 1984, decreased fuel economy in the continuing configurations and the shifts in sales toward standard pickups and special purpose vehicles resulted in the drop of 0.83 mpg (Table 26). Despite the fact that sales within a given size class shifted to more fuel efficient vehicles, and that sales in a given nameplate shifted to more fuel efficient configurations, resulting in 0.43 mpg and 0.28 mpg improvements respectively, these improvements in fuel economy were not great enough to offset the drops caused by other factors. The same table also shows that Jeep and imports experienced fuel economy improvements from model year 1983.

Table 27 presents the results for model year 1982 and 1983. Table 28 presents a summary table of fuel economy changes from model year 1978 through 1984. Since model year 1979, the first half of model year 1984 experienced: (1) the largest drop in the fuel economy of continuing configurations, −0.91 mpg, (2) the largest drop in fuel economy due to sales shift away from the more fuel efficient size classes, −0.43 mpg, (3) the largest improvement in fuel economy due to sales shifts toward

more efficient nameplates within classes, 0.43 mpg. For the light truck part of the industry, 1984 has certainly been a year of dramatic changes.

Table 22
Model Year Sales, Market Shares, and Sales-Weighted Fuel Efficiencies of Domestic and Import Trucks, Model Years 1979–1984

	1979	1980	1981	1982	1983	1984[a]
SMALL PICKUP						
Total sales, units	448,797	548,126	472,611	579,263	887,677	359,648
Market share, %	16.3	22.7	23.9	26.7	32.6	21.5
Fuel efficiency, MPG	23.4	25.2	27.8	28.4	27.9	26.6
STANDARD PICKUP						
Total sales, units	1,640,587	1,229,019	967,242	1,000,772	958,408	660,518
Market share, %	59.5	50.9	48.9	46.1	35.3	39.5
Fuel efficiency, MPG	16.6	16.9	18.5	18.9	18.2	18.3
STANDARD VAN						
Total sales, units	590,479	367,202	338,737	391,074	484,349	271,369
Market share, %	21.4	15.2	17.1	18.0	17.8	16.2
Fuel efficiency, MPG	15.9	16.2	17.8	17.8	17.2	16.5
MINI VAN						
Total sales, units					13,645	75,488
Market share, %					0.5	4.5
Fuel efficiency, MPG					20.9	24.7
SPECIAL PURPOSE						
Total sales, units	76,303	268,477	199,730	198,884	374,853	304,620
Market share, %	2.8	11.1	10.1	9.2	13.8	18.2
Fuel efficiency, MPG	16.6	15.5	17.6	18.5	20.1	19.6
FLEET						
Total sales, units	2,756,166	2,412,824	1,978,320	2,169,993	2,718,832	1,671,643
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0
Fuel efficiency, MPG	17.2	17.9	19.8	20.4	20.5	19.7

[a]Represents sales for the first 6 months of the model year (October through March).

Table 23
Model Year Sales, Market Shares, and Sales-Weighted Fuel Efficiencies of Domestic and Domestic-Sponsored Trucks, Model Years 1979–1984

	1979	1980	1981	1982	1983	1984[a]
SMALL PICKUP						
Total sales, units	210,867	246,223	178,050	276,562	476,435	233,256
Market share, %	8.4	11.7	10.7	14.9	20.9	16.5
Fuel efficiency MPG	25.1	25.8	26.9	27.7	27.5	24.7
STANDARD PICKUP						
Total sales, units	1,640,587	1,229,019	967,242	1,000,772	958,408	562,390
Market share, %	65.3	58.3	57.9	54.0	42.0	39.7
Fuel efficiency, MPG	16.6	16.9	18.5	18.9	18.2	17.3
STANDARD VAN						
Total sales, units	590,479	367,202	327,730	379,110	484,349	271,369
Market share, %	23.5	17.4	19.6	20.5	21.2	19.2
Fuel efficiency, MPG	15.9	16.2	17.8	17.7	17.2	16.5
MINI VAN						
Total sales, units						50,201
Market share, %						3.5
Fuel efficiency, MPG						24.9
SPECIAL PURPOSE						
Total sales, units	70,116	264,018	197,679	196,034	363,144	297,805
Market share, %	2.8	12.5	11.8	10.2	15.9	21.0
Fuel efficiency, MPG	16.9	15.5	17.7	18.6	20.1	19.6
FLEET						
Total sales, units	2,512,049	2,106,462	1,670,701	1,852,478	2,282,336	1,415,021
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0
Fuel efficiency, MPG	16.9	17.3	18.9	19.5	19.6	18.7

[a]Represents sales for the first 6 months of the model year (October through March).

Table 24
Model Year Sales, Market Shares, and Sales-Weighted Fuel Efficiencies of Import Trucks, Model Years 1979–1984

	1979	1980	1981	1982	1983	1984[a]
SMALL PICKUP						
Total sales, units	237,930	301,903	294,561	302,701	411,142	126,392
Market share, %	97.5	98.5	95.8	95.3	94.2	49.3
Fuel efficiency MPG	22.0	24.7	28.4	29.0	28.4	31.1
STANDARD PICKUP						
Total sales, units						98,128
Market share, %						38.2
Fuel efficiency, MPG						27.2
STANDARD VAN						
Total sales, units						
Market share, %						
Fuel efficiency, MPG						
MINI VAN						
Total sales, units			11,007	11,964	13,645	25,287
Market share, %			3.6	3.8	3.1	9.9
Fuel efficiency, MPG			18.5	21.0	20.9	24.2
SPECIAL PURPOSE						
Total sales, units	6,187	4,459	2,051	2,850	11,709	6,815
Market share, %	2.5	1.5	0.7	0.9	2.7	2.7
Fuel efficiency, MPG	13.5	13.5	14.0	14.0	20.6	20.5
FLEET						
Total sales, units	244,117	306,362	307,619	317,515	436,496	256,622
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0
Fuel efficiency, MPG	21.7	24.4	27.6	28.3	27.8	28.4

[a]Represents sales for the first 6 months of the model year (October through March).

Table 25
Sales, Market Shares, and Sales-Weighted Fuel Economies of All Light Trucks, First Six Months of Model Year 1983–1984

	Domestic and import		Domestic		Import	
	1983	1984	1983	1984	1983	1984
SMALL PICKUP						
Total sales, units	397,679	359,648	216,227	233,256	181,452	126,392
Market share, %	33.8	21.5	22.0	16.5	93.5	49.3
Fuel economy, mpg	28.0	26.6	27.6	24.7	28.4	31.1
STANDARD PICKUP						
Total sales, units	410,040	660,518	410,040	562,390		98,128
Market share, %	34.9	39.5	41.8	39.7		38.2
Fuel economy, mpg	18.2	18.3	18.2	17.3		27.2
STANDARD VAN						
Total sales, units	212,013	271,369	212,013	271,369		
Market share, %	18.0	16.2	21.6	19.2		
Fuel economy, mpg	17.2	16.5	17.2	16.5		
MINI VAN						
Total sales, units	6,713	75,488		50,201	6,713	25,287
Market share, %	0.6	4.5		3.5	3.5	9.9
Fuel economy, mpg	20.9	24.7		24.9	20.9	24.2
SPECIAL PURPOSE						
Total sales, units	148,998	304,620	143,200	297,805	5,798	6,815
Market share, %	12.7	18.2	14.6	21.0	3.0	2.7
Fuel economy, mpg	19.6	19.6	19.6	19.6	20.7	20.5
FLEET						
Total sales, units	1,175,443	1,671,643	981,480	1,415,021	193,963	256,622
Market share, %	100.0	100.0	100.0	100.0	100.0	100.0
Fuel economy, mpg	20.5	19.7	19.6	18.7	27.8	28.4

Table 26
Allocation of Light Truck MPG Differences Between Model Years 1983 and 1984

	1983 MPG	Difference in MPG due to:								Total change in MPG	1984[a] MPG
		Sales shift		Configuration information				Model introduction	Model discontinuation		
		Between classes	Within classes	Improvement	Sales shift	Introduction	Discontinuation				
AMC	23.54			−0.98	−0.04					−1.02	22.52
Jeep	19.40		1.48	−0.60	−0.30		−0.05			.54	19.94
Plymouth/Dodge	18.30	−0.10	−0.10	−1.00	−0.40	−0.05	0.02	1.23	−0.03	-.42	17.88
Ford	18.06	−0.10	0.04	−0.30	−0.01	−0.05				−0.42	17.64
Chevrolet	21.28	0.27	0.01	−1.44	0.67	−0.24	0.05	−0.86		−1.53	19.75
GMC	20.49	−0.07	−0.08	−3.53	2.58	−0.27	0.06			−1.32	19.18
Import	27.81	9.96	−9.76	0.81	−0.37	−0.08	−0.01			.56	28.36
Fleet	20.52	−0.43	0.43	−0.91	0.28	−0.12	−0.02	−0.10		−0.83	19.69

[a]Represents fuel economy for the first 6 months of model year (October through March).

