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AUTOMOBILE SECTOR FORECASTING MODEL
USER'S GUIDE

Final Report

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Submitted by
JACK FAUCETT ASSOCIATES, INC.
5454 Wisconsin Avenue
Chevy Chase, Maryland 20015

CONTENTS

I. INTRODUCTION

A. MODEL PURPOSE AND SCOPE

The Auto Sector Forecasting (ASF) Model presented here is designed to be a tool for describing the effects of alternative automobile fuel economy policies. It produces the future gasoline consumption, vehicle miles of travel, new car sales, fleet size, and fleet composition which are projected to result from a given fuel economy policy posture. These postures include the use of excise taxes and rebates applied to new car fuel economy, imposition of sales-weighted fuel economy standards by manufacturer, and manipulation of the price of gasoline through taxation or other measures.

The purpose of this document is to present the mechanics of using this model. It is a user's guide, not a discussion of the model's motivation or statistical properties. Details on the design and structure of this model are presented elsewhere[1] and will be summarized only breifly here.

The inputs and outputs of the ASF Model are shown in Table 1. The user inputs, shown at the upper left, include gasoline prices and policy descriptions. In addition, the program itself furnishes a number of other "inputs," such as the population forecast, income forecast, etc. While the user cannot alter these in normal operation, the model is modularly structured with respect to these characteristics and they are readily alterable through minor programming changes. The outputs shown to the right of Table 1 are computed for each model year and may be printed for each year of the projection period if desired.

For reference purposes, the key model equations are shown in Table 2. The equations shown constitute the empirical basis for this model, and their

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[1] *Carmen Difiglio and Damian Kulash, Marketing and Mobility, report of a panel of the Interagency Task Force on Motor Vehicle Goals Beyond 1980, March 1976; and Damian Kulash, "Forecasting Long-Run Automobile Demand," Transportation Research Record, forthcoming, 1976.*

TABLE 1.-AUTO SECTOR FORECASTING MODEL: INPUTS AND OUTPUTS

USER INPUTS	OUTPUTS
• Gasoline Prices • New Car Fuel Economy Policies - Excise Tax/Rebate Description - Fuel Economy Standards/ Penalties STANDARD INPUTS • Population Forecast • Income Forecast • Unemployment Rate Forecast • Technology Forecast • Existing Fleet Composition • Existing Fleet Fuel Economies	• New Car Sales • Composition of Sales • New Car Prices • New Car Fuel Economies • Fleet Size • Fleet Composition • Scrappage • Vehicle Miles of Travel • Gasoline Consumption

TABLE 2.-MODEL EQUATIONS

1) $$N_t = (286{,}721.3)\left[O_t^* - (Autos_t - D_t)\right]^{.2178}(X_t^*)^{-1.7039}$$

2) $$O_t^* = \left(\sum_I H_I P_{It}\right) HHLD_t$$

3) $$H_I = .017861^{.4743}$$

4a) $$S_t = \frac{1}{1+e^{-\left[-4.1749 - 1.8660(X_t^S) + 3.5093(X_t^M) + 5.6428(S_{t-1})\right]}}$$

4b) $$M_t = \frac{1}{1+e^{-\left[-4.1749-2.0765(X_t^M)+3.5450(X_t^S)+.2589(X_t^L)+5.6428(M_{t-1})\right]}}$$

4c) $$L_t = \frac{1}{1+e^{-\left[-4.1749-.4299(X_t^L)+1.8117(X_t^M)+5.6428(L_{t-1})\right]}}$$

5) $$SPG_t = .4068 - .0784(P_n)_t - .0155(U_t)$$

6) $$\frac{VMT}{HHLD_t} = -52979.8 + 15087\ LOG\ \frac{DI}{HHLD_t} - 2204.24(CMP)_t + 6337.24\ \frac{Autos}{HHLD_t}$$

N_t = Total new car sales in year t

O_t^* = Target ownership of automobiles in year t

$(Autos)_t$ = The stock of automobiles on hand as of January 1 of year t

D_t = The number of autos scrapped during year t

X_t^* = An index of the real generalized price of new cars, 1967=1.00

S_t, M_t, L_t = Market shares of small, medium, and large cars, respectively, in year t

X_t^S, S_t^M, X_t^L = An index of the real generalized price of small, medium and large cars, respectively, relative to that of all new cars in year t, 1967=1.00

