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Index of the Relative Importance of Fuel Efficiency (IFE) in the Motor Vehicle Market

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Final Report

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16. Abstract

The need for the National Highway Traffic Safety Administration to understand the importance of vehicle fuel economy in the marketplace has created the requirement for a quantitative measure of consumer attitudes toward fuel efficiency.

This paper surveys the currently available measures of consumer attitudes toward fuel efficiency, concludes that they do not adequately meet NHTSA's needs, and develops the Index of the Relative Importance of Fuel Efficiency (IFE) to fill this void.

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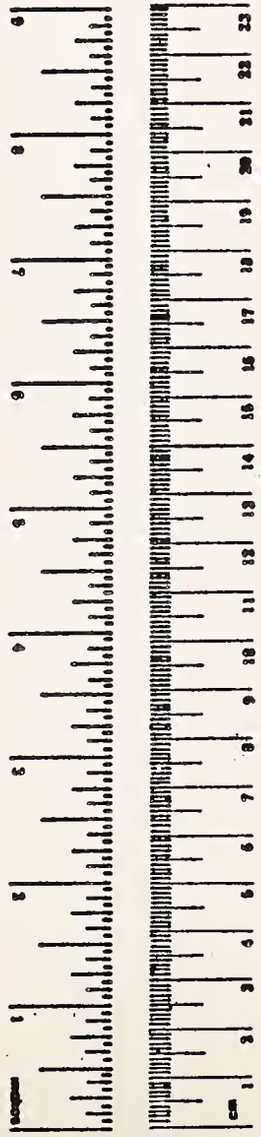
PREFACE

This paper has benefitted from the efforts of several persons. John H. Hallaq detailed the methodology, completed the technical research, and assembled the data for the preliminary draft. His work was based on concepts developed by K.H. Schaeffer. David Westenberg wrote the final report with editorial assistance from Robert Martin of Raytheon Service Company.

METRIC CONVERSION FACTORS

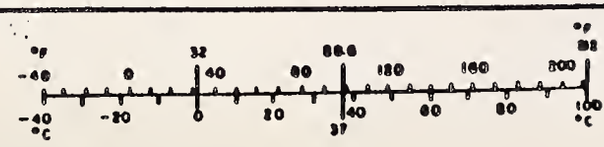
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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1. INTRODUCTION

The need for the National Highway Traffic Safety Administration to understand the importance of vehicle fuel economy in the marketplace has created the requirement for a continuous measure of consumer attitudes toward fuel efficiency. An adequate quantitative index of measuring the importance of fuel efficiency to consumers must have two attributes. First, it must be available on a monthly basis and second, it must involve a "chain" type procedure to lend it temporal continuity. Since none of the available indices or studies meets these criteria (see Section 2.2), the Index of the Relative Importance of Fuel Efficiency in the marketplace (IFE) was developed.

2. THE IFE AND ALTERNATIVE APPROACHES

2.1 THE IFE*

The Index of the Relative Importance of Fuel Efficiency (IFE) is based on used car wholesale auction prices. The auction market consists of many buyers and sellers and closely approximates the classical free market. As such, no one buyer or seller exerts a significant influence on price determination. Neither monopolistic nor monopsonistic forces intrude on the price system; the interaction of supply and demand determines an equilibrium price for each car-type. Other than large-scale stock and securities markets, there is probably no better example of a free market in the United States today than in the wholesale used car auction market. Although these are transaction prices between car dealers, they clearly tend to reflect current consumer attitudes. The buyers will not purchase on the auction market unless they believe they can recover their cost at a profit in the retail market. Thus, while, strictly speaking, used car auction prices are not identical to changes in consumer attitudes toward fuel efficiency, they represent car dealer (the experts) perceptions of these changes.

The IFE meets the two criteria set out in the Introduction. One, it is based on monthly data, and can be calculated and reported on a monthly basis. Two, it involves a weighted market basket that ensures continuity over time. The development of the IFE will be described in Section 3.

2.2 OTHER APPROACHES

The IFE was developed because none of the available measures of the importance of fuel economy fulfilled the twin goals of

*The IFE is only one index that can be developed from used car auction prices. Other simpler indices, together with their shortcomings, are described in Appendix A.

being quickly available and having continuity over the model year. Several alternative approaches and their shortcomings are described below.

2.2.1 New Car Sales Data

New car sales data are supply dominated and do not reflect underlying consumer demand. Every car that is manufactured will be sold. Simply counting sales of "fuel efficient" cars compared with sales of "non-fuel-efficient" cars indicates little. A similar weakness exists in manufacturers' "sticker" prices. These prices are ordinarily nothing but an invitation to negotiate. Estimating demand on the basis of sales at fixed sticker prices understimates demand for popular cars and overestimates demand for slow-clearing cars. This estimation approach, in essence, matches the demand to the supply, and reflects changes in demand only to the extent that these changes are reflected by the manufacturers' production adjustments. Such a convoluted mechanism is not capable of quickly indicating the changing importance that consumers place on fuel efficiency. New car transaction prices, reached after bargaining between dealer and buyer, theoretically indicate consumer preferences, but these data are unavailable.

2.2.2 Attitudinal Surveys

The consumer surveys of such organizations as the Survey Research Center of the University of Michigan and J.D. Powers Associates have too long a collection, data processing, and analysis span (three months or longer) to be useful as continuous measures of consumer valuation of fuel efficiency. The cost and complexity of monthly surveys are prohibitive.

2.2.3 Bureau of Labor Statistics (BLS) Indices

The consumer price indices of the U.S. Bureau of Labor Statistics distinguish between new and used cars, but not between different types of cars. The used car index is dominated by a

mix of larger cars making it ineffective as an accurate measure of consumer evaluation of fuel efficient automobiles relative to those cars which are not fuel efficient. This index is not responsive to volatile oil prices and/or shortages.

2.2.4 Automotive Market Report (AMR) Index

AMR publishes its own index of used car prices. The index is based on average price changes from the previous auction, and is reported as an average dollar figure per used car sale. It is reported twice each month. AMR's composite index does not distinguish between car types. Hence, changes in the index cannot be readily linked to underlying consumer behavior toward fuel efficiency and other car attributes.

3. METHODOLOGY FOR DEVELOPING THE IFE INDEX

3.1 DATA SOURCES

The biweekly Automotive Market Report (AMR) is the primary data source for the IFE index. Although the composite AMR used car price index is an inadequate measure of the value consumers place on fuel efficiency (see Section 2.2.4), AMR also contains a "Recap Section." This Recap Section summarizes the actual wholesale transaction prices of used cars based on activity at major automobile auctions in three zones across the country (see Figure 1). These prices are listed by make, model, year and car condition (sharp, clean or fair). In addition, by using AMR's "Additional Appraisal Values and Deductions" table, adjustments can be made to determine comparable average auction prices for less well equipped and more well equipped models. The newest cars listed in the AMR Recap Section, in calendar year 1980, are 1979 model year cars.

3.2 GENERAL METHOD FOR ESTIMATING THE IFE INDEX

The IFE index is calculated from differences in average wholesale auction prices among a basket of used car models. The cars used in calculating the index are selected one- and two-year old models with automatic transmission, air conditioning, power brakes, and power steering, if these options were available for the model.

The selected cars are chosen such that the variation in each car's wholesale auction price is primarily explained as a function of its fuel economy and roominess. Although it is recognized that other car attributes, such as luxury, influence car evaluation for at least some consumers, the twin demands of computational and interpretive simplicity led to the decision to confine the index construction to fuel economy and roominess. To some extent the effect of the excluded variables is minimized by the standardizing of options across models and the method for selecting the used