Table 27
Allocation of Light Truck MPG Differences Between Model Years 1982 and 1983

	1982 MPG	Difference in MPG due to:								Total change in MPG	1983 MPG
		Sales shift		Configuration information				Model introduction	Model discontinuation		
		Between classes	Within classes	Improvement	Sales shift	Introduction	Discontinuation				
AMC	23.62			2.39	−2.45	−0.02				−.08	23.54
Jeep	19.72	−0.02	−0.04	0.38	−0.69			0.05		−.32	19.40
Plymouth/Dodge	18.76	−0.30	0.05	−0.35	−0.29		−0.02	0.45	0.01	−.46	18.30
Ford	17.44	−0.19	−0.07	−0.13	−0.29	0.13	−0.01	1.19		.62	18.06
Chevrolet	21.50	0.08	−0.03	−0.61	−0.37	0.11	0.32	0.29		−.22	21.28
GMC	20.65	−0.14		−0.18	−0.22	−0.06	0.25	0.21		−.15	20.49
Import	28.33	0.01	−0.20	−0.31	−0.11	0.09		−0.01		−.53	27.81
Fleet	20.45	0.13	−0.07	−0.28	−0.33	0.09	0.11	0.43		.07	20.52

Table 28
Allocation of Light Truck MPG Differences Between Consecutive Model Years 1978–1984

Beginning model year	Beginning MPG[a]	Difference in MPG due to:								Total change in MPG	Ending MPG[b]	Ending model year
		Sales shift		Configuration information				Model introduction	Model discontinuation			
		Between classes	Within classes	Efficiency improvement	Sales shift	Introduction	Discontinuation					
1978	17.85	0.29	0.01	−1.22	0.25	−0.03	0.07	0.02		−0.61	17.24	1979
1979	17.24	0.42	−0.01	0.64	−0.09	−0.04	−0.04	−0.19	0.01	0.70	17.94	1980
1980	17.94	0.29	−0.06	1.18	0.12	0.31	0.01	0.05		1.89	19.84	1981
1981	19.84	−0.28	0.01	−0.18	0.31	0.19	0.08	0.48		0.61	20.45	1982
1982	20.45	0.13	−0.07	−0.28	−0.33	0.09	0.11	0.43		0.07	20.52	1983
1983	20.52	−0.43	0.43	−0.91	0.28	−0.12	−0.02	−0.10		−0.83	19.69	1984[c]

[a]Fuel economy of the beginning model year.

[b]Fuel economy of the ending model year.

[c]Represents fuel economy for the first 6 months of the model year (October through March).

ANNUAL TRENDS IN VEHICLE CHARACTERISTICS

The curb weight (always a sales-weighted average) of the entire automobile fleet, domestic and import combined, increased from 2,787 lbs. in model year 1983 to 2,791 lbs. in the first six months of model year 1984, a gain of 4 lbs. (Table 29). Midsize, large cars and two-seaters all had declines in their curb weights in the first half of model year, 26 lbs., 40 lbs. and 89 lbs., respectively. In contrast, the smaller sized automobiles increased in curb weight. Among them, minicompacts had the highest jump of approximately 500 lbs., from 2,072 lbs. in model year 1983 to 2,576 lbs. in the first half of model year 1984. This jump in curb weight can be attributed to: (1) consumers tending to purchase heavier minicompacts, such as the Porsche 944 with 2,778 lbs., and the Porsche 911 with 2,756 lbs., and (2) the reclassification of Honda's Civic and Prelude to the subcompact category. Since the figures reported here are sales-weighted, the distribution of market shares within classes has a significant influence on the statistics.

Tables 30 and 31 give the sales-weighted average curb weight of domestic automobiles, and import automobiles by EPA size classification. Domestic automobiles in the first half of model year 1984 dropped approximately 36 lbs. in curb weight from the previous model year while import automobiles added approximately 60 lbs., a 2.6% increase.

Tables 32 to 34 show the sales-weighted average interior space of automobiles, by EPA size classification. The interior space of automobiles in the first half of model year 1984 increased 0.6 cubic feet from model year 1983. The slight increase in interior space resulted from the fact that each of the three largest market share classes — midsize,

compact and subcompact cars -- either enlarged the interior space or kept it constant compared to previous model year. The interior space of domestic cars in the first half of model year 1984 lost 0.4 cubic feet from the previous model year. On the other hand, import automobiles had an increase of 2.1 cubic feet in interior space from the previous model year, despite the striking decrease of interior space in minicompacts.

Tables 35 to 37 demonstrate the sales-weighted average engine size of domestic and import automobiles combined, domestic automobiles, and import automobiles by EPA size classification. The first half of model year 1984 reported an increase of 0.2 cubic inches in engine size from the previous model year, for domestic and import automobiles combined. Among all of the size classes, minicompacts had the largest jump in engine size, from 97.8 cubic inches in model year 1983 to 150.3 cubic inches in the first half of model year 1984; an increase of 53.7%. This increase in sales-weighted average engine size can be attributed to the fact that the three minicompact cars with the largest engine sizes, Porsche's 928, 911 and 944, all septupled their market shares compared to the previous model year. (Again, recall the shift of Honda's Civic and Prelude to the subcompact category.) Consequently, the sales-weighted average engine size for domestic and import automobiles had a striking increase.

Domestic automobiles lost 4.5 cubic inches in engine size, from 203.5 cubic inches in model year 1983 to 199.0 in the first half of model year 1984. Engine sizes dropped in all domestic size classes from the previous model year, except for compacts. Import automobiles reported a jump of 3.8 cubic inches in engine size, from 116.4 cubic

inches in model year 1983 to 120.2 cubic inches in the first half of this model year. Although most of the size classifications of import automobiles experienced drops in engine size, the 52.5 cubic inch increase in the engine size in import minicompacts balanced the losses and netted the increase in engine size for the import automobiles in the first half of model year 1984.

Tables 38 to 40 present the sales-weighted average annual fuel costs of domestic and import combined, domestic automobiles, and import automobiles by EPA size classification. The annual fuel costs reported in EPA's Gas Mileage Guide were based on 15,000 miles of driving and the unit fuel prices which were estimated to reflect current fuel prices and economic situations. For example, the annual fuel costs for 1984 cars were based on a gasoline cost of $1.25 per gallon or diesel fuel at $1.20 per gallon, while the 1983 figures were based on $1.65 per gallon for gasoline or $1.50 per gallon for diesel. The sales-weighted average annual fuel cost for domestic and import automobiles dropped from $1,100 in model year 1983 to $830.0 in the first half of model year 1984. This was the first time since model year 1981 that the estimated annual fuel cost dropped below $1,000. All of the size classes decreased their annual fuel costs by at least 20% from the previous year, except for the minicompacts which increased its sales-weighted annual fuel cost by 7.1%.

Table 41 shows that retail diesel car sales in the first half of model year 1984 were merely 1.9% of the total automobile sales. This was the first time since model year 1979 that the market share of diesel cars fell below 2%. This also was the first year that Ford and Toyota started to produce diesel-powered vehicles. Comparing the first half of

both model years 1983 and 1984, the latter experienced dramatic drops in both market share and sales volume of diesel-powered vehicles, across all manufacturers. Audi reported a decrease of 19.0% in diesel car market share, from 19.3% in the first half of model year 1983 to 0.3% in the first half of model year 1984 (Table 41 and Figure 7). Isuzu also experienced a striking market shift away from the diesel cars, from 65.9% in the first half of model year 1983 to 11.2% in the same period of model year 1984.

Table 29
Sales Weighted Curb Weight of Domestic and Import Automobiles by Size Class
(lbs)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	2,117.5	2,366.9	3,053.7	3,284.3	3,765.9	2,696.8	3,002.8
80	2,157.3	2,273.2	2,817.2	3,083.4	3,667.0	2,714.6	2,799.4
81	1,919.8	2,370.5	2,348.5	2,995.4	3,671.8	2,583.0	2,741.7
82	2,002.1	2,301.7	2,397.0	2,991.6	3,702.8	2,524.8	2,727.0
83	2,072.3	2,333.9	2,431.5	3,026.5	3,779.0	2,662.5	2,787.1
84[a]	2,575.7	2,374.3	2,449.1	3,000.7	3,738.6	2,573.5	2,791.3

[a]Represents sales for the first 6 months of the model year (October through March).

Table 30
Sales Weighted Curb Weight of Domestic Automobiles by Size Class
(lbs)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	2,438.0	2,502.5	3,058.7	3,284.6	3,765.9	3,503.0	3,172.4
80	2,470.8	2,379.2	2,757.8	3,083.8	3,667.0	3,334.0	2,974.2
81	2,473.7	2,555.8	2,247.0	2,995.4	3,671.8	2,576.9	2,898.7
82		2,392.2	2,296.4	2,990.9	3,702.8	2,471.4	2,878.1
83		2,486.1	2,352.9	3,025.5	3,779.0	2,594.2	2,937.7
84[a]		2,508.7	2,410.5	2,998.9	3,738.6	2,578.3	2,901.8

[a]Represents sales for the first 6 months of the model year (October through March).

Table 31
Sales Weighted Curb Weight of Import Automobiles
by Size Class
(lbs)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	1,871.8	2,133.2	3,029.1	3,197.9		2,526.7	2,210.0
80	1,850.4	2,147.8	2,992.0	2,999.3		2,584.7	2,221.8
81	1,846.3	2,211.1	3,032.9			2,586.6	2,250.4
82	2,002.1	2,237.2	2,799.3	3,640.0		2,559.3	2,303.7
83	2,072.0	2,234.4	2,727.0	3,422.6		2,692.0	2,339.7
84[a]	2,575.7	2,264.9	2,591.4	3,104.3		2,569.4	2,397.6

[a]Represents sales for the first 6 months of the model year (October through March).