SPG_t = The rate of scrappage in year t of vehicles eight or more years of age

$(P_n)_t$ = An index of the real price of new cars in year t, 1967=1.00

U_t = The unemployment rate in year t

DI_t = Total real disposable income in year t

VMT_t = Total vehicle miles travelled in year t

CPM_t = An index of the fleet real gasoline costs per miles in year t, 1967=1.00

$HHLD_t$ = The total number of households existing in year t

P_{It} = Fraction of total households in year t having income I

derivation is described in the Marketing and Mobility Panel Report.[1] They require a considerable volume of supporting computation in actual operation. These computational processes are described in a program documentation report.[2]

B. MODEL STRUCTURE

This section presents a brief, largely qualitative, overview of the structure of the Auto Sector Forecasting Model. This background is intended to give the user some general understanding of the operation of the model programs. Their use will be detailed in a later section.

The existing fleet (adjusted for vehicles scrapped during the year) is used as the primary basis for constructing new car demand. An index of the need for new vehicles is obtained by comparing the stock of vehicles-in-use with a "target" stock based upon demographic and economic factors. Vehicle price factors are then incorporated to determine the extent to which the "target" fleet size is realized through new car sales. Once the total new car sales level is determined, this is subdivided into size classes on the basis of relative prices by share. The new vehicles thus added form the basis for revising the vehicle stock (as shown by the dotted line in Figure 1) as well as for computing the vehicle miles of travel and gasoline consumption of the fleet.

The sequence of general steps shown in Figure 1 is repeated once for each year of the forecast period. In the long run, the nation's stock of cars grows in response to increasing population and affluence. Each year's "new" fleet becomes the next year's "existing" fleet. It is diminished by scrappage and augmented by new car sales, year after year, so that the composition of the "old" fleet in distant years is a product of earlier sales projections. Any future year's scrappage, new car sales, or total fleet size are thus the result of forecasts for all preceding years, as are forecasts of vehicle miles of travel and gasoline consumption.

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[1] *ibid*.

[2] *Jack Faucett Associates, Auto Sector Forecasting Model: Program Documentation, report prepared for the Federal Energy Administration, June 1976.*