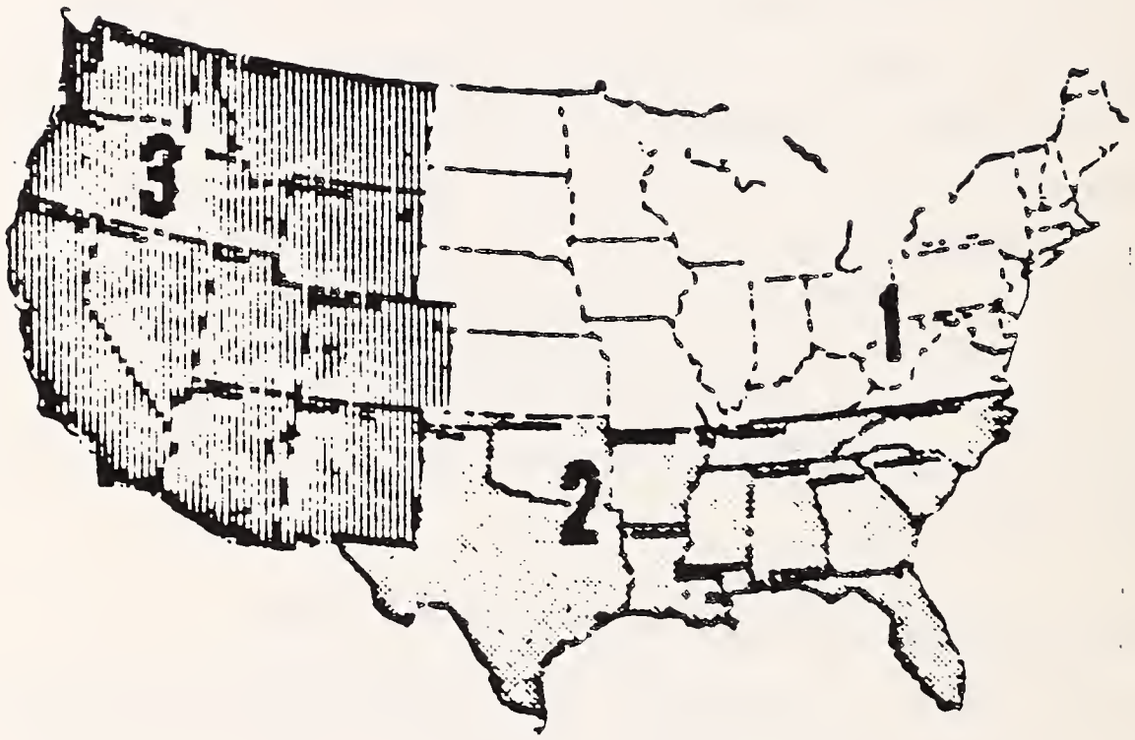

FIGURE 1. USED CAR AUCTION ZONES

car models (see Section 3.3).

The index is based on a mathematical function of the fuel economy and roominess regression coefficients. The IFE represents the degree to which used car prices are determined by fuel efficiency relative to roominess.

3.3 SELECTION OF USED CAR MODELS

Used car models are selected for inclusion in the index calculation in January of the calendar year following the model year. Once selected, the used car models will be used without change for twenty-four monthly index calculations. The selection process has two steps.

Step 1. The Primary List

In the first step, one model is selected from each car line produced by General Motors, Ford, and Chrysler. Domestic trucks, foreign vehicles, and AMC cars were excluded because of insufficient monthly auction data. The model selected from each car line was the standard sedan with automatic transmission, air conditioning, power brakes, and power steering, if these options were available. If there was a choice of engines, the most commonly available one was selected. If the car line did not include a sedan, a hatchback was selected. For each selected model, the auction price for "clean" cars in each zone was determined, as well as the EPA rating on fuel efficiency and roominess (cubic foot capacity of the passenger compartment). This became the "primary" used car list. Since EPA data are available only for some of the car lines in 1975, the "primary" used car list is shorter for this model year than for the more recent model years. As a result, only 14 automobiles were included in the primary list for the 1975 model year, 26 cars were included in model years 1976 and 1977, and 37 cars were included in model years 1978 and 1979. These lists are shown in Table 1.

TABLE 1. PRIMARY LIST OF AUTOMOBILES

MY 1975				MY 1976				MY 1977				MY 1978				MY 1979			
Car	Style	Cyl.	MPG	Car	Style	Cyl.	MPG	Car	Style	Cyl.	MPG	Car	Style	Cyl.	MPG	Car	Style	Cyl.	MPG
CH. VEGA	HC	4	20	B. SKYLARK	S	8	14	B. SKYLARK	S	8	16	B. SKYHAWK	H	6	19	B. SKYHAWK	H	6	19
CH. NOVA	S	6	15	B. CENTURY	S	8	14	B.CENTURY	S	8	15	B. SKYLARK	S	8	16	B. SKYLARK	S	8	19
CH. MALIBU	S	8	14	BUICK	S	8	14	BUICK	S	8	15	BUICK	S	8	16	BUICK	S	8	15
CHEVY	S	8	12	MONZA	H	4	14	MONZA	H	6	21	CHEVETTE	H	4	25	CHEVETTE	H	4	25
CHRYSLER	S	6	12	NOVA	S	6	13	NOVA	S	6	18	MONZA	H	4	23	MONZA	H	4	22
D.DART	S	6	16	MALIBU	S	8	14	MALIBU	S	8	16	NOVA	S	6	18	NOVA	S	6	16
DODGE	S	8	12	MONTE CARLO "S"	C	8	14	MONTE CARLO "S"	C	8	14	CH. MALIBU	S	8	17	CH. MALIBU	S	8	18
F. PINTO	S	4	20	CHEVY	S	8	13	CHEVY	S	8	15	MONTE CARLO	C	8	17	MONTE CARLO	C	8	18
F. MAVERICK 4D	S	8	16	CHRYSLER	S	8	11	CHRYSLER	S	8	14	CHEVY	S	8	16	CHEVY	S	8	16
TORINO	S	8	12	O. ASPEN	S	6	18	O. ASPEN	S	6	18	CORDOBA	C	8	16	CORDOBA	C	8	16
FORD	S	8	12	F. PINTO 2D	S	4	22	F. PINTO 2D	S	4	22	LEBARON	S	8	15	LEBARON	S	8	15
VALIANT	S	6	15	MAVERICK	S	6	17	MAVERICK 4D	S	6	17	CHRYSLER	HT	8	11	CHRYSLER	HT	8	14
SM. FURY	S	8	12	GRANADA	S	8	15	GRANADA	S	8	16	OMNI	H	4	23	OMNI	H	4	24
GR. FURY	S	8	12	TORINO	S	8	13	TORINO	S	8	14	ASPEN	S	6	19	ASPEN	S	6	18
				FORD	S	8	13	FORD	S	8	13	MONACO	S	8	14	MONACO	S	8	15
				M. BOBCAT	R	4	22	M. BOBCAT	R	4	23	DIPLOMAT	S	8	16	DIPLOMAT	S	8	16
				M. MONARCH	S	8	15	M. MONARCH	S	8	16	F. PINTO 2D	S	4	21	F. PINTO 2D	S	4	21
				MERCURY	S	8	13	MERCURY	S	8	13	FAIRMONT 4D	S	6	19	FAIRMONT 4D	S	6	18
				O. STARFIRE	C	6	18	O. STARFIRE	C	6	19	GRANADA	S	8	16	GRANADA	S	8	16
				OLDS	S	8	13	OLDS	S	8	15	LTD II	S	8	14	LTD II	S	8	13
				P. VOLARE	S	6	18	P. VOLARE	S	6	18	FORD	S	8	14	FORD	S	8	14
				SM. FURY	S	8	13	SM. FURY	S	8	13	M. BOBCAT	R	4	21	M. BOBCAT	R	4	21
				GR. FURY	S	8	11	GR. FURY	S	8	12	M. ZEPHYR 4D	S	6	19	M. ZEPHYR 4D	S	6	18
				P. SUNBIRD	C	4	18	P. SUNBIRD	C	4	19	M. MONARCH	S	8	16	M. MONARCH	S	8	16
				PONTIAC	S	8	13	PONTIAC	S	8	14	COUGAR	S	8	14	COUGAR	S	8	11
				CHEVETTE	H	4	26	CHEVETTE	H	4	26	MERCURY	S	8	13	MERCURY	S	8	15
												O. STARFIRE	C	6	19	O. STARFIRE	C	6	19
												O. OMEGA	S	8	16	O. OMEGA	S	8	16
												B. CUTLASS	S	8	19	O. CUTLASS	S	8	19
												OLDS	S	8	17	OLDS	S	8	16
												M. HORIZON	H	4	23	PL. HORIZON	H	4	24
												PL. HORIZON	S	6	19	P. VOLARE	S	6	18
												SM. FURY	S	8	14	PO. SUNBIRD	C	6	20
												PO. SUNBIRD	C	6	19	PHOENIX	S	8	16
												PHOENIX	S	8	16	PONTIAC	S	8	15
												PONTIAC	S	8	16	BUICK CENTURY	S	8	18
												B. CENTURY	S	8	17				

Step 2. The Final Basket

The primary list of used cars for each model year was reduced to the final basket by means of regression techniques. The purpose of this procedure was to reduce the primary list to the final basket of those cars for which variations in price were predominately a function of fuel economy and roominess.