Table 32
Sales Weighted Interior Volume of Domestic and Import Automoiles by Size Class
(cubic feet)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	80.0	90.2	105.6	113.4	130.1		107.0
80	82.4	89.9	105.3	113.5	130.8		105.1
81	83.3	90.2	103.6	113.8	130.6		105.5
82	83.1	91.3	101.8	113.9	130.4		105.9
83	82.7	93.3	103.0	113.1	131.3		107.3
84[a]	75.3	93.7	103.0	113.4	130.6		107.9

[a]Represents sales for the first 6 months of the model year (October through March).

Table 33
Sales Weighted Interior Volume of Domestic Automobiles
by Size Class
(cubic feet)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	83.1	91.1	106.1	113.4	130.1		110.6
80	83.1	90.6	106.6	113.5	130.8		109.5
81	83.0	91.0	103.6	113.8	130.6		110.2
82		91.9	101.2	113.9	130.4		110.7
83		92.6	102.6	113.1	131.3		111.3
84[a]		93.8	102.8	113.3	130.6		110.9

[a]Represents sales for the first 6 months of the model year (October through March).

Table 34
Sales Weighted Interior Volume of Import Automobiles
by Size Class
(cubic feet)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	77.5	88.7	103.3	111.0			88.1
80	81.7	89.1	101.7	111.7			89.5
81	83.3	89.5	103.8				89.7
82	83.1	90.9	104.2	115.0			91.8
83	82.7	93.7	104.6	112.8			94.6
84[a]	75.3	93.8	103.9	113.8			96.7

[a]Represents sales for the first 6 months of the model year (October through March).

Table 35
Sales Weighted Engine Size of Domestic and Import Automobiles
by Size Class
(cubic inch)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	113.0	146.2	233.9	268.7	339.3	168.4	231.7
80	116.0	128.5	185.5	237.4	312.8	170.2	197.5
81	96.1	124.7	130.8	221.3	304.8	151.7	181.9
82	93.5	127.2	125.5	211.7	288.2	147.2	175.6
83	97.8	133.0	132.3	210.3	301.3	153.8	181.5
84[a]	150.3	134.8	134.5	208.9	296.9	155.2	181.7

[a]Represents sales for the first 6 months of the model year (October through March).

Table 36
Sales Weighted Engine Size of Domestic Automobiles
by Size Class
(cubic inch)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	139.4	171.6	249.9	269.1	339.3	350.0	257.9
80	138.9	146.7	200.7	237.8	312.8	350.0	223.7
81	139.5	142.5	129.3	221.3	304.8	192.6	204.7
82		148.8	123.2	211.7	288.2	167.8	197.5
83		164.3	131.7	210.3	301.3	206.2	203.5
84[a]		159.7	136.7	209.9	296.9	185.1	199.0

[a]Represents sales for the first 6 months of the model year (October through March).

Table 37
Sales Weighted Engine Size of Import Automobiles
by Size Class
(cubic inch)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	92.6	102.4	155.4	178.5		130.2	108.5
80	93.7	107.0	140.8	159.7		132.5	110.7
81	90.3	109.4	141.3			128.0	110.6
82	93.5	111.8	134.8	234.0		133.9	114.2
83	97.8	112.5	134.5	198.5		131.3	116.4
84[a]	150.3	114.5	126.3	151.4		129.4	120.2

[a]Represents sales for the first 6 months of the model year (October through March).

Table 38
Sales Weighted Average Annual Fuel Cost of Domestic and Import Automobiles by Size Class
(dollars)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	432.1	475.5	622.3	631.3	701.2	617.4	585.6
80	525.0	566.0	691.1	736.0	815.3	759.6	672.3
81	727.7	878.1	959.9	1,171.0	1,321.9	1,118.3	1,049.1
82	758.6	933.4	948.1	1,193.9	1,411.5	1,143.4	1,085.4
83	762.4	926.4	943.8	1,188.0	1,506.7	1,224.6	1,100.0
84[a]	816.4	708.8	704.7	904.6	1,106.7	832.5	830.0

[a]Represents sales for the first 6 months of the model year (October through March).

Table 39
Sales Weighted Average Annual Fuel Cost of Domestic Automobiles by Size Class
(dollars)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	491.7	499.1	637.9	631.2	701.2	765.2	614.1
80	582.1	601.0	703.6	736.0	815.3	964.0	710.5
81	584.9	920.8	939.3	1,171.0	1,321.9	1,126.6	1,107.2
82		1,001.6	935.9	1,193.7	1,411.5	1,091.4	1,151.5
83		1,061.4	938.5	1,188.0	1,506.7	1,181.1	1,174.2
84[a]		778.9	710.6	903.5	1,106.7	797.6	870.2

[a]Represents sales for the first 6 months of the model year (October through March).

Table 40
Sales Weighted Average Annual Fuel Cost of Import Automobiles by Size Class
(dollars)

Model year	Minicompact	Subcompact	Compact	Midsize	Large	Two seater	Fleet
79	386.4	434.7	545.8	659.8		586.3	452.3
80	469.0	524.6	653.5	744.2		715.9	545.6
81	746.7	841.4	1,099.1			1,113.4	867.3
82	758.6	885.7	995.1	1,455.0		1,209.0	896.7
83	762.4	838.1	963.5	1,184.5		1,243.3	880.1
84[a]	816.4	651.8	682.9	969.2		862.5	686.8

[a]Represents sales for the first 6 months of the model year (October through March).

Table 41
U.S. Retail Diesel Car Sales by Manufacturer, Model Years 1979–84

	Ford	General Motors	Volkswagen	Nissan	Mercedes Benz	Peugeot	Isuzu	Volvo	Audi	Toyota	Total diesel automobile sales	Percentage of total automobile sales
1979		126,959	70,730		35,655	7,916			910		242,170	2.2
1980		204,800	119,997		39,272	10,612		2,558	6,932		384,171	3.9
1981		300,238	115,380	4,949	46,210	13,189	6,649	3,056	6,706		496,377	5.6
1982		228,139	69,983	11,240	50,484	11,021	12,075	6,618	7,032		396,592	5.2
1983		105,291	32,333	6,511	55,907	6,243	8,822	6,836	7,892		229,835	3.0
1984[a]	15,814[b]	25,460	13,993	1,758	24,187	2,175	1,017	3,100	103	4,793	92,400	1.9
Percentage of manufacturers total sales												
1979		2.4	25.7		74.4	72.4			2.2			
1980		4.5	45.1		76.9	89.7		4.3	15.5			
1981		7.5	48.3	1.1	77.6	87.0	50.7	7.7	14.2			
1982		6.7	43.7	2.5	83.6	75.7	79.6	9.3	15.2			
1983		2.7	55.6	1.0	80.6	43.0	46.0	9.0	19.0			
1984[a]	1.7	1.1	15.5	0.8	61.4	24.5	11.2	6.8	0.3	1.8		

[a]Represents sales for the first 6 months of the model year (October through March).

[b]Ford includes some dealer orders.

Source: See Appendix B.