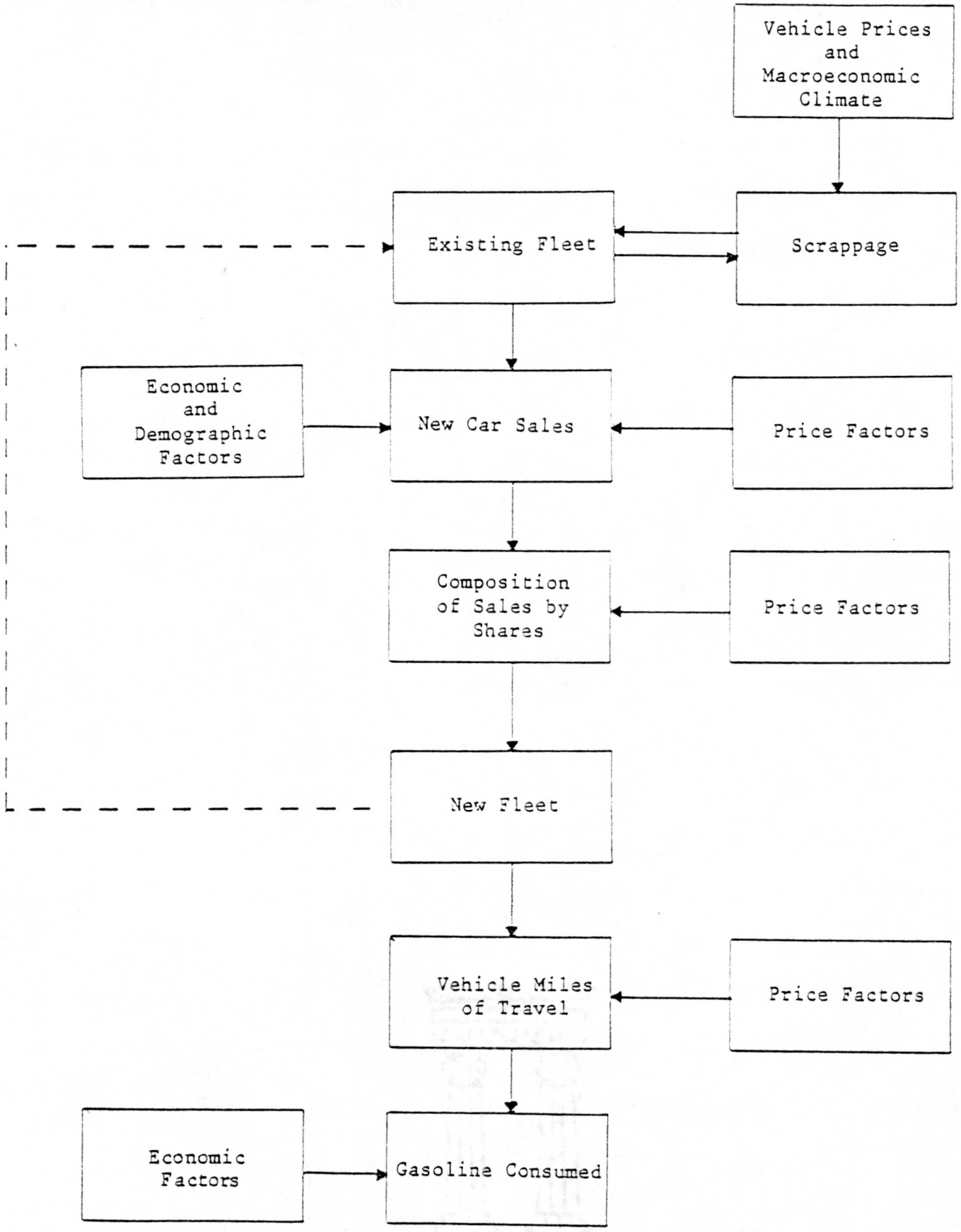

FIGURE 1.-AUTOMOBILE SALES FORECASTING MODEL

The highly interactive process sketched above can be understood in greater structural detail by considering its major segments individually. This is done below by breaking the overall process into eight key parts which will be discussed in turn:

- number of surviving cars on the road
- generalized price
- target automobile ownership
- new car sales
- market shares
- vehicle miles of travel (VMT)
- petroleum product consumption
- vehicle price and fuel economy.

Number of Surviving Cars on the Road

Figure 2 shows the process by which the number of cars on the road is calculated, prior to estimation of new car demand. First of all, the existing stock of vehicles, by size class and vintage, is available from previous forecast cycles or, for years in the immediate future, from a combination of forecasts and knowledge of the fleet in existence in 1975. The rates by which vehicles are scrapped from this fleet depend on vehicle age. The average scrappage rates are applied for vehicles one through nine years of age, as these tend to be constant over time. Older vehicles, by contrast, tend to be maintained longer when macroeconomic conditions are poor or when replacement costs are high. In the Auto Sector Forecasting Model, scrappage rates for these older vehicles are computed, by class, as a function of new car prices (which reflect replacement costs) and the unemployment rate (which serves as a proxy for the macroeconomic climate). These scrappage rates are then applied to the vehicle stock in existence for each forecast year and scrappage by class and vintage category are then computed, and the total number of surviving vehicles is calculated by summing across all classes and vintages. This total stock of operating vehicles net of scrappage is later used as one of the key determinants of new car demand. Revision of the scrappage process to reflect holding cost differentials attributable to registration fees is one of the key modifications detailed later.