With car price as the dependent variable and fuel economy and roominess as independent variables, the final list of cars was chosen from the primary list so as to yield an $R^2 \geq .90$ with t-statistics for the fuel economy and roominess coefficients statistically significant at the .05 level. In the selection of the final list, as effort was made to maximize the smaller of the two t-values while retaining the .05 significance level.

With these general guidelines, a trial and error method was used to select the final basket of cars for each model year. Though a formal algorithm could have been developed, the improved result did not appear to be worth the effort. Specifically, the trial and error techniques included regressions, rank correlation, price clusters, and residuals analysis. Table 2 shows the final lists of cars for each model year 1975 - 1979. In addition, Table 2 lists the EPA and "rescaled" fuel efficiency and passenger roominess data for each car. To allow direct comparison, the EPA data were rescaled so that the minimum value for each variable was set equal to 50 and the maximum value for each variable was set equal to 100. The remaining values within this range were then rescaled (harmonically for MPG and arithmetically for roominess). This rescaling makes it possible to claim that a ratio of one indicates that fuel efficiency and passenger roominess are contributing approximately equally to price determination. Table 3 summarizes selection criteria values for each model year.

3.4 CALCULATION OF THE SUBINDEX

A subindex is calculated once a month for each model year in every zone. Each of these six subindices is calculated as

TABLE 2. FINAL LISTS - FUEL EFFICIENCY AND ROOMINESS

	ORIGINAL		RESCALED	
MY 75	MPG	ROOMINESS	MPG	ROOMINESS
1. CHEVY NOVA SEDAN	15	93	68	80
2. CHEVY MALIBU SEDAN	14	99	65	87
3. CHEVY IMPALA SEDAN	12	108	56	97
4. FORD TORINO SEDAN	12	97	56	85
5. FORD LTD SEDAN	12	103	56	91
6. SMALL FURY SEDAN	12	98	56	86
MY 76				
1. CHEVY MALIBU SEDAN	14	99	65	87
2. CHEVY IMPALA SEDAN	13	108	61	97
3. DODGE ASPEN SEDAN	18	92	77	79
4. FORD MAVERICK SEDAN	17	87	74	74
5. FORD LTD SEDAN	13	103	61	91
6. PLYMOUTH VOLARE SEDAN	18	92	77	79
7. SMALL FURY SEDAN	13	98	61	86
8. GRAN FURY SEDAN	11	105	50	93
9. PONTIAC SEDAN	13	108	61	97

TABLE 2. FINAL LISTS - FUEL EFFICIENCY AND ROOMINESS (CONTINUED)

	ORIGINAL		RESCALED	
MY 77	MPG	ROOMINESS	MPG	ROOMINESS
1. BUICK SKYLARK SEDAN	16	93	71	80
2. BUICK CENTURY SEDAN	15	97	68	85
3. BUICK SEDAN	15	104	68	92
4. CHEVY IMPALA SEDAN	15	103	68	91
5. DODGE ASPEN SEDAN	16	92	77	79
6. FORD MAVERICK SEDAN	17	87	74	74
7. LTD-II SEDAN	14	97	65	85
8. OLDS SEDAN	15	104	68	92
9. SMALL FURY SEDAN	13	98	61	86
10. GRAN FURY SEDAN	12	105	56	93
MY 78				
1. BUICK SEDAN	16	111	71	99
2. FORD PINTO COUPE	21	74	83	60
3. FORD LTD II - SEDAN	14	102	65	90
4. OLDS OMEGA SEDAN	16	96	71	84
5. OLDS SEDAN	17	111	74	99
6. PLYMOUTH HORIZON H.	23	85	86	72
7. PHOENIX SEDAN	16	96	71	84
8. BUICK CENTURY SEDAN	17	101	74	89
MY 79				
1. BUICK SEDAN	15	111	68	99
2. CHEVETTE H.	25	79	89	65
3. CHEVY NOVA SEDAN	16	96	71	84
4. FORD PINTO COUPE	21	75	83	61
5. FORD LTD-II SEDAN	13	101	61	89
6. OLDS OMEGA SEDAN	16	96	71	84
7. OLDS SEDAN	16	111	71	99
8. PHOENIX SEDAN	16	96	71	84

TABLE 3. SUMMARY OF SELECTION CRITERIA VALUES

		t-values and their level of significance for each coeffecient	
MODEL YEAR	R^2-VALUE	FUEL EFFICIENCY	ROOMINESS
MY 75	98.5%	2.2 (.11)	12.5 (.001)
MY 76	95.4	4.3 (.005)	9.4 (.0001)
MY 77	94.5	5.6 (.001)	10.5 (.0001)
MY 78	98.1	6.5 (.001)	12.8 (.0001)
MY 79	94.5	7.0 (.001)	9.2 (.0003)

follows:

Step 1.

The calculation of the subindex begins by determing the standard auction price for each of the cars in the set of model year cars for the month and zone for which the index is to be calculated.

Step 2.

Using the rescaled EPA fuel efficiency and romminess values as the independent variables and the standard auction price for each car as the dependent variable, multiple regression yields fuel efficiency and roominess coefficients.

Step 3.

The ratio (p) of the fuel efficiency coefficient (a) divided by the roominess coefficient (b) is obtained:

$$p = \frac{a}{b}$$

If the fuel efficiency coefficient is negative or equal to zero, the ratio (p) is set equal to zero. If the roominess coefficient is negative or equal to zero, the ratio (p) is set equal to infinity.

Step 4.

Since the ratio (p) can vary from 0 to ∞ , the ratio is transformed to a more appropriate range of 0 to 100. This transformation is accomplished by using the formula:

$$SI = \frac{10}{9} \tan^{-1}(p)$$

This is the subindex for the model year and zone.

3.5 CALCUALTION OF THE NATIONAL INDEX

The national index for any one month is a summation of the six subindices for that month, i.e., of the subindices for the two model years in three zones. The weighting scheme for the summation is as follows:

Model Year Weights

To smooth out extreme fluctuations, especially when a new basket of cars is introduced, the national index is based on prices of two sets of model year cars. For example, the January 1980 index was based on prices of 1978 model year cars and 1979 model year cars. In January 1981, the 1978 model year cars will be replaced by 1980 model year cars. Thus, the same basket of cars for a certain model year is kept as a component of the national index for two calendar years. This process creates a continuous chain for updating the index such that the calculations are always based on one-year old and two-year old cars. See Figure 2.

In calculating the national index, each of the subindices is weighted so that during the first year a model year is part of the national index the weight assigned to it increases from 1/13 in January to 12/13 in December. During the second year, the weight of the subindex is reduced monthly from 12/13 in January to 1/13 in December. With this scheme, in any one month the combined weight of the subindices of the past two years will equal one. Table 4 shows the monthly weights for one- and two-year old cars.

Zone Weights

The three zones are assigned constant weights which roughly reflect the number of registered cars in each zone. These weights are: Zone 1 - 0.55; Zone 2 - 0.25; and Zone 3 - 0.20.

A sample calculation of the national IFE index (January 1980) is shown in Table 5. The rest of the IFE calculations, for the period January 1977 through December 1980, are included in Appendix B.

3.6 QUALITY OF THE INDEX

An R^2 coefficient, ranging from 0 (no correlation) to 1 (perfect correlation), can be obtained for each of the six subindices. The average value of these coefficients represents a