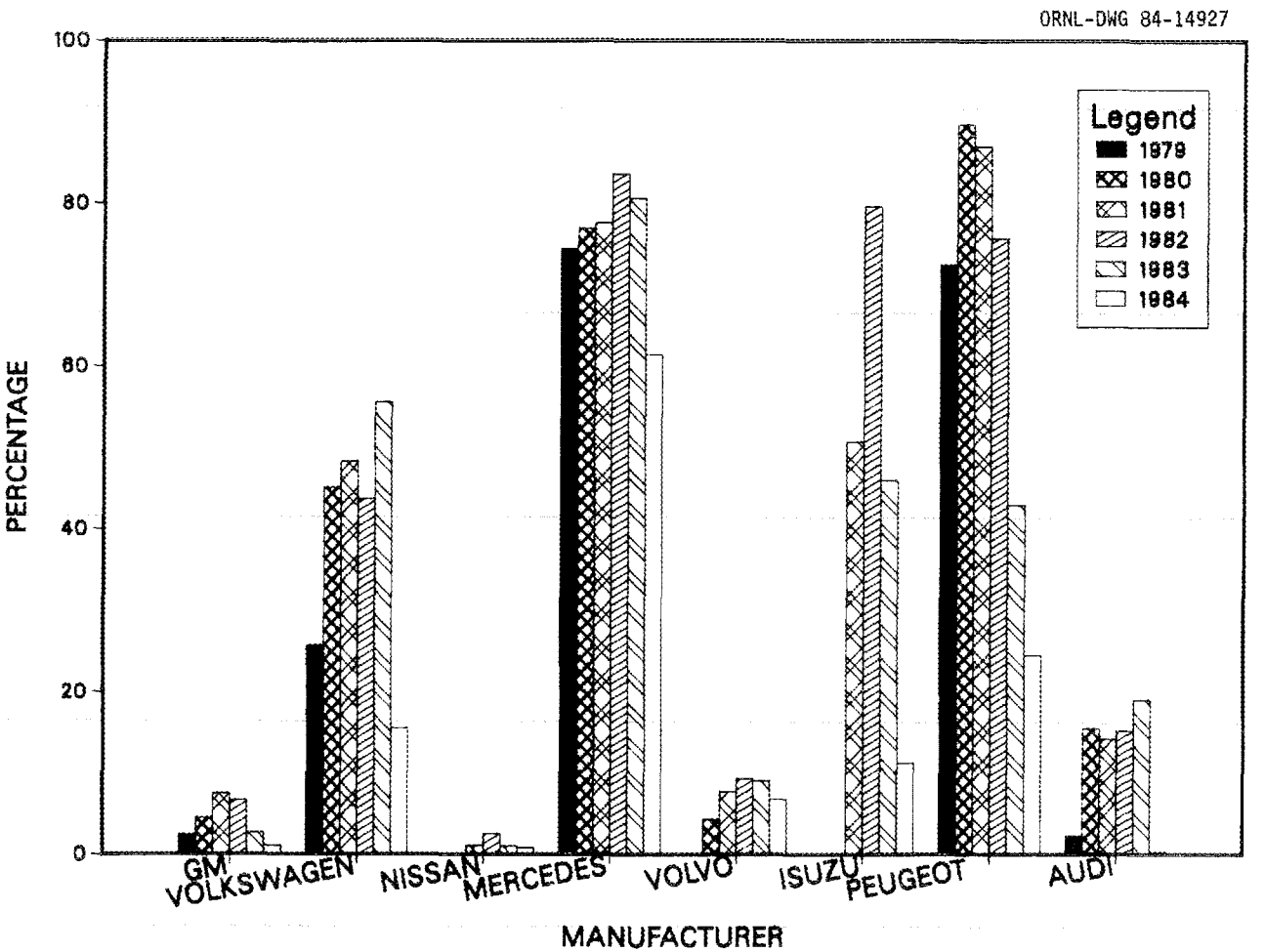

Fig. 7. Market Shares of Diesel Car by Manufacturer 1979–1984.

Appendix A

Glossary

- EPA size classifications for automobiles are derived by the interior size of each vehicle.

Automobile Classes

Minicompact — Less than 85 cubic feet of passenger and luggage volume.

Subcompact — Between 85 and 100 cubic feet of passenger and luggage volume.

Compact — Between 100 to 110 cubic feet of passenger and luggage volume.

Midsize — Between 110 to 120 cubic feet of passenger and luggage volume.

Large — 120 or more cubic feet of passenger and luggage volume.

Two seater — Cars designed to primarily seat two adults.

- Trucks are grouped by capacity in terms of gross vehicle weight.

Truck Classes

Small pickups — Trucks having gross vehicle weight ratings (GVWR, truck weight plus carrying capacity) under 4,500 pounds.

Standard pickup — Trucks having a GVWR of 4,500 to 8,500 pounds.

Special purpose vehicles — All other vehicles not in another car or truck class, e.g. Ford Bronco II, Dodge Caravan.

- Curb weight — Weight of a vehicle including all standard equipment, spare tire and wheel, plus all fluids and lubricants to capacity, full tank of gasoline, and the weight of major optional accessories normally found on the vehicle.

Appendix B

Data Sources of ORNL MPG and Market Share Data System

- Sales for domestic and domestic-sponsored automobiles:

  "Ward's Automotive Reports," monthly, Ward's Communication, Inc., Detroit, Mich.

- Sales for imported automobiles:

  "Ward's Automotive Reports," monthly, Ward's Communication, Inc., Detroit, Mich.

- Sales for diesel automobiles:

  "Ward's Automotive Reports," monthly, Ward's Communication, Inc., Detroit, Mich.

- Sales for light-duty trucks, domestic and import:

  "Ward's Automotive Reports," weekly, Ward's Communication, Inc., Detroit, Mich.

- Fuel economies, annual fuel cost, engine displacement, cylinder, transmission type, interior/truck spaces:

  "Gas Mileage Guide," annual, Environmental Protection Agency, Department of Energy.

- Wheel base, curb weight, length, width, height, price:

  "Automotive News Market Data Book," annual, Crain Communication, Inc., Detroit, Mich.

- EPA estimated new car fuel economy:

  "Light Duty Automotive Fuel Economy... Trends through 1983," J. D. Murrell et al., U.S. Environmental Protection Agency, SAE paper 830544, February 1982.

- EPA estimated 1984 new car fuel economy:

  "Passenger Car Fuel Economy... Trends through 1984," R. M. Heavenrich et al., U.S. Environmental Protection Agency, SAE paper 840499, February 1984.

- EEA new car fuel economy:

  "The Highway Fuel Consumption Model — Ninth Quarterly Report," Energy and Environmental Analysis, Inc., prepared for the U.S. Department of Energy, Washington, D.C., February 1983.

- Average fleet fuel economy:

  "Highway Statistics," Table VM-1, annual, U.S. Department of Transportation, Federal Highway Administration, Washington, D.C.

Appendix C

Nameplates by EPA Size Classification

Minicompact	Subcompact	Compact	Midsize	Large	Two seater
		Model year 1984			
Porsche 928†	AMC Spirit	AMC Concord	Audi 5000S*†	Buick Electra	Alfa Romeo†
Porsche 911†	Aston Martin†	AMC Renault Alliance	Buick Riviera	Buick LeSabre	Chevrolet Corvette
Porsche 944†	Audi Coupe†	AMC Renault Encore	Buick Century	Cadillac Limousine*	Fiat X 1/9†
Toyota Starlet†	Audi 4000†	Audi 5000†	Buick Regal	Cadillac DeVille	Fiat Spider†
Volkswagen Rabbit-Convertible†	Audi Quattro†	BMW 528I†	Cadillac Seville	Chevrolet	Ford EXP
Renault LeCar	Audi 4000S Quattro*†	BMW 733I†	Cadillac Eldorado	Ford LTD Crown Victoria	Honda Civic Coupe*†
	BMW 320 I†	Buick Riviera Convertible*	Chevrolet Malibu	Lincoln Town Car	Lotus†
	BMW 633 CSI†	Buick Skyhawk	Chevrolet Monte Carlo	Mercury Grand Marquis	Mazda RX-7†
	BMW 325*†	Buick Skylark (X-Car)	Chevrolet Citation (X-Car)	Oldsmobile 88	Mercedes Benz 380SL†
	Chevrolet Camaro	Cadillac Eldorado Convertible*	Chevrolet Celebrity	Oldsmobile 98	Mercury LN7
	Chevrolet Chevette	Cadillac Cimarron	Chrysler Cordoba	Pontiac	Nissan 300ZX*†
	Chrysler Laser	Chevrolet Cavalier	Chrysler Executive Sedan/Limousine*		Pontiac Fireo
	Chrysler LeBaron Convertible*	Dodge Omni	Chrysler Imperial		
	Dodge Challenger	Ford Tempo	Chrysler LeBaron		
	Dodge Conquest*†	Ford Thunderbird	Chrysler New Yorker 5th Ave		
	Dodge Daytona	Ford Escort	Chrysler New Yorker-E Class		
	Dodge Colt Hatchback†	Mazda 626†	Dodge Diplomat		
	Dodge Charger 024	Mercedes Benz 240D†	Dodge Aires		
	Dodge 600 Convertible*	Mercedes Benz 300SD†	Dodge 600		
	Ford Mustang	Mercedes Benz 300D/300CD†	Dodge 400		
	Honda Accord-American	Mercedes 500SEC*†	Dodge Mirada		
	Honda Civic†	Mercedes 380SE*†	Ford LTD 83		
	Honda Accord†	Mercury Topaz	Lincoln Continental		
	Honda Prelude†	Mercury Cougar XR-7	Lincoln Mercury Mark VII*		
	Isuzu†	Mercury Lynx	Mercedes Benz 380SEL†		
	Isuzu Impulse†	Nissan Stanza†	Mercury Marquis		
	Jaguar XJ/XJS†	Oldsmobile Omega (X-Car)	Oldsmobile Toronado		
	Lancia Beta†	Oldsmobile Firenza	Oldsmobile Supreme		
	Mazda GLC†	Peugeot 604†	Oldsmobile Ciera		
	Mercedes Benz 190D 2.2†	Peugeot 505†	Plymouth Gran Fury		
	Mercedes Benz 190E 2.3*†	Plymouth Horizon	Plymouth Reliant		
	Mercury Capri	Pontiac J2000	Pontiac Bonneville		
	Mitsubishi Cordia†	Rolls Royce Camargue†	Pontiac Grand Prix		
	Mitsubishi Precis†	Saab 900†	Pontiac Phoenix (X-Car)		
	Mitsubishi Starion†	Toyota Corolla†	Pontiac A6000		
	Mitsubishi Tredia†	Toyota Camry†	Rolls Royce Silver Spirit†		
	Nissan Sentra†	Volkswagen Quantum†	Volvo 760GLE†		
	Nissan 200SX†	Volvo Diesel Sedan†			
	Nissan Maxima†	Volvo DL†			
	Nissan Pulsar†	Volvo GL†			
	Nissan Pulsar NX†	Volvo GLT†			
	Nissan 300ZX 2+2†*				
	Plymouth Conquest (Sapparo)†				
	Plymouth Arrow Champ†				
	Plymouth Turismo (TC3)				
	Pontiac Firebird				
	Pontiac Sunbird Convertible*				
	Pontiac T1000				
	Renault 18I†				
	Renault Fuego†				
	Rolls Royce Corniche†				
	Subaru†				
	Toyota Celica†				
	Toyota Cressida†				
	Toyota Supra†				
	Toyota Tercel†				
	Toyota Corrolla Sport*†				
	Volkswagen Rabbit-American				
	Volkswagen Scirocco†				
	Volkswagen Jetta†				