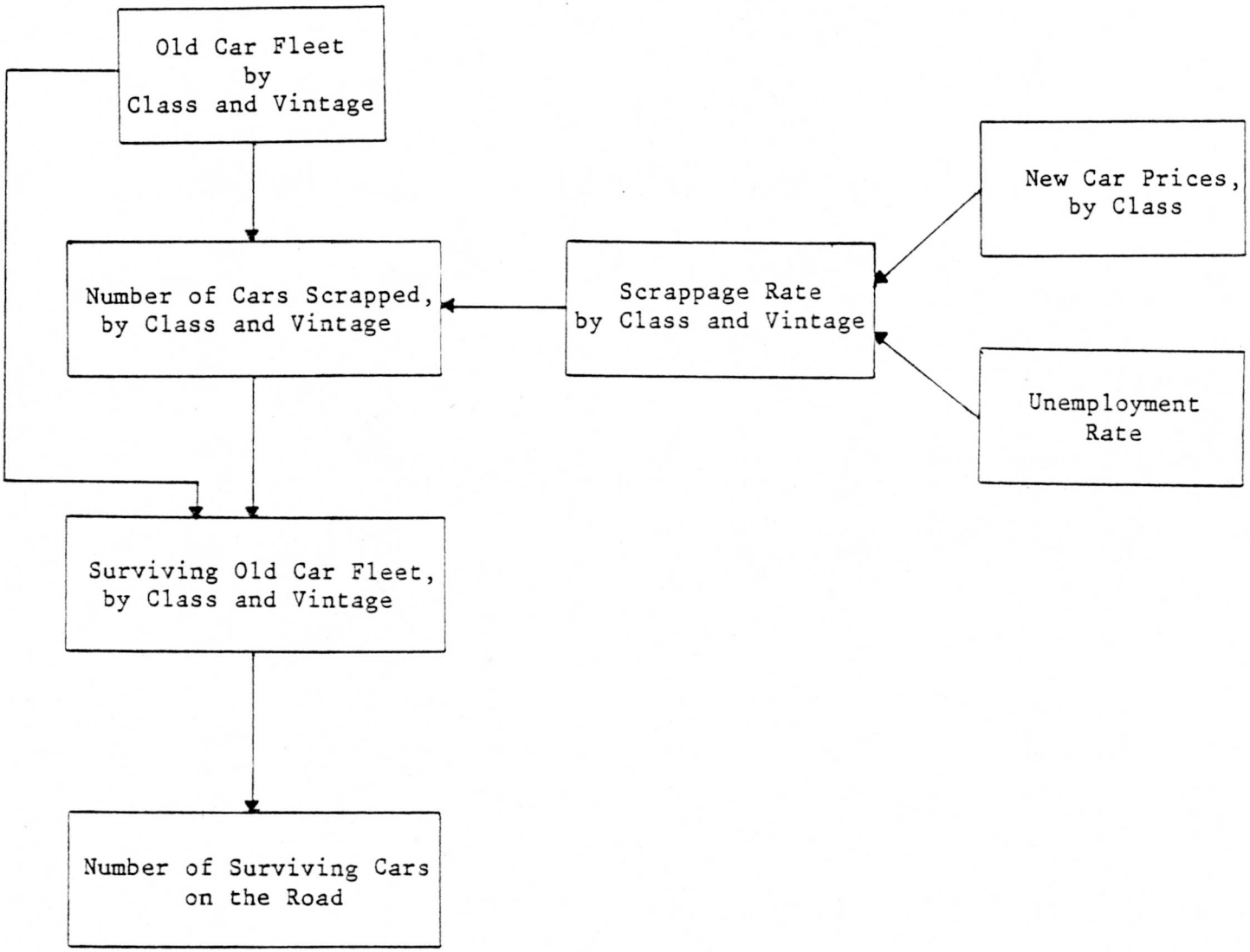

FIGURE 2.- COMPUTATION OF THE NUMBER OF SURVIVING CARS ON THE ROAD

Generalized Price

Prices clearly play a role in determining new car sales and there are several price-related automotive features which require consideration in a model of vehicular fuel use, namely new car prices, new car fuel economies, and gasoline prices. The lifetime operating costs of the car which are attributable to gasoline may be computed from the price of gasoline and the fuel economy of the car, taking into account the expected profile of mileage per year over the vehicle's life and the economic discount rate. This lifetime gasoline opearating cost may then be combined with the price of a new car to arrive at an index of a vehicle's overall cost -- both the acquisition cost and the operating cost. (Obviously, incurance, maintenance, repair, and numerous other costs also contribute to lifetime costs, but these are not isolated here because they are not closely related to variations in vehicular fuel economy, the primary focus of this investigation.) Figure 3 illustrates the process by which we compute the generalized price. The price of gasoline and the fuel economy of the car are combined to yield the lifetime gasoline costs of operating a vehicle in each class. This is then added to the new car price for each class to compute the generalized price, by class. Finally, these generalized prices for each class are merged into a single weighted-average generalized price for new cars. The weights used in computing this average are the shares of sales during the previous year. The generalized price thus computed is the key new vehicle price variable which triggers new car sales within the Auto Sector Forecasting Model.