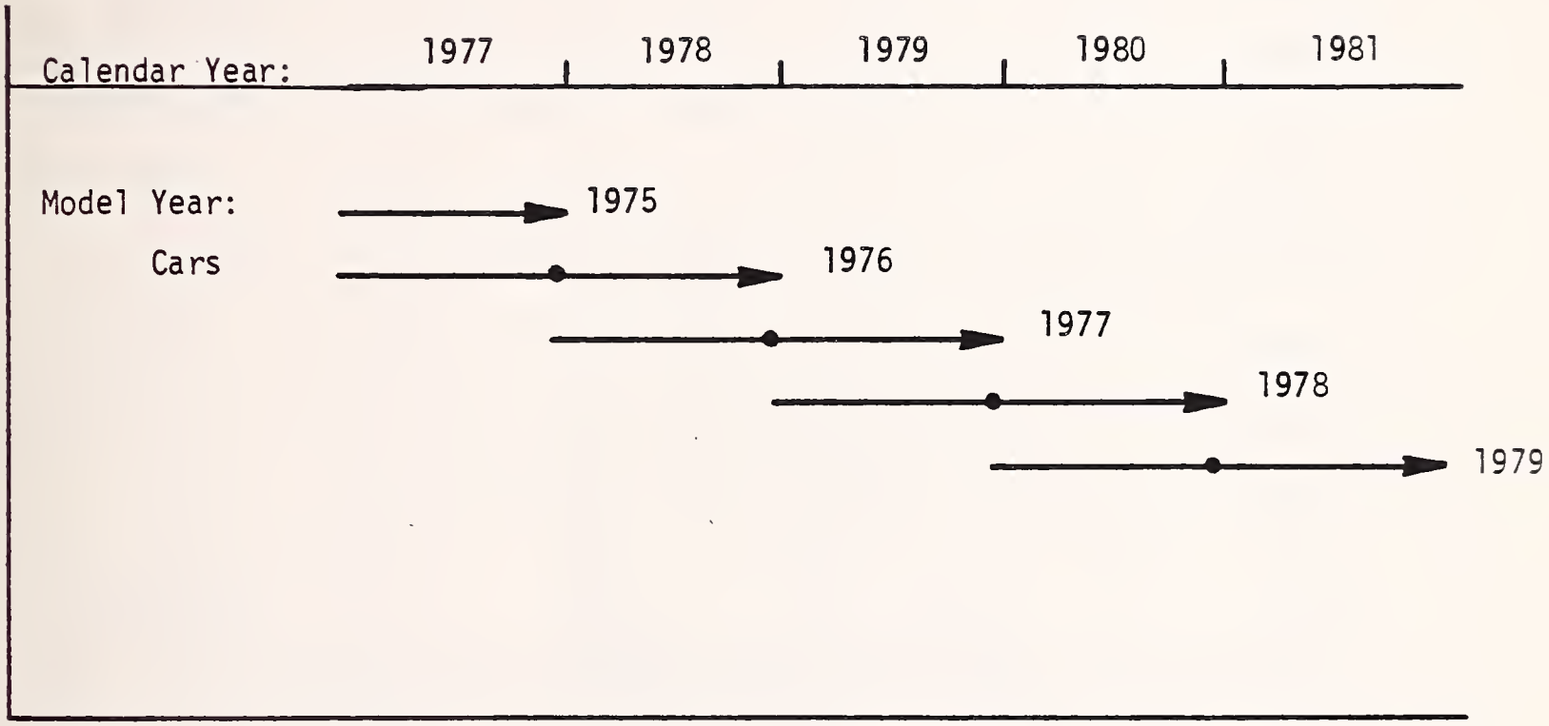

FIGURE 2. TIME PERIODS FOR WHICH EACH MODEL YEAR IS USED

TABLE 4. MONTHLY AUTOMOBILE BASKET WEIGHTS

MONTH	TWO-YEAR OLD CARS	ONE-YEAR OLD CARS
JAN.	12	1
FEB.	11	2
MAR.	10	3
APR.	9	4
MAY	8	5
JUNE	7	6
JULY	6	7
AUG.	5	8
SEP.	4	9
OCT.	3	10
NOV.	2	11
DEC.	1	12

TABLE 5. SAMPLE IFE CALCULATION FOR JANUARY 1980

	ZONE I		ZONE II		ZONE III	
	MY 78	MY 79	MY 78	MY 79	MY 78	MY 79
R^2-COEF. OF DET.	0.71	0.94	0.72	0.95	0.72	0.95
FUEL EFF. COEF.	76.91	55.30	78.03	55.97	79.13	56.73
ROOMINESS COEF.	31.86	45.76	32.41	46.53	33.27	47.37
RATIO FE/RM	2.41	1.21	2.41	1.20	2.38	1.20
INV. TAN. CONV.	67.50	50.39	67.45	50.27	67.19	50.14
DIV. FACTOR	0.9	0.9	0.9	0.9	0.9	0.9
MY INDEX	75.00	55.99	74.94	55.85	74.66	55.71
MY WT.	12/13	1/13	12/13	1/13	12/13	1/13
WT. ZONE INDEX	73.54		73.47		73.20	
ZONE WT.	0.55		0.25		0.20	

National Index (Jan. 1980)	73.45
Ave. R^2 (Consistency or Quality Measure)	(0.83)

measure of the degree to which car prices in the standard sets are determined by fuel efficiency and roominess and are free from "contamination" by other factors that determine car prices. These average R^2 values are thus a measure of the quality of the national index in measuring the relationship between fuel efficiency and roominess. This measure of quality is reported along with the national IFE index in Table 6.

TABLE 6. INDEX OF RELATIVE IMPORTANCE OF FUEL EFFICIENCY IN THE MARKETPLACE - NATIONAL AVERAGE

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1977	13(97)	15(96)	17(96)	18(96)	23(98)	36(92)	43(85)	46(84)	49(84)	53(86)	59(86)	60(85)
1978	59(93)	56(93)	53(92)	49(89)	46(88)	45(88)	42(88)	39(89)	38(89)	39(89)	39(87)	41(88)
1979	40(93)	41(92)	44(92)	52(86)	59(79)	67(72)	72(68)	73(64)	71(67)	72(69)	73(69)	75(68)
1980	73(83)	76(82)	79(82)	85(70)	82(66)	79(64)	73(67)	68(77)	64(83)	64(80)	63(81)	61(82)

Note: The first value is the National Index and the number in parentheses is the quality measure of the Index.

4. THE IFE INDEX VALUES

The index was calculated for every month from January 1977 through December 1980. The January 1977 calculation used the final basket of 1975 and 1976 model year cars. The index value for that month, 13, was the lowest yet calculated. The highest calculated value was 85 in April 1980. Since that time, with steady or slightly falling gasoline prices, the index has declined monthly, reaching a value of 61 in December 1980.

Table 6 shows each of the monthly IFE values and quality measures (R^2) from January 1977 through December 1980. Figure 3 depicts these values graphically.