Minicompact	Subcompact	Compact	Midsize	Large	Two seater
		Change size class in model year 1984			
Honda Civic* Honda Prelude*	Honda Civic** Honda Prelude** Toyota Corolla*	Toyota Corolla**			
		Nameplates discountined from model year 1983 to 1984			
Porsche 924	Mitsubishi Sapporo Volkswagen Dasher	Mercury Cougar	Ford Granada Ford Fairmont Mercury Zephyr	Lincoln Continental Mark VI	Nissan 280ZX Pontiac Catalina
		Model year 1983			
		New nameplates for model year 1983			
Porsche 944	Audi Quatro Chrysler Laser Dodge Daytona Isuzu Impulse Mercedes Benz 190D2.2 Mitsubishi Cordia Mitsubishi Starlo Mitsubishi Tredia Nissan Pulsar Nissan Pulsar NX	Ford Tempo Mercury Topaz Renault Alliance Renault Encore Volvo GLT	Chrysler New Yorker-E Class Dodge 600 Ford LTD 83 Mercury Marzuis	Lincoln Town Car	Pontiac Catalina Pontiac Fiero
		Changed size class in model year 1983			
Volkswagen Rabbit-Convertible**	Mazda 626* Oldsmobile Firenza* Toyota Camry* Volkswagen Rabbit-Convertible*	Ford Thunderbird** Mazda 626** Mercury Cougar** Mercury XR-7** Oldsmobile Firenza** Toyota Camry** Volvo 760 GLE*	Ford Thunderbird* Mercury Cougar* Mercury XR-7* Volvo 760 GLE**		
		Nameplates discontinued from model year 1982 to 1983			
Volkswagen Convertible	Datsun 210 Datsun 310 Datsun 810 Fiat Brava	Datsun 510 Fiat Strada	Checker		
		Model year 1982			
		New nameplates for model year 1982			
	Oldsmobile Firenza Renault Fevgo	Cadillac Cimarron Chevrolet Cavalier Peugeot 604 Pontiac J-2000 Volkswagen Quantum	Chevrolet Celebrity Chrysler New Yorker Dodge 400 Pontiac A6000		Ford EXP Mercury LN7
		Changed size class in model year 1982			
	BMW 528I** Datsun 510** Jaguar*	BMW 528I* Datsun 510* Jaguar**	Gran Fury** Lincoln Continental**	Gran Fury* Lincoln Continental*	
		Nameplates discontinued from model year 1981 to 1982			
Ford Pinto Mercury Bobcat Plymouth Arrow	Chevrolet Monza Ford Fiesta Pontiac Sunbird	AMC Pacer JRT Rover Mercury Versailles	Dodge Aspen Plymouth Volare Pontiac LeMans	Chrysler Dodge St. Regis	JRT MG JRT Triumph

Minicompact	Subcompact	Compact	Midsize	Large	Two seater
		Model year 1981			
		New nameplates for model year 1981			
Porsche 911 Porsche 924 Toyota Starlet	Isuzu Pontiac T-1000 Renault 18i	Ford Escort Mercury Lynx	Chrysler Imperial Dodge Aires Mercury Cougar Plymouth Reliant		
		Changed size class in model year 1981			
	Dodge Omni-024** Plymouth Horizon**	Dodge Omni* Plymouth Horizon* Ford Granada* Saab 900*	Ford Granada** Saab 900**		Ford EXP Mercury LN7
		Nameplates discontinued from model year 1980 to 1981			
	Buick Skyhawk Oldsmobile Starfire	Mercury Monarch Volvo GLE			
		Model year 1980			
		New nameplates for model yera 1980			
Honda Prelude	AMC Spirit Audit 4000 Toyota Tercel Volkswagen Jetta		Dodge Mirada Mercury Cougar XR-7	Plymouth Gran Fury	
		Changed size classes in model year 1980			
Datsun 200SX** Dodge Colt** Subaru**	Datsun 200SX* Dodge Colt* Subaru* BMW 528I*	BMW 528I** Cadillac Seville**	Cadillac Seville* Continental Mark V**	Continental Mark VI*	
		Nameplates discontinued from model year 1979 to 1980			
Renault Gordini	Audi Fox Buick Opel Fiat 128	Chevrolet Nova Peugeot 504	Dodge Magnum Ford LTD II		Porsche 930

*New nameplate for model year.

†Imported nameplates.

'Old size classification.

**New size classification.

Appendix D

Methodology for Sales-Weighted Estimates

The ORNL MPG and Market Share Data System, under the sponsorship of the Office of Vehicle and Engine Research and Development, DOE, monitors changes in the composition of new car sales and in sales-weighted fuel efficiencies. Monthly sales statistics, fuel economies, engine/transmission configurations and other vehicle characteristics for each of the nameplates in a given model year are maintained in the data base system. For some imports (Volvo, Mercedes Benz, BMW, Fiat) and standard size light trucks (GM C-10, GM C-20, Ford F100/F150, Chevrolet C-10, Chevrolet C-20), only manufacturers' monthly sales totals are available. In order to allocate the sales data to specific makes and models for these vehicles, the previous year's model sales are used to estimate the detailed monthly sales data by make and model.

Monthly sales data are reported by make and model while EPA estimated fuel economies (mpg) are broken down by engine size and transmission type within a given make and model. Prior to 1983, an unweighted harmonic mean of fuel economies was calculated and reported in all the previous publications. A numerical example is given to illustrate how the unweighted fuel economy for a given nameplate was calculated:

(1) Information from the Gas Mileage Guide for each nameplate is entered by engine/transmission configurations as follows:

Chevrolet Chevette

Combined MPG	Engine description		Type	Transmission
	CID	CYL		
36	98	4	FFS	M5
32	98	4	FFS	A3
35	98	4	FFS	M4
48	111	4	CAL•DIESEL	M5
49	111	4	DIESEL	M5
40	111	4	DIESEL	A3

(2) Because sales data are only available for a given nameplate and not by specific engine/transmission configuration, the unweighted harmonic mean of fuel economy for Chevrolet Chevette was calculated as:

$$\left[\frac{1/36 + 1/32 + 1/35 + 1/48 + 1/49 + 1/40}{6}\right]^{-1} = 39 \text{ mpg} .$$

This estimated fuel economy could reflect mpg changes due to sales shifts across models or changes in EPA size classes quite accurately. However, it could not capture the effect of how shifting to a more efficient engine/ transmission type within a given nameplate will change the fuel economy.

Prior to model year '83, this unweighted harmonic averaging was used to compute all fuel economy numbers reported in the Motor Vehicle MPG and Market Shares Report. Estimates made in 1982 showed that the error introduced by this approximation was small (Motor Vehicle MPG and Market Shares, 81/4, March 1982, pp. 38-40).

By 1983, however, it had become apparent that the unweighted approach was producing unreliable estimates of make and model fuel economy. The primary reason for this was the high number of diesel

options available combined with the relatively low sales for these vehicles. ORNL solved this problem by estimating the sales percentages for the individual engine and transmission combinations. The fuel economy of a nameplate is therefore estimated by weighting the individual fuel economies of each engine/ transmission combination by the corresponding sales percentages.

Since sales data are not available at the engine/transmission level, the sales percentages by engine/transmission combination are estimated based on the percentage breakdown by engine type and on the percentage breakdown by transmission type of factory installations. From Ward's Automotive Reports, the marginal totals for % factory-installed equipment data are available to form the marginal totals of a matrix of engine vs. transmission type, such as:

Engine Type \ Transmission Type	M4	M5	A3	% installed
Gasoline				E1
Diesel				E2
% installed	T1	T2	T3	

Where it is known that engine/transmission combinations do not exist, a zero is inserted in the appropriate cell (e.g. E2, T1). By employing the iterative proportional fitting procedure, the percentages of each engine/transmission combination installed can be estimated based on the known marginal percentages E1, E1, T1, T2 and T3. Upon completion of

this estimating procedure, the sales percentages for each engine/ transmission combinations can be obtained by multiplying the nameplate's total sales by the corresponding percentages of engine/ transmission combinations installed by the factory. The fuel economy of the nameplate can then be estimated by weighting the fuel economies by the corresponding sales percentages at each engine/transmission combination level.

For Chevrolet Chevette, the marginal totals of % factory-installed equipment are as follows:

		Transmission Type			
		M4	M5	A3	% installed
Engine Type	Gasoline				98.8
	Diesel				1.2
	% installed	33.8	4.2	62.0	

Applying iterative proportional fitting to this table yields the following estimated installation percentages:

		Transmssion Type			
		M4	M5	A3	% installed
Engine Type	Gasoline	33.8	3.54	61.46	98.8
	Diesel	0.0	0.66	0.54	1.2
	% installed	33.8	4.2	62.0	

Since no information is available on the split between California and non-California diesel sales, the 0.66 is split evenly between them.