Target Automobile Ownership

Conventional stock adjustment models employ a variable reflecting the "desired" stock of some durable good and then proceed to model the demand for new goods of that sort based on a lagged movement toward the desired stock. A somewhat similar construct is employed by the Auto Sector Forecasting Model. Like the stock adjustment approach, the Auto Sector Forecasting Model shows the sale of new automobiles to be driven by some underlying (annually increasing) target stock. Unlike the stock adjustment approach, deviations from the target stock levels are not primarily attributed to adjustment lags but to vehicle prices. That is, the target is not some idealized point in stock ownership but rather is a

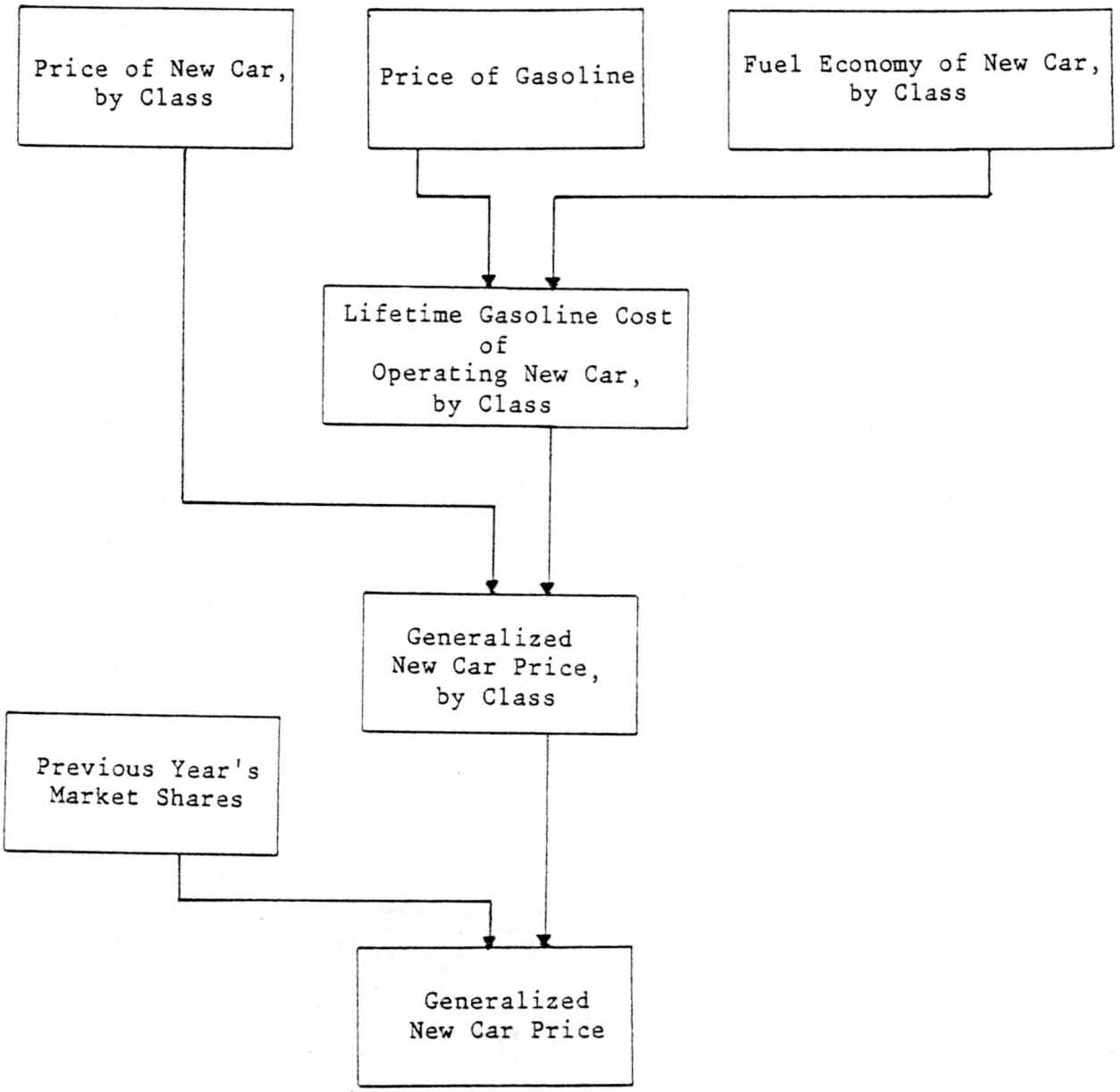

FIGURE 3.-COMPUTATION OF GENERALIZED PRICE

baseline ownership profile reflecting increasing population and affluence. Departures from that baseline may run in either direction, depending upon price conditions. There is also a critical structural difference. Stock adjustment models are generally designed to collapse to a single equation model, allowing minimal description of scrappage and used cars generally. The Auto Sector Forecasting Model employs a recursive structure whereby scrappage is estimated separately and fed into the new car sales equation.