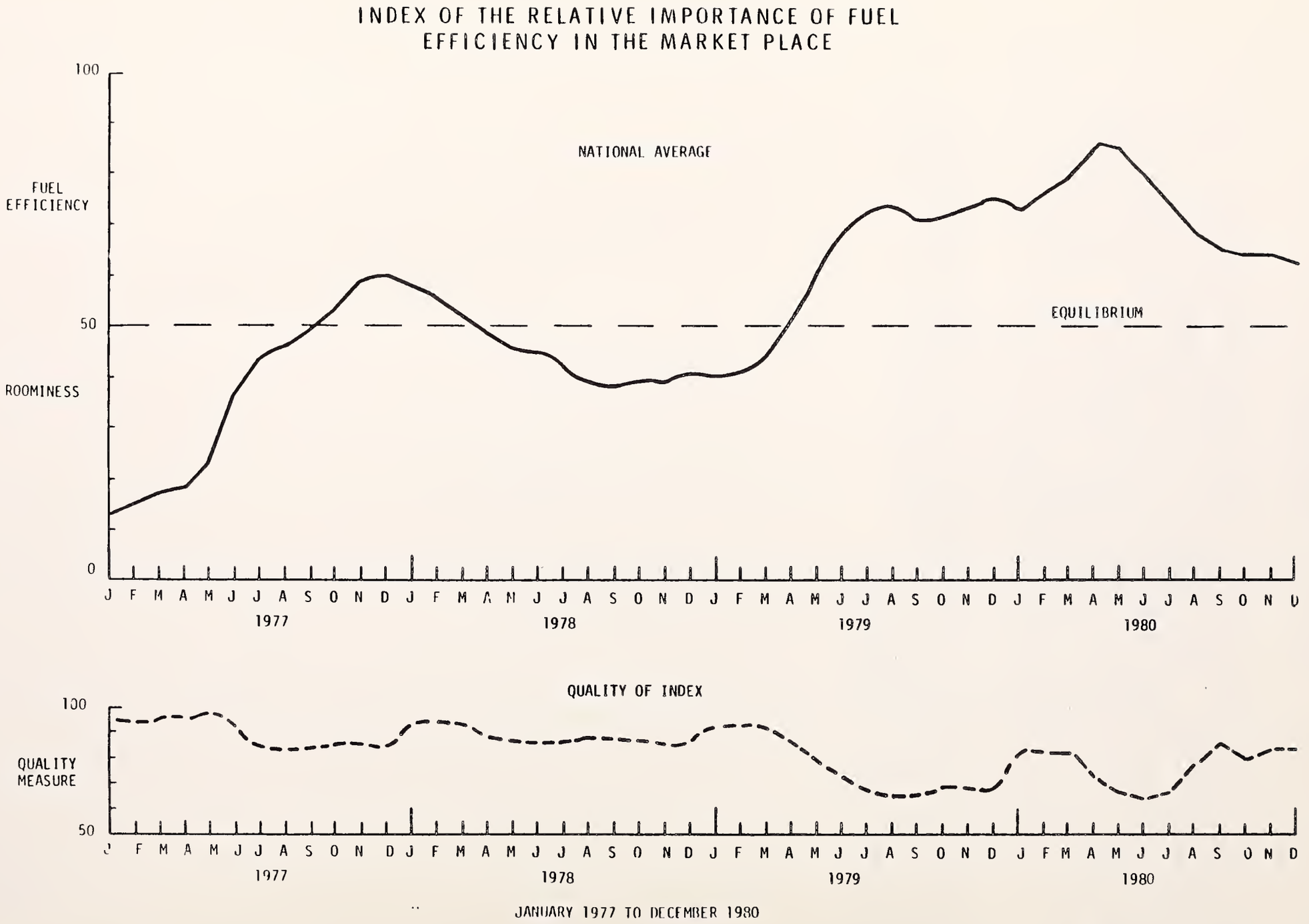

FIGURE 3. INDEX OF THE RELATIVE IMPORTANCE OF FUEL EFFICIENCY IN THE MARKET PLACE

5. INTERPRETATION OF THE IFE

IFE index value ranges from a low of 0 to a high of 100. The IFE index is an ordinal scale, not a cardinal scale. As such, a higher index number only means that fuel economy is of increased importance relative to roominess. No indication of the magnitude of the increased importance is given. In other words, an index number of 80 compared with an index number of 40 does not mean that fuel economy has become twice as important relative to roominess; it means only that fuel economy has become more important. As another example, a movement from 70 to 72 is larger than a movement from 70 to 71, but not necessarily twice as large. Furthermore, a movement in the index from 30 to 40 is not necessarily the same as a movement from 50 to 60 or 70 to 80.

Although the IFE cannot be treated as a ratio scale with arithmetically comparable values, some general interpretations are valid and useful. First, as stated above, a higher value implies a greater importance of fuel efficiency relative to roominess. This observation is valid everywhere on the scale. Second, a value of 0 indicates that fuel economy is of no significance in used car price determination. An IFE reading of 0 would imply that consumers do not consider fuel efficiency in their purchase decision. Third, a value of 100 indicates that roominess is no longer a determinant of consumer car valuation. In such a situation, purchasers will pay increased price premiums for fuel efficiency, regardless of the car's roominess. As a final interpretive guide, an index value of 50 indicates that fuel economy and roominess are of equal importance in consumer car choice. On Figure 3, depicting the trend in monthly IFE values, this value is called the "equilibrium" point. If fuel economy becomes relatively more important than roominess, the value will rise above 50; if fuel economy becomes relatively less important than roominess, the value will fall below 50. Hence, 50 is an "equilibrium" point.

One final interpretive caution must be mentioned. Since the automobile industry is retooling to produce more fuel efficient

cars with each succeeding model year, the available fuel economy/roominess mix changes from year to year. Because this mix is a fundamental ingredient of the IFE, the index is not strictly comparable from year to year. Thus, the best use of the IFE is to compare monthly changes, i.e., from June 1980 to July 1980. Comparisons within one calendar year or so should also be reasonably consistent. Users of the IFE are cautioned, however, against placing undue emphasis on any comparison of index values over several years. An index value of 60 in late 1980 does not necessarily represent the same consumer valuation of fuel economy relative to roominess that an index value of 60 did in the winter of 1977/78. This caution is particularly necessary if the index reversed itself several times in the interim.

APPENDIX A

COMPARISON OF IFE WITH OTHER INDICES

In the course of developing the IFE several other indices, derived from used car data, were experimented with. These will be briefly described.

Chevette/Chevrolet Impala (CCI)

One very simple variation of the IFE is to use the ratio of the monthly prices of the Chevette and the Chevrolet Impala. This index, the CCI, presumes that the Chevette is the prototypical "fuel efficient" car and that the Impala is the best proxy for a car valued mostly (if not entirely) for its roominess. It is hypothesized that as concern with fuel efficiency mounts, the price ratio will increase in favor of the Chevette. Table A-1 shows the CCI index values from January 1977 through May 1980. Each value is based on the two most recent model years and weighted in the same manner as the IFE (see Section 3.5).

The CCI index has two inherent limitations. First, the index places too much emphasis on only two automobiles, making it susceptible to unforeseen exogenous forces which could interfere with price movements. Second, this index provides little information on the interaction of fuel economy and roominess considerations in the marketplace.

Small/Large (SLI)

An obvious improvement in the CCI index would be to increase the number of automobiles. This was done by selecting 26 automobiles and grouping them as either small (fuel efficient) or large (roomy). The price ratio of the group of small cars relative to the group of large cars became the SLI index. The results are shown in Table A-2 and the procedure is illustrated in Figure A-1.

The SLI is an improvement over the CCI, but it can be refined still more. The SLI, with improvements, became the IFE.

TABLE A-1. CC INDEX - CHEVETTE/CHEVROLET IMPALA

Period	wt	MY 76		MY 77		MY 78		MY 79		2-YR OLD	1-YR OLD WEIGHTED	
		C	I	C	I	C	I	C	I	CCI	CCI	CCI
77-1		S2265	3606								.63	63
2		2231	3573								.62	62
3		2271	3602								.63	63
4		2301	3638								.63	63
5		2274	3649								.62	62
6		2235	3376								.66	66
7		2295	3239								.71	71
8		2295	3163								.73	73
9		2324	3102								.75	75
10		2317	2976								.78	78
11		2271	2796								.81	81
12		2257	2673								.84	84
78-1	12-1	2233	2652	2725	3918					.84	.70	83
2	11-2	2183	2657	2664	3898					.82	.68	80
3	10-3	2262	2781	2756	4019					.81	.69	78
4	9-4	2288	2882	2769	4039					.79	.69	76
5	8-5	2330	2912	2801	4064					.80	.69	76
6	7-6	2294	2859	2758	4002					.80	.69	75
7	6-7	2242	2835	2673	3921					.79	.68	73
8	5-8	2216	2854	2642	3885					.78	.68	72
9	4-9	2186	2849	2595	3869					.77	.67	70
10	3-10	2153	2817	2556	3799					.76	.67	69
11	2-11	2105	2732	2499	3684					.77	.68	69
12	1-12	2031	2594	2433	3524					.78	.69	70
79-1	12-1			2379	3401	3025	4253			.70	.71	70
2	11-2			2354	3374	2993	4231			.70	.71	70
3	10-3			2381	3323	3022	4179			.72	.72	72
4	9-4			2706	3256	3429	4094			.83	.84	83
5	8-5			2879	3183	3600	3949			.90	.91	90
6	7-6			2996	2867	3665	3633			1.04	1.01	103
7	6-7			2996	2766	3648	3526			1.08	1.03	105
8	5-8			3014	2731	3638	3542			1.10	1.03	106
9	4-9			2946	2720	3576	3517			1.08	1.02	104
10	3-10			2927	2720	3563	3488			1.08	1.02	103
11	2-11			2835	2665	3480	3400			1.06	1.02	103
12	1-12			2734	2464	3325	3161			1.11	1.05	105
80-1	12-1					3223	3037	3736	3956	1.12	.94	105
2	11-2					3296	2938	3824	3834	1.12	1.00	110
3	10-3					3400	2864	3964	3752	1.29	1.06	116
4	9-4					3477	2693	4092	3564	1.29	1.15	125
5	8-5					3393	2715	4018	3550	1.25	1.13	120

TABLE A-2. SL INDEX - SMALL/LARGE AUTOMOBILES

CODING: SMALL - 19-26 MPG, 71-79 PASSENGER ROOMINESS; 11-14, 101-111 - LARGE

PERIOD	WT.	MY 76 AVE. PRICES S	MY 76 AVE. PRICES L	MY 77 AVE. PRICES S	MY 77 AVE. PRICES L	MY 78 AVE. PRICES S	MY 78 AVE. PRICES L	2-YR OLD S/L	1-YR OLD S/L	SLI
77-1		2461	3656						.67	67
2		2440	3633						.67	67
3		2463	3674						.67	67
4		2496	3677						.68	68
5		2484	3649						.68	68
6		2433	3362						.72	72
7		2478	3245						.76	76
8		2493	3175						.79	79
9		2524	3123						.81	81
10		2516	3026						.83	83
11		2467	2851						.87	87
12		2428	2730						.89	89
8-1	12-1	2379	2704	3044	3885			.88	.78	87
2	11-2	2347	2701	3001	3846			.87	.78	86
3	10-3	2399	2714	3045	3900			.88	.78	86
4	9-4	2434	2848	3094	3931			.85	.79	83
5	8-5	2443	2866	3114	3936			.85	.79	83
6	7-6	2400	2829	3062	3886			.85	.79	82
7	6-7	2340	2793	2997	3802			.84	.79	81
8	5-8	2271	2826	2943	3807			.80	.77	78
9	4-9	2242	2799	2911	3779			.80	.77	78
10	3-10	2166	2751	2882	3699			.79	.78	78
11	2-11	2146	2663	2800	3581			.81	.78	78
12	1-12	2066	2565	2715	3450			.81	.79	79
79-1	12-1			2599	3318	3278	3927	.78	.83	79
2	11-2			2574	3280	3251	3871	.78	.84	79
3	10-3			2606	3232	3277	3812	.81	.86	81
4	9-4			2902	3134	3523	3710	.93	.95	94
5	8-5			3016	3009	3655	3583	1.00	1.02	101
6	7-6			3059	2713	3682	3272	1.13	1.13	113
7	6-7			3087	2590	3722	3143	1.19	1.18	118
8	5-8			3091	2537	3781	3066	1.22	1.23	120
9	4-9			3013	2514	3614	3052	1.20	1.18	119
10	3-10			2977	2497	3693	3026	1.19	1.22	121
11	2-11			2879	2429	3589	2950	1.19	1.22	121
12	1-12			2754	2415	3420	2769	1.14	1.24	124