Using these installation percentages as weights, the sales-weighted harmonic mean of fuel economy for Chevrolet Chevette is obtained by:

$$\left[\frac{0.0345 * (1/36) + 0.6146 * (1/32) + \ldots + 0.0054 * (1/40)}{(0.0345 + 0.6146 + 0.338 + 0.0033 + 0.0033 + 0.0054)}\right]^{-1} = 33 \text{ mpg}$$

Currently this technique is applied only to domestic and imported automobiles. Application to light trucks is complicated by the wide range of engine and transmission combinations and by the lack of sufficiently detailed information on installations.

Appendix E

Analysis of Fuel Economy Changes

The total change in fuel economy from one model year to the next can be thought of as composed of shifts in sales from one type of vehicle to another, introductions or discontinuations of vehicle types, and improvements in the fuel economy of continued vehicle types. For example, an increase in sales of larger, less efficient cars, or of configurations with less efficient larger engines and automatic transmissions will tend to depress new car fuel economy. At the same time, however, manufacturers may introduce new, more efficient models and discontinue older, less efficient ones or may employ engineering and design changes such as lock-up automatic transmissions, or lighter materials, which tend to improve vehicle fuel economy. With enough data on vehicle sales and fuel economies it is possible to identify and measure each component.

The first step is to define vehicle types. This can be done in any number of ways but defining meaningful vehicle types is key to the usefulness of the results. Three, hierarchical levels of vehicle types will be used:

1. size class, as defined by EPA interior volume,
2. nameplate, e.g. Chevette, Escort, Reliant, etc.
3. configuration, an engine-transmission combination within a nameplate.

Thus, the smallest unit in the analysis is a configuration of a nameplate, e.g. a four cylinder diesel Rabbit with a four-speed manual

transmission. Since this is the level at which the EPA certifies vehicles' fuel economies it is a logical choice for the basic unit.

Since neither all nameplates nor all configurations will be the same from one year to the next, it will be useful to define three sets of vehicles for the analysis. Let,

V — be the set of all (nameplate) configurations existing in either year t or t-1. This is the universe of configurations;

C — be the subset of V containing all configurations of nameplates which continue from year t-1 to year t;

C′ — be the subset of C containing all configurations which continue from one year to the next.

Total fuel economy change must be calculated on the set V, including all vehicle configurations. It makes sense to compute nameplate and configuration sales shifts only over the sets C (continued nameplates) and C′ (continued configurations), respectively. Size class sales shifts could be computed over V or C. We choose to compute the effect of size class shifts over C only. As a result, size class shifts associated with the introduction or discontinuation of nameplates will be attributed to nameplate changes. The purpose is to make a clearer distinction between consumer choice effects, and those due to changes in the range of options offered to consumers.

The analysis of fuel economy changes will be carried out in terms of gallons per mile rather than miles per gallon to simplify the arithmetic. The mean of different gallons per mile is the arithmetic mean, while the mean of miles per gallon is the harmonic mean.

The following definitions are required.

E — vehicle efficiency in gallons per mile,

ΔE — change in efficiency from year t-1 to t,

S_{Kt} — is nameplate K's share of total sales in year t

f_{iKt} — is configuration i's share of nameplate K's sales in year t,

i — indexes configurations,

K — indexes nameplates

(Note that, $\sum_i f_{iKt} = 1$, and $\sum_K S_{Kt} = 1$),

ℓ — indexes size classes,

t — indexes years.

The decomposition of efficiency changes is represented in Figure E-1. The total efficiency change can be partitioned into two vehicle sets: 1) continued, and 2) discontinued or new nameplates. For continued nameplates it is possible to break out the change due to changes in the nameplate sales mix versus the combined effect of efficiency improvements and the configuration sales mix. The nameplate sales mix effect can be further decomposed into a size class sales shift effect. The efficiency and configuration effect can be partitioned into two sets: 1) continued, and 2) discontinued or new configurations. For continued configurations, the change in efficiency can be decomposed into a configuration sales shift effect and a configuration efficiency effect.

Sales shifts effects are always computed by holding fuel efficiency constant at last year's level (for each configuration) and contrasting this year's sales distribution with last year's. Thus all changes in efficiency within a continued configuration are attributed to efficiency improvement. The mathematical derivation, following the steps in Figure E-1, is provided below.

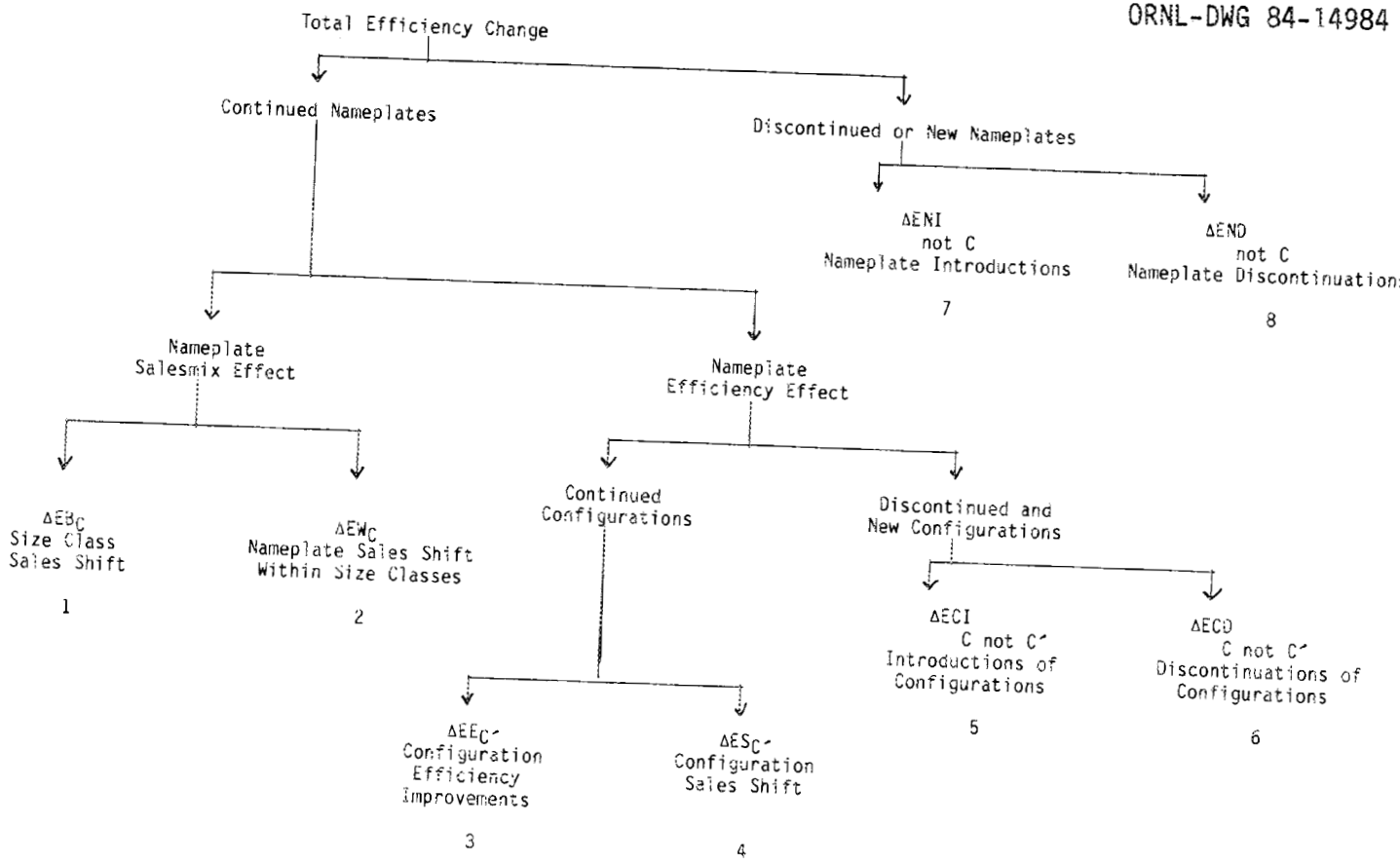

Fig. E-1. Decomposition of Efficiency Changes.

TOTAL CHANGE IN EFFICIENCY

$$\Delta E = \sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt} - \sum_{iK}\sum S_{Kt-1} f_{iKt-1} E_{iKt-1} \qquad (1)$$

$$= E_t - E_{t-1} \qquad (1a)$$

(1a) states that the overall annual efficiency is a salesweighted average of configuration efficiencies.

CONTINUED NAMEPLATES' EFFICIENCY CHANGE

Considering only the set C, ΔE_C can be decomposed into two components:

$$\Delta E_C = \left(\sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt} - \sum_{iK}\sum S_{Kt} f_{iKt-1} E_{iKt-1}\right) + \left(\sum_{iK}\sum S_{Kt} f_{iKt-1} E_{iKt-1} - \sum_{iK}\sum S_{Kt-1} f_{iKt-1} E_{iKt-1}\right) . \qquad (2)$$

The first and last summation terms are identical to those in (1) except that only nameplates offered in both t and t-1 are included. A term including this year's nameplate sales shares but last year's nameplate effficiencies has been subtracted from the first component and added to the last component so that its net effect is zero. The first part of (2) represents the nameplate efficiency improvement effect, the second part of the nameplate sales mix effect.