The structure by which the target auto stock is computed is set out in Figure 4. The average target automobile ownership per household is computed by weighting the target automobile ownership per income group by the fraction of the population falling in each income group. The overall target ownership is then computed from the per-household statistic (which reflects affluence effects) and the projected population.

New Car Sales

The number of new cars sold is estimated directly from the characteristics described above, as illustrated in Figure 5. The forecast of sales draws on three processes described above:

- the number of surviving cars on the road,
- the generalized price of new cars, and
- the target automobile ownership.

The number of surviving cars on the road is subtracted from the target automobile ownership to find the shortfall in the existing automobile stock. This shortfall forms the backbone of our new car demand estimation procedure. It serves as an index of "normal" demand which is adjusted downward or upward depending upon price conditions, represented in the model by the generalized new car price.

Market Shares

The shares of new car sales within each size class are computed from econometrically-estimated relationships which incorporate the market-weighted

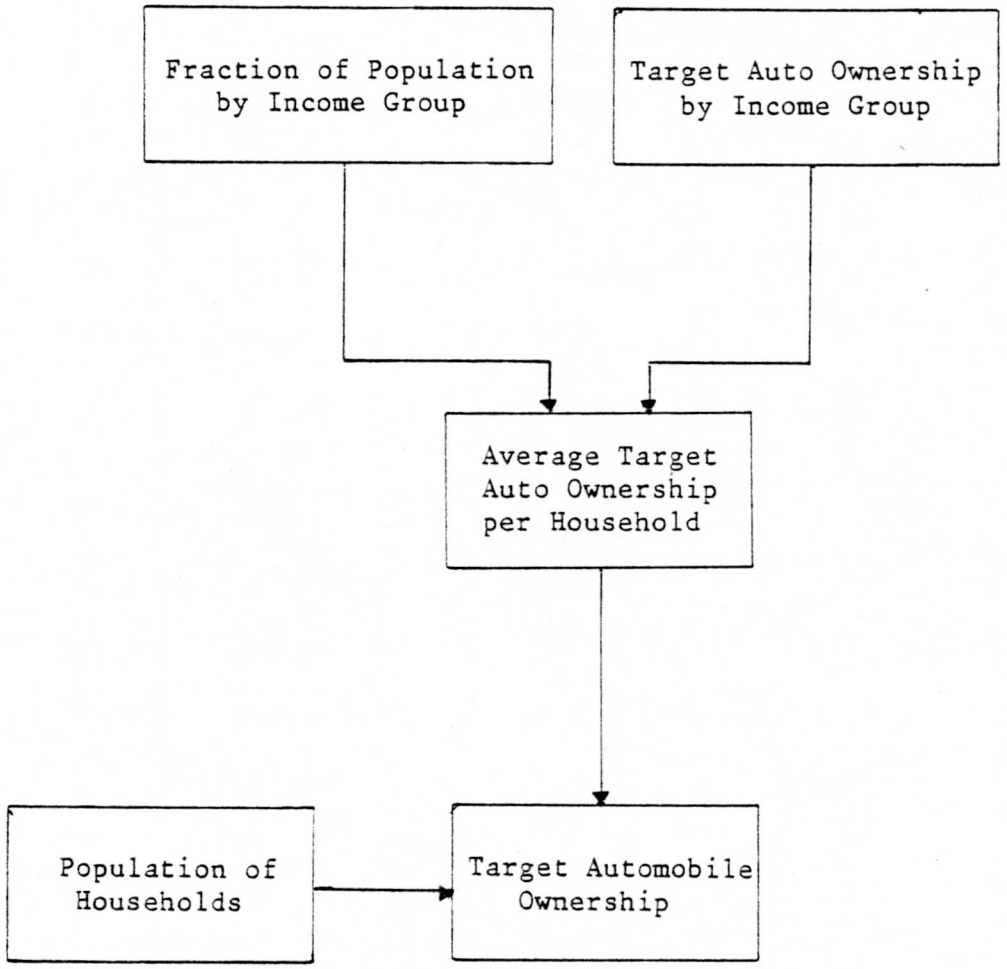

FIGURE 4.-COMPUTATION OF TARGET AUTOMOBILE OWNERSHIP