Small/Large Index

1. A basket of 26 autos was selected from Jan. 77 to Dec. 1979.
2. These cars were broken into 3 groups based on MPG (11-14; 15-18; 19-26) and 3 groups based on passenger roominess (74-79; 80-100; 101-111).
3. "Small" group contains cars with 19-26 MPG and 74-79 for roominess.
4. "Large" group contains cars with 11-14 MPG and 101-111 roominess.

Groups are for the following model years:

- . in 1977: MY 76
- . in 1978: MY 76 and MY 77 using weights
- . in 1979: MY 77 and MY 78 using weights

- weights used when two model years were invovled are:

January	older MY	wt.	12	newer MY wt.	1
February			11		2
.			.		.
.			.		.
.			.		.
.			.		.
.			.		.
.			.		.
December			1		12

Note that since May 1979 the group of Small cars were selling at an average price higher than that of the group of Large cars.

Chevette/Impala Curve

1. Period covered was Jan. 1977 to May 1980.
2. Ratio represents the used car auction price of the above two models for the same model years as above and a similar weighting scheme.

NOTE: Options on all cars were standardized to reflect a car with: AT - PS - AC

FIGURE A-1. DESIGNING THE CCI AND SLI

These improvements (see Section 3) mainly consist of choosing a basket of cars that will better explain fuel economy and roominess interaction in determining car valuation with a minumum of interference from other factors.

APPENDIX B
IFE CALCULATIONS

APPENDIX B. IFE-CALCULATIONS

CALENDAR YEAR: 1977												
MONTH MON.WT	JAN 12-1	FEB 11-2	MAR 10-3	APR 9-4	MAY 8-5	JUN 7-6	JUL 6-7	AUG 5-8	SEP 4-9	OCT 3-10	NOV 2-11	DEC 1-12
PARAMETERS												
ZONE I MY 75 :R^2	99	98	96	97	98	88	77	75	76	79	80	81
:MPG	8.17	8.46	9.90	9.28	14.04	23.53	27.40	28.94	30.27	31.32	31.47	32.75
:SIZE	44.13	41.95	45.58	40.24	40.91	35.61	30.67	23.32	24.81	20.30	14.10	14.85
:RATIO	0.185	0.202	0.217	0.231	0.343	0.661	0.893	1.241	1.220	1.543	2.232	2.205
:INDEX	11.65	12.67	13.62	14.43	21.05	37.17	46.42	50.69	56.29	63.39	73.18	72.90
MY 76 :R^2	93	94	95	95	98	96	92	91	91	93	91	88
:MPG	20.78	22.17	22.69	22.66	23.34	26.07	27.98	28.46	29.98	28.71	28.66	27.38
:SIZE	50.28	48.67	49.17	48.43	50.64	43.15	37.36	35.58	33.84	28.55	23.45	20.63
:RATIO	0.413	0.456	0.461	0.468	0.462	0.604	0.749	0.800	0.886	1.006	1.222	1.327
:INDEX	24.95	27.21	27.52	27.86	27.55	34.60	40.92	42.95	45.15	50.18	56.34	58.89
:WT. INDEX	12.67	14.91	16.83	18.56	23.55	35.98	43.46	45.93	49.27	53.23	58.93	59.97
ZONE II MY 75 :R^2	98	98	96	97	98	88	77	76	77	80	80	82
:MPG	8.29	8.51	7.83	9.27	14.11	23.73	27.81	29.27	30.73	31.73	31.84	33.10
:SIZE	44.41	42.39	39.24	40.73	41.36	36.07	31.19	28.67	25.21	20.60	14.40	15.12
:RATIO	0.19	0.20	0.20	0.23	0.34	0.66	0.89	1.02	1.22	1.54	2.21	2.19
:INDEX	11.75	12.61	12.54	14.25	20.93	37.04	46.36	50.66	56.26	63.34	72.96	72.76
MY 76 :R^2	96	94	95	95	98	96	92	92	91	93	91	90
:MPG	21.03	22.36	22.87	22.91	23.63	26.36	28.35	29.00	30.45	29.00	29.35	27.60
:SIZE	51.12	49.42	49.88	49.22	51.48	43.92	38.14	36.66	34.63	29.12	24.24	21.15
:RATIO	0.41	0.45	0.46	0.47	0.46	0.60	0.74	0.79	0.88	1.00	1.21	1.30
:INDEX	24.85	27.05	27.37	27.73	27.40	34.41	40.69	42.61	45.92	49.87	56.05	58.37
:WT. INDEX	12.76	14.83	15.96	18.40	23.42	35.83	43.31	45.71	49.10	52.98	58.65	59.48
ZONE III MY 75 :R^2	98	98	96	97	98	88	77	75	76	79	80	81
:MPG	8.24	8.44	11.62	9.29	14.23	24.34	28.26	29.72	31.09	32.08	32.31	33.60
:SIZE	44.99	42.90	43.01	41.12	41.78	36.61	31.44	28.92	25.31	20.74	14.39	15.18
:RATIO	0.18	0.20	0.27	0.23	0.34	0.66	0.90	1.03	1.23	1.55	2.25	2.22
:WT. INDEX	11.53	12.37	16.80	14.15	20.10	37.35	46.61	50.87	56.43	63.46	73.33	73.03
MY 76 :R^2	96	94	95	95	98	97	93	92	92	94	91	89
:MPG	21.17	22.55	22.86	23.36	24.01	26.63	28.61	29.41	30.71	29.24	29.50	28.00
:SIZE	51.97	50.24	50.64	50.53	52.65	44.75	38.81	37.52	35.20	29.60	24.60	21.58
:RATIO	0.41	0.45	0.45	0.46	0.46	0.60	0.74	0.78	0.87	1.00	1.20	1.30
:INDEX	24.63	26.86	26.99	41.57	27.24	34.17	40.44	42.32	45.67	49.61	55.75	58.20
:WT. INDEX	12.54	14.60	19.10	18.28	23.34	35.88	43.29	45.61	48.98	52.81	58.45	59.34
NATIONAL INDEX (1.55,72.29, 73.20	12.67	14.83	17.08	18.46	23.48	35.92	43.39	45.81	49.17	53.08	58.76	59.72
AVE R^2	97.0	96.0	95.5	96.0	98.0	92.2	84.7	83.5	83.8	86.3	85.5	85.2

APPENDIX B. IFE-CALCULATIONS (CONT)