SIZE CLASS SALES AND NAMEPLATE SHIFT EFFECTS

The second part of (2) can be further decomposed into size class sales shift and within size class nameplate sales shift effects. First, define

$$\bar{E}_{Kt-1} = \sum_i f_{iKt-1} E_{iKt-1}$$

as the average fuel consumption rate for nameplate K in year t-1. Summing over i, the second term of (2) becomes

$$\sum_K S_{Kt} \bar{E}_{Kt-1} - \sum_K S_{Kt-1} \bar{E}_{Kt-1} \cdot$$

Now split the sum over K into a set of sums for each size class ℓ

$$\sum_\ell \sum_{K\epsilon\ell} S_{Kt} \bar{E}_{Kt-1} - \sum_K S_{Kt-1} \bar{E}_{Kt-1} \cdot$$

Note that $\sum_{K\epsilon\ell} S_{Kt}$ is the size class share of total car sales in year t. Then $S_{Kt} / \sum_{K\epsilon\ell} S_{Kt}$ is nameplate K's share of size class ℓ's sales. We can then write,

$$\sum_\ell \left(\frac{\sum_{K\epsilon\ell} S_{Kt}}{\sum_{K\epsilon\ell} S_{Kt}} \right) \sum_{K\epsilon\ell} S_{Kt} \bar{E}_{Kt-1} - \sum_\ell \left(\frac{\sum_{K\epsilon\ell} S_{Kt-1}}{\sum_{K\epsilon\ell} S_{Kt-1}} \right) \sum_{K\epsilon\ell} S_{Kt-1} \bar{E}_{Kt-1}$$

or, rearranging

$$\sum_\ell \left(\sum_{K\epsilon\ell} S_{Kt} \right) \sum_{K\epsilon\ell} \frac{S_{Kt}}{\sum_{K\epsilon\ell} S_{Kt}} \bar{E}_{Kt-1} - \sum_\ell \left(\sum_{K\epsilon\ell} S_{Kt-1} \right) \sum_{K\epsilon\ell} \frac{S_{Kt-1}}{\sum_{K\epsilon\ell} S_{Kt-1}} \bar{E}_{Kt-1} \cdot$$

Adding and subtracting a term which contains this year's sales mix across size classes and last year's sales mix within size classes and fuel economy,

$$\sum_\ell \left(\sum_{K\epsilon\ell} S_{Kt} \right) \sum_{K\epsilon\ell} \frac{S_{Kt-1}}{\sum_{K\epsilon\ell} S_{Kt-1}} \bar{E}_{Kt-1}$$

we get,

$$\Delta ES_C = \left(\sum_{\ell}\left(\sum_{K\epsilon\ell} S_{Kt}\right)\sum_{K\epsilon\ell}\frac{S_{Kt}}{\sum_{K\epsilon\ell} S_{Kt}}\bar{E}_{Kt-1} - \sum_{\ell}\left(\sum_{K\epsilon\ell} S_{Kt}\right)\sum_{K\epsilon\ell}\frac{S_{Kt-1}}{\sum_{K\epsilon\ell} S_{Kt-1}}\bar{E}_{Kt-1}\right)$$

$$+\left(\sum_{\ell}\left(\sum_{K\epsilon\ell} S_{Kt}\right)\sum_{K\epsilon\ell}\frac{S_{Kt-1}}{\sum_{K\epsilon\ell} S_{Kt-1}}\bar{E}_{Kt-1} - \sum_{\ell}\left(\sum_{K\epsilon\ell} S_{Kt-1}\right)\sum_{K\epsilon\ell}\frac{S_{Kt-1}}{\sum_{K\epsilon\ell} S_{Kt-1}}\bar{E}_{Kt-1}\right) . \quad (3)$$

The first part of equation (3) is the change in fuel efficiency due to nameplate sales shifts within size classes. The only term which differs is the nameplate share of size class sales.

The second part of (3) represents the effect of size class sales shifts. The only terms which differ are the size class shares of total sales. Note that the sales shares of all continued nameplates may be different in years t and t-1. This could result in confusion of size class sales shifts and the effect of different sales shares for new introductions versus discontinued models. A correction for this effect will be introduced when nameplate introductions and discontinuations are considered below.

CONFIGURATION SHIFT EFFICIENCY CHANGE

The first part of equation (2) includes configuration shifts, introductions and discontinuations of configurations, and efficiency improvements for a given configuration. Consider the subset of C which include only those configurations which continue from year t-1 to year t, namely C′. For this subset only, configuration sales shifts and efficiency improvement effects can be calculated.

Add and subtract the following from the first part of (2)

$$\sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt-1} \ ,$$

to get

$$\Delta E_{C'} = \left(\sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt} - \sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt-1}\right) + \left(\sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt-1} - \sum_{iK}\sum S_{Kt} f_{iKt-1} E_{iKt-1}\right) \cdot \tag{4}$$

The first part of (4) differs only in the configuration efficiency terms and so represents the effect of configuration efficiency improvements from t-1 to t. The second term differs only in configuration sales shares and so represents only that effect. However the sum of sales share weights in the first and second parts of the second term are not necessarily equal.

INTRODUCTIONS AND DISCONTINUATIONS OF CONFIGURATIONS

In computing $\Delta E_{C'}$ in (4) newly introduced or discontinued configurations of continued nameplates were excluded. To calculate the effect of configuration introductions or deletions we compute the first part of (2) using configurations in the set C but not C'.

$$\Delta EC_{\text{C not C'}} = \sum_{\substack{iK \\ \text{C not C'}}}\sum S_{Kt} f_{iKt} E_{iKt} - \sum_{\substack{iK \\ \text{C not C'}}}\sum S_{Kt} f_{iKt-1} E_{iKt-1} \cdot \tag{5}$$

This is equivalent to subtracting (4) from the first part of (2) since (2) is performed over all configurations of continued nameplates (C) while (4) is performed over continued configurations (C') only.

In equation (5) the sales share weights in the first and second terms will in general not be equal. As a result changes in the total sales share of new versus discontinued configurations could confuse the interpretation of this term. To prevent this, the term is split into separate introduction and discontinuation effects by adding the term,

$$- \sum_{\substack{iK \\ C \text{ not } C'}} S_{Kt} f_{iKt} \bar{E}_{Kt-1} + \sum_{\substack{iK \\ C \text{ not } C'}} S_{Kt} f_{iKt-1} \bar{E}_{Kt-1} \qquad (6)$$

and splitting equation (5) into two separate effects.

Introductions

$$\sum_{\substack{iK \\ C \text{ not } C'}} S_{Kt} f_{iKt} E_{iKt} - \sum_{\substack{iK \\ C \text{ not } C'}} S_{Kt} f_{iKt} \bar{E}_{Kt-1} \qquad (7)$$

Discontinuations

$$\sum_{\substack{iK \\ C \text{ not } C'}} S_{Kt} f_{iKt-1} \bar{E}_{Kt-1} - \sum_{\substack{iK \\ C \text{ not } C'}} S_{Kt} f_{iKt-1} E_{iKt-1} \cdot \qquad (8)$$

Since equation (6) is not zero, it must be subtracted from some other term in the equation set to preserve the property that the sum of all terms equals the total change in efficiency. Subtracting it from the configuration sales shift effect [the second term of equation (4)] makes a correction to that equation for any change in the sales share of continued configuration.

Sales shifts

$$\Delta ES_{C'} = \sum_{\substack{iK \\ C'}} \sum S_{Kt} f_{iKt} E_{iKt-1} + \sum_{\substack{iK \\ C \text{ not } C'}} \sum S_{Kt} f_{iKt} \bar{E}_{Kt-1}$$

$$- \left(\sum_{\substack{iK \\ C \text{ not } C'}} \sum S_{Kt} f_{iKt-1} \bar{E}_{Kt-1} + \sum_{\substack{iK \\ C'}} \sum S_{Kt} f_{iKt-1} E_{iKt-1} \right) .$$

NAMEPLATE INTRODUCTIONS AND DISCONTINUATIONS

Finally, it remains to compute the effect of introductions and discontinuations of nameplates. Involved with the introduction or removal of these new products may be size class shifts, nameplate shifts, configuration shifts, and engineering and design improvements. We are comparing two bundles of commodities: 1) newly introduced vehicles, and 2) discontinued models. This term, together with the corresponding term for configurations, represent actions that vehicle producers have taken to respond to the market demand for or regulations requiring fuel economy improvement.

This effect is computed by subtracting the total efficiency change for continued nameplates from that for all nameplates.

$$\Delta EN = \Delta E - \Delta E_C \ . \tag{9}$$

This is what would be obtained by calculating the total efficiency change for all vehicles not in the set C.

$$\Delta EN = \sum_{\substack{iK \\ \text{not in } C}} \sum S_{Kt} f_{iKt} E_{iKt} - \sum_{\substack{iK \\ \text{not in } C}} \sum S_{Kt-1} f_{iKt-1} E_{iKt-1} \ . \tag{9a}$$

(Note that the first and second terms of (9a) contain no common nameplates.) Once again, however, the sum of sales shares will not be equal in the first and second terms. A correction for this is introduced below which also involves a correction for a related problem in the size class sales shift effect.