CALENDAR YEAR: 1978													
	MONTH MON.WT	JAN 12-1	FEB 11-2	MAR 10-3	APR 9-4	MAY 8-5	JUN 7-6	JUL 6-7	AUG 5-8	SEP 4-9	OCT 3-10	NOV 2-11	DEC 1-12
PARAMETERS													
ZONE I	MY 76 :R^2	90	92	90	88	80	86	86	90	90	89	87	80
	:MPG	28.36	29.49	31.56	32.83	33.21	33.15	33.17	30.69	30.44	30.69	30.54	29.49
	:SIZE	19.62	21.37	24.74	28.99	31.22	32.09	35.64	37.88	39.66	39.77	38.46	34.67
	:RATIO	1.445	1.380	1.276	1.132	1.064	1.033	0.931	0.810	0.768	0.772	0.794	0.851
	:INDEX	61.47	60.08	51.67	53.45	51.97	51.03	47.72	43.35	41.67	41.84	42.70	44.88
	MY 77 :R^2	94	94	93	90	90	89	89	88	89	88	87	88
	:MPG	37.32	40.39	45.82	47.89	47.75	49.74	50.78	53.20	54.78	55.64	56.01	56.44
	:SIZE	66.09	67.49	70.31	71.09	71.41	74.92	76.04	82.29	83.36	81.77	79.70	77.08
	:RATIO	0.565	0.598	0.652	0.674	0.668	0.664	0.668	0.646	0.657	0.680	0.703	0.733
	:INDEX	32.73	31.33	36.77	31.74	37.49	37.31	37.48	36.54	37.02	38.04	39.00	40.26
	:WT. INDEX	59.26	56.12	52.85	48.96	46.40	44.70	42.21	39.16	38.45	38.92	39.57	40.62
ZONE II	MY 76 :R^2	91	92	91	88	86	87	86	91	88	90	87	89
	:MPG	28.62	29.74	31.90	33.19	33.59	33.54	33.26	31.23	29.56	31.04	30.81	29.54
	:SIZE	20.05	21.83	25.33	29.61	31.87	32.79	36.08	38.83	40.23	40.48	39.11	35.14
	:RATIO	1.43	1.36	1.26	1.12	1.05	1.02	9.92	0.80	0.73	0.77	0.79	0.84
	:INDEX	61.10	51.61	51.28	53.63	51.67	50.72	47.41	43.12	40.34	41.65	42.48	44.50
	MY 77 :R^2	95	94	93	90	90	89	89	88	89	88	88	88
	:MPG	37.73	40.81	46.44	48.24	48.26	50.71	51.73	53.90	55.98	56.33	56.74	57.26
	:SIZE	67.20	68.67	71.63	72.01	73.15	76.21	77.33	83.63	84.90	83.11	80.95	78.25
	:RATIO	0.56	0.60	0.65	0.67	0.66	0.67	0.67	0.64	0.66	0.68	0.70	0.73
	:INDEX	32.57	34.19	36.62	37.58	37.13	37.38	37.53	36.45	37.11	37.92	38.92	40.22
	:WT. INDEX	59.91	55.77	52.51	48.69	46.08	44.56	42.09	39.02	38.10	38.78	39.47	40.55
ZONE III	MY 76 :R^2	91	92	91	88	86	86	86	91	90	89	87	88
	:MPG	28.97	30.15	32.34	33.59	33.91	33.85	33.77	31.09	31.09	31.24	31.05	29.78
	:SIZE	20.54	22.34	25.87	30.12	32.35	33.23	36.82	39.54	41.14	41.19	39.87	35.81
	:RATIO	1.41	1.35	1.25	1.12	1.05	1.02	0.92	0.76	0.80	0.76	0.78	0.83
	:INDEX	60.74	59.40	57.05	53.46	51.50	50.59	47.25	42.86	41.20	41.31	42.12	44.16
	MY 77 :R^2	95	94	93	90	89	89	89	89	89	88	87	88
	:MPG	38.29	41.20	46.87	48.82	48.83	50.99	52.08	56.15	56.15	57.04	57.44	57.85
	:SIZE	68.70	70.01	72.94	73.49	74.15	77.75	78.88	85.31	86.39	84.82	82.61	79.89
	:RATIO	0.56	0.59	0.64	0.66	0.66	0.66	0.66	0.64	0.65	0.67	0.70	0.72
	:INDEX	32.37	33.89	36.33	37.33	37.07	36.95	37.15	36.21	36.69	37.69	38.68	39.95
	:WT. INDEX	58.56	55.48	52.28		45.95	44.29	44.29	38.08	38.08	38.53	39.21	40.23
NATIONAL INDEX (Z1=.55, Z2=.25, Z3=.20)		59.28	55.90	52.65	48.80	46.23	44.38	42.10	39.05	38.29	38.81	39.47	40.52
	:AVE. 0^2	92.7	92.0	91.8	89.0	87.8	87.7	87.5	89.3	89.2	88.7	87.2	88.2

APPENDIX B. IFE-CALCULATIONS (CONT)

CALENDAR YEAR: 1979												
MONTH MON. WT		JAN 12-1	FEB 11-2	MAR 10-3	APR 4-4	MAY 8-5	JUN 7-6	JUL 6-7	AUG 5-8	SEP 4-9	OCT 3-10	NOV 2-11	DEC 1-12
PARAMETERS													
ZONE I	MY 77 :R^2	87	88	88	84	79	75	69	66	66	66	66	66
	:MPG	55.39	56.00	57.67	60.33	58.10	58.97	61.52	67.59	70.41	70.50	67.62	62.44
	:SIZE	77.15	76.79	73.76	60.36	49.51	31.43	36.74	37.83	45.46	46.71	44.15	38.35
	:RATIO	0.72	0.73	0.78	1.00	1.17	1.50	1.67	1.79	1.55	1.51	1.50	1.63
	INOEX:	39.64	40.11	42.24	49.98	55.07	62.48	65.73	67.54	63.53	62.75	62.65	64.93
	MY 78 :R^2	98	97	96	88	79	68	66	62	67	71	71	69
	:MPG	57.15	56.73	57.19	56.84	64.31	70.56	75.82	77.99	83.37	83.31	82.00	75.63
	:SIZE	61.53	60.63	58.67	45.53	38.03	31.41	29.06	29.72	35.13	35.79	34.59	30.22
	:RATIO	0.93	0.94	0.97	1.25	1.69	2.25	2.61	2.62	2.37	2.47	2.37	2.50
	:INDEX	47.65	47.89	49.19	57.01	66.00	73.34	76.70	76.82	74.61	75.49	74.59	75.80
	:WT. INDEX	40.26	41.31	43.84	52.14	59.24	67.49	71.64	73.25	71.20	72.55	72.75	74.96
ZONE II	MY 77 :R^2	87	86	88	84	79	71	70	66	66	66	66	66
	:MPG	56.07	56.50	57.86	60.93	58.94	59.54	62.08	68.34	71.21	71.23	68.31	63.11
	:SIZE	78.54	76.34	74.28	61.32	50.67	39.82	37.43	38.62	46.28	47.53	45.73	39.02
	:RATIO	0.71	0.74	0.78	0.99	1.16	1.50	1.66	1.77	1.54	1.50	1.49	1.62
	:INOEX	39.47	40.56	42.13	49.80	54.79	62.47	65.46	67.25	63.31	62.54	62.44	64.75
	MY 78 :R^2	98	97	96	88	80	69	67	62	68	71	72	69
	:MPG	57.93	57.56	58.06	57.78	65.42	71.63	77.01	79.22	84.70	84.57	83.31	76.79
	:SIZE	62.41	61.46	59.48	46.24	38.71	31.95	29.61	30.30	35.78	36.41	35.22	30.78
	:RATIO	0.93	0.94	0.98	1.25	1.69	2.24	2.60	2.61	2.37	2.32	2.37	2.49
	:INOEX	47.63	47.91	49.23	57.03	65.99	73.29	76.63	76.74	74.55	74.12	74.54	75.73
	:WT. INOEX	40.10	41.69	43.77	52.02	59.10	67.46	71.47	73.09	71.09	71.45	72.68	74.89
ZONE III	MY 77 :R^2	87	88	88	84	79	75	70	66	66	66	66	66
	:MPG	56.83	57.23	58.92	61.95	59.46	60.15	62.95	69.28	72.23	72.21	69.44	63.98
	:SIZE	79.95	79.40	75.92	62.83	51.36	41.01	38.21	39.44	47.28	48.48	46.94	39.86
	:RATIO	0.71	0.72	0.78	0.99	1.16	1.47	1.65	1.76	1.53	1.49	1.48	1.61
	:INDEX	39.34	39.76	42.02	49.55	54.64	62.00	65.27	67.05	63.10	62.36	62.16	64.33
	:R^2	98	98	96	89	80	69	67	62	68	71	72	70
	:MPG	58.95	58.55	58.92	58.57	66.26	72.64	78.06	80.16	85.73	85.71	84.34	77.80
	:SIZE	63.79	62.88	60.83	47.33	39.63	32.81	30.38	31.01	36.59	37.34	36.05	31.56
	:RATIO	0.92	0.93	0.97	1.24	1.67	2.21	2.57	2.53	2.34	2.36	2.34	2.46
	:INDEX	47.49	47.13	48.98	56.73	65.68	72.99	76.37	76.50	74.32	73.84	74.28	75.45
	:WT. INDEX	39.97	40.99	43.63	51.76	58.89	67.07	71.25	72.87	70.87	71.19	72.42	74.69
NATIONAL INDEX (71 .55, 72 .25, 73 .20)		40.16	49.34	43.78	52.03	59.14	67.40	71.52	73.13	71.11	72.00	72.67	74.87
	:AVE R^2	92.5	92.2	92.0	86.2	77.3	77.5	68.2	64.0	66.8	68.5	68.8	67.7

APPENDIX B. IFE-CALCULATIONS (CONT)

CALENDAR YEAR: 1980 MONTH MON.WT	JAN 12-1	FEB 11-2	MAR 10-3	APR 9-4	MAY 8-5	JUN 7-6	JUL 6-7	AUG 5-8	SEP 4-9	OCT 3-10	NOV 2-11	OEC 1-12
PARAMETERS												
ZONE I MY 78 :R^2	71	72	72	64	59	57	59	71	77	73	74	75
:MPG	76.91	82.82	82.83	80.37	77.25	72.47	74.79	83.14	83.19	78.00	79.01	78.44
:SIZE	31.86	28.05	23.15	14.94	15.46	16.78	24.55	33.70	38.19	35.41	36.41	36.97
:RATIO	2.41	2.95	3.58	5.38	5.00	4.32	3.05	2.47	2.18	2.20	2.17	2.12
:INDEX	75.00	79.21	82.65	88.30	87.43	85.51	79.80	75.48	72.60	72.87	73.51	71.96
MY 79 :R^2	94	89	92	76	72	72	75	83	89	86	87	88
:MPG	55.30	57.12	63.96	64.06	68.09	68.78	73.33	77.67	76.02	75.10	76.32	77.06
:SIZE	45.76	40.80	35.89	24.97	29.65	33.06	41.43	50.25	53.50	52.42	53.93	55.19
:RATIO	1.208	1.400	1.78	2.57	2.30	2.08	1.77	1.55	1.42	1.43	1.42	1.40
:INDEX	55.99	60.51	67.45	76.34	73.85	71.48	67.26	63.44	60.96	61.21	60.84	60.43
:WT. INDEX	73.54	76.33	79.14	84.62	82.21	79.03	73.05	68.07	64.54	63.90	62.64	61.32
ZONE II MY 78 :R^2	72	72	72	64	60	57	59	71	77	73	74	75
:MPG	78.03	83.98	83.94	81.44	78.20	73.30	75.46	83.90	83.87	78.61	79.63	78.98
:SIZE	32.41	28.56	23.58	15.23	15.72	17.03	24.77	34.03	38.51	35.69	36.69	37.23
:RATIO	2.41	2.94	3.56	5.35	4.97	4.30	3.05	2.47	2.18	2.20	2.17	2.12
:INOEX	74.94	79.13	82.56	88.23	87.37	85.47	79.81	75.47	72.60	72.87	72.51	71.96
MY 79 :R^2	95	93	92	75	72	72	75	83	89	86	87	88
:MPG	55.97	61.36	64.65	64.68	68.70	69.45	74.03	78.51	76.67	75.92	77.12	77.77
:SIZE	46.53	41.93	36.49	25.43	30.15	33.62	42.03	50.99	54.20	53.21	54.73	55.93
:RATIO	1.20	1.46	1.77	2.54	2.28	2.07	1.76	1.54	1.41	1.43	1.40	1.39
:INOEX	55.85	61.84	67.29	76.15	73.67	71.30	67.13	63.33	60.83	61.08	60.71	60.31
:WT. INOEX	73.47	76.47	79.04	84.51	82.10	78.93	72.98	67.99	64.45	63.80	62.53	61.21
ZONE III MY 78 :R^2	72	73	73	64	60	57	59	72	77	73	74	75
:MPG	79.13	85.17	85.15	82.62	79.33	73.91	76.71	85.28	85.23	79.95	81.05	80.42
:SIZE	33.27	29.32	24.25	15.78	16.25	17.40	25.55	34.95	39.51	36.65	37.67	38.21
:RATIO	2.38	2.90	3.51	5.24	4.88	4.25	3.00	2.44	2.16	2.18	2.15	2.10
:INOEX	74.66	78.89	82.34	87.99	87.14	85.28	79.53	75.24	72.37	72.64	73.30	71.76
MY 79 :R^2	95	93	92	75	72	71	75	83	89	86	87	88
:MPG	56.73	62.32	65.62	65.69	69.87	70.63	75.30	79.87	77.95	77.22	78.43	79.21
:SIZE	47.37	42.84	37.19	25.99	30.86	34.35	42.95	52.07	55.32	54.30	55.84	57.11
:RATIO	1.20	1.45	1.76	2.53	2.26	2.06	1.75	1.53	1.41	1.42	1.40	1.39
:INOEX	55.71	61.66	67.18	76.02	73.52	71.18	67.00	63.22	60.71	60.98	60.61	60.23
:WT. INDEX	73.20	76.24	78.84	84.31	81.90	78.77	72.78	67.84	64.30	63.67	62.41	61.12
NATIONAL INDEX	73.45	76.35	79.06	84.50	82.12	79.00	72.98	68.00	64.47	63.83	62.57	61.25
(Z1=.55, Z2=.25, Z3=.20) :AVE. R^2	83.3	82.0	82.2	69.7	65.8	64.3	67.0	77.2	83.0	79.5	80.5	81.5

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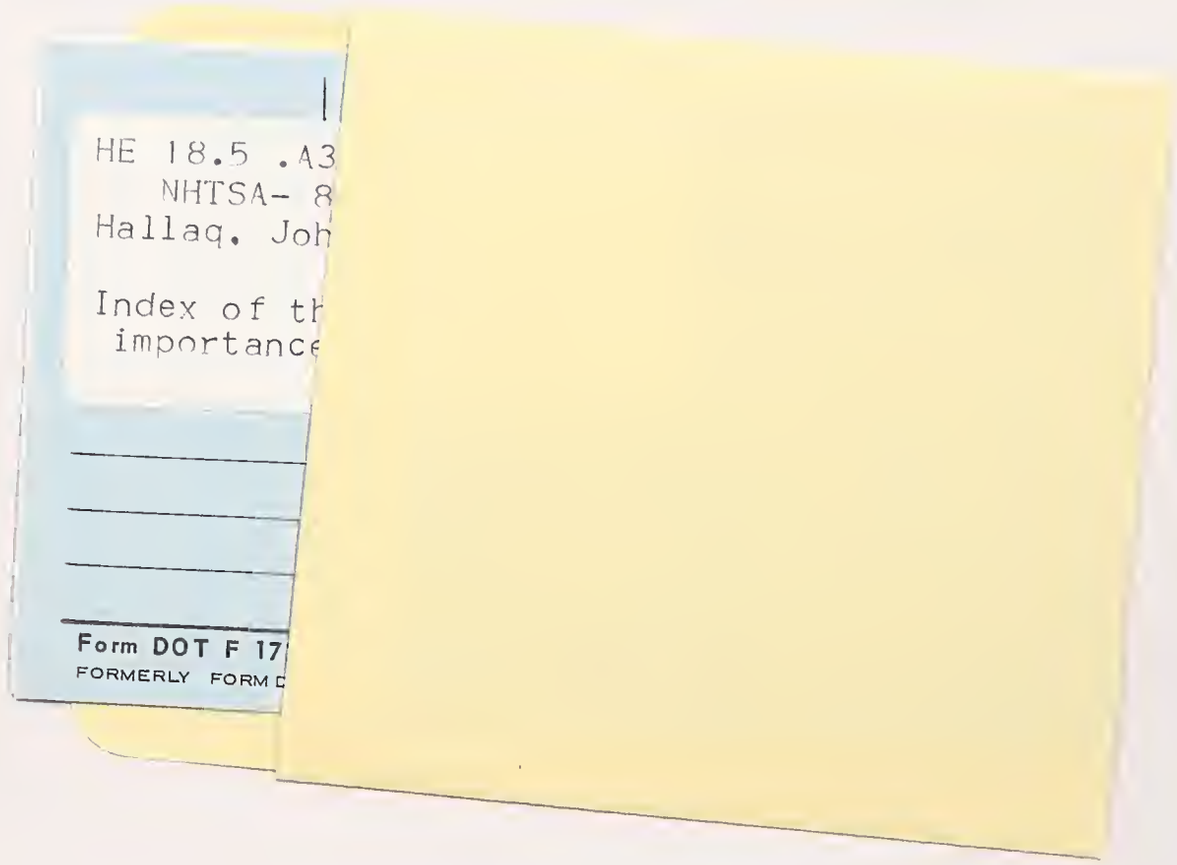

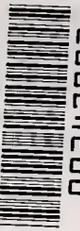

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