SEPARATION OF INTRODUCTIONS AND DELETIONS EFFECTS AND CORRECTION OF SIZE CLASS SHIFT EFFECT

Two of the efficiency change effects compare sales shares which may not be the same from one year to the next. The size class sales shift effect compares sales shares in year t for nameplates which continued from year t-1 to t, with the sales share of these vehicles in year t-1. The nameplate introductions and discontinuations effect similarly contrasts the market share of new introduction in year t with that of discontinued models in year t-1. This is problematic since if the sales shares of new introductions differ substantially from those of discontinued nameplates, that sales shift could mask efficiency differences. A solution to this problem can be obtained by splitting introduction and discontinuation effects into separate factors, while at the same time adding factors to the size class share effect which, in a sense, complete the shares.

It is convenient to first simplify notation.

Let,

$$S_{\ell t} = \sum_{K \in \ell} S_{Kt} \ ,$$

$$\bar{E}_{\ell t-1} = \sum_{K \in \ell} \frac{S_{Kt-1}}{\sum_{K \in \ell} S_{Kt-1}} \bar{E}_{Kt-1}$$

and

$$\overline{E}_{\substack{t-1 \\ \text{in } C}} = \sum_{\substack{K \\ \text{in } C}} \frac{S_{Kt-1}}{\sum_{\substack{K \\ \text{in } C}} S_{Kt-1}} \overline{E}_{Kt-1} \cdot$$

$S_{\ell t}$ is the sales share of size class ℓ in year t (for continued nameplates only if we sum over the set C). $\overline{E}_{\ell t}$ is the average efficiency of size class ℓ (in gallons per mile) and $\overline{E}_{\substack{t-1 \\ \text{in } C}}$ is the average efficiency in year t-1 of all continued nameplates.

The efficiency improvement of introductions can be measured by comparing their sales share weighted efficiency to that of continued nameplates in year t-1.

Introductions effect

$$\sum_{\substack{K \\ \text{not } C}} S_{Kt}\overline{E}_{Kt} - \left(\sum_{\text{not } C} S_{Kt}\right) \overline{E}_{\substack{t-1 \\ \text{in } C}} \quad .$$

Likewise, the share weighted efficiency of discontinued nameplates can be contrasted with that of continued nameplates in t-1.

Discontinuations effect

$$\left(\sum_{\substack{K \\ \text{not } C}} S_{Kt-1}\right) \overline{E}_{\substack{t-1 \\ \text{in } C}} - \left(\sum_{\text{not } C} S_{Kt-1}\overline{E}_{Kt-1}\right) \quad .$$

In each, the share weighted efficiency of nameplates not in the set of continued nameplates in each year is compared with an equal share weight times the efficiency of continued nameplates in year t-1. By so doing we have added another quantity to the total efficiency change:

$$\left(\sum_{\substack{K \\ \text{not } C}} S_{Kt}\right) \overline{E}_{\substack{t-1 \\ \text{in } C}} - \left(\sum_{\substack{K \\ \text{not } C}} S_{Kt-1}\right) \overline{E}_{\substack{t-1 \\ \text{in } C}} .$$

In order that the sum of all terms equals exactly the total efficiency change, the additional term must be subtracted from some term. Subtracting it from the size class sales shift effect adjusts that effect for the difference in sales shares of continued nameplates between t-1 and t. The adjusted size class sales shift effect is,

$$\Delta EB' = \left(\sum_{\substack{\ell \\ \text{in } C}} S_{\ell t} \overline{E}_{\ell t-1} + \left(\sum_{\substack{K \\ \text{not } C}} S_{Kt}\right) \overline{E}_{\substack{t-1 \\ \text{in } C}}\right)$$

$$- \left(\sum_{\substack{\ell \\ \text{in } C}} S_{\ell t-1} \overline{E}_{\ell t-1} + \left(\sum_{\substack{K \\ \text{not } C}} S_{Kt-1}\right) \overline{E}_{\substack{t-1 \\ \text{in } C}}\right) .$$

By multiplying and dividing the second term of $\Delta EB'$ by

$$S_{Ct-1} = \sum_{\substack{\ell \\ \text{in } C}} S_{\ell t-1}$$

it is easy show that it equals $\overline{E}_{\substack{t-1 \\ \text{in } C}}$, since

$$\sum_{\substack{K \\ \text{not } C}} S_{Kt-1} = 1 - S_{Ct-1} .$$

Similarly by muliplying and dividing the first term of $\Delta EB'$ by S_{Ct} we get,

$$S_{Ct} \left(\sum_{\substack{\ell \\ \text{in } C}} \frac{S_{\ell t}}{S_{Ct}} \overline{E}_{\ell t-1}\right) + (1 - S_{Ct}) \overline{E}_{\substack{t-1 \\ \text{in } C}} .$$

Let,

$$\overline{E}'_{\substack{t-1 \\ \text{in } C}} = \sum_{\substack{\ell \\ \text{in } C}} \frac{S_{\ell t}}{S_{Ct}} \overline{E}_{\ell t-1}$$

$\overline{E}'_{\substack{t-1 \\ \text{in } C}}$ is equivalent to $\overline{E}_{\substack{t-1 \\ \text{in } C}}$, except that year t size class shares are used as weights.

Thus, we have

$$\Delta EB' = S_{Ct}\left(\overline{E}'_{\substack{t-1 \\ \text{in } C}} - \overline{E}_{\substack{t-1 \\ \text{in } C}}\right) .$$

The size class sales shift effect is thus the difference between the average efficiency of continued nameplates in year t-1 and what that efficiency would be using year t size class shares, weighted by the sales share of continued nameplates in year t.

SUMMARY

The eight components of efficiency change derived above are summarized below. Summing all components will return the total change in efficiency, ΔE, (1).

1. Size class sales shift

$$\Delta EB_C = \left(\sum_{\substack{\ell \\ \text{in } C}} S_{\ell t}\overline{E}_{\ell t-1} + \left(\sum_{\substack{K \\ \text{not } C}} S_{Kt}\right)\overline{E}_{\substack{t-1 \\ \text{in } C}}\right)$$

$$- \left(\sum_{\substack{\ell \\ \text{in } C}} S_{\ell t-1}\overline{E}_{\ell t-1} + \left(\sum_{\substack{K \\ \text{not } C}} S_{Kt-1}\right)\overline{E}_{\substack{t-1 \\ \text{in } C}}\right) .$$

2. Nameplate sales shift within size classes

$$\Delta EW_C = \sum_{\ell}\left(\sum_{K\epsilon\ell} S_{Kt}\right) \sum_{K\epsilon\ell} \frac{S_{Kt}}{\sum_{K\epsilon\ell} S_{Kt}} \bar{E}_{Kt-1} - \sum_{\ell}\left(\sum_{K\epsilon\ell} S_{Kt}\right) \sum_{K\epsilon\ell} \frac{S_{Kt-1}}{\sum_{K\epsilon\ell} S_{Kt-1}} \bar{E}_{Kt-1} \cdot$$

3. Configuration efficiency improvements

$$\Delta EE_{C'} = \sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt} - \sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt-1} \cdot$$

4. Configuration sales shift

$$\Delta ES_{C'} = \left(\sum_{iK}\sum S_{Kt} f_{iKt} E_{iKt-1} + \sum_{\substack{iK \\ C \text{ not } C'}}\sum S_{Kt} f_{iKt} \bar{E}_{Kt-1}\right)$$

$$- \left(\sum_{\substack{iK \\ C \text{ not } C'}}\sum S_{Kt} f_{iKt-1} \bar{E}_{Kt-1} + \sum_{iK}\sum S_{Kt} f_{iKt-1} E_{iKt-1}\right) \cdot$$

5. Introductions of configurations

$$\Delta ECI_{C \text{ not } C'} = \sum_{\substack{iK \\ C \text{ not } C'}}\sum S_{Kt} f_{iKt} E_{iKt} - \sum_{\substack{iK \\ C \text{ not } C'}}\sum S_{Kt} f_{iKt} \bar{E}_{Kt-1} \cdot$$

6. Discontinuations of configurations

$$\Delta ECD_{C \text{ not } C'} = \sum_{\substack{iK \\ C \text{ not } C'}}\sum S_{Kt} f_{iKt-1} \bar{E}_{Kt-1} - \sum_{\substack{iK \\ C \text{ not } C'}}\sum S_{Kt} f_{iKt-1} E_{iKt-1} \cdot$$

7. Nameplate introductions

$$\Delta ENI_{\text{not } C} = \sum_{\substack{K \\ \text{not } C}} S_{Kt} \bar{E}_{Kt} - \left(\sum_{\substack{K \\ \text{not } C}} S_{Kt}\right) \bar{E}_{t-1 \text{ in } C} \cdot$$

8. Nameplate discontinuations

$$\Delta END_{\text{not } C} = \left(\sum_{\substack{K \\ \text{not } C}} S_{Kt-1}\right) \overline{E}_{t-1 \text{ in } C} - \sum_{\text{not } C} S_{Kt-1} \overline{\overline{E}}_{Kt-1} \cdot$$

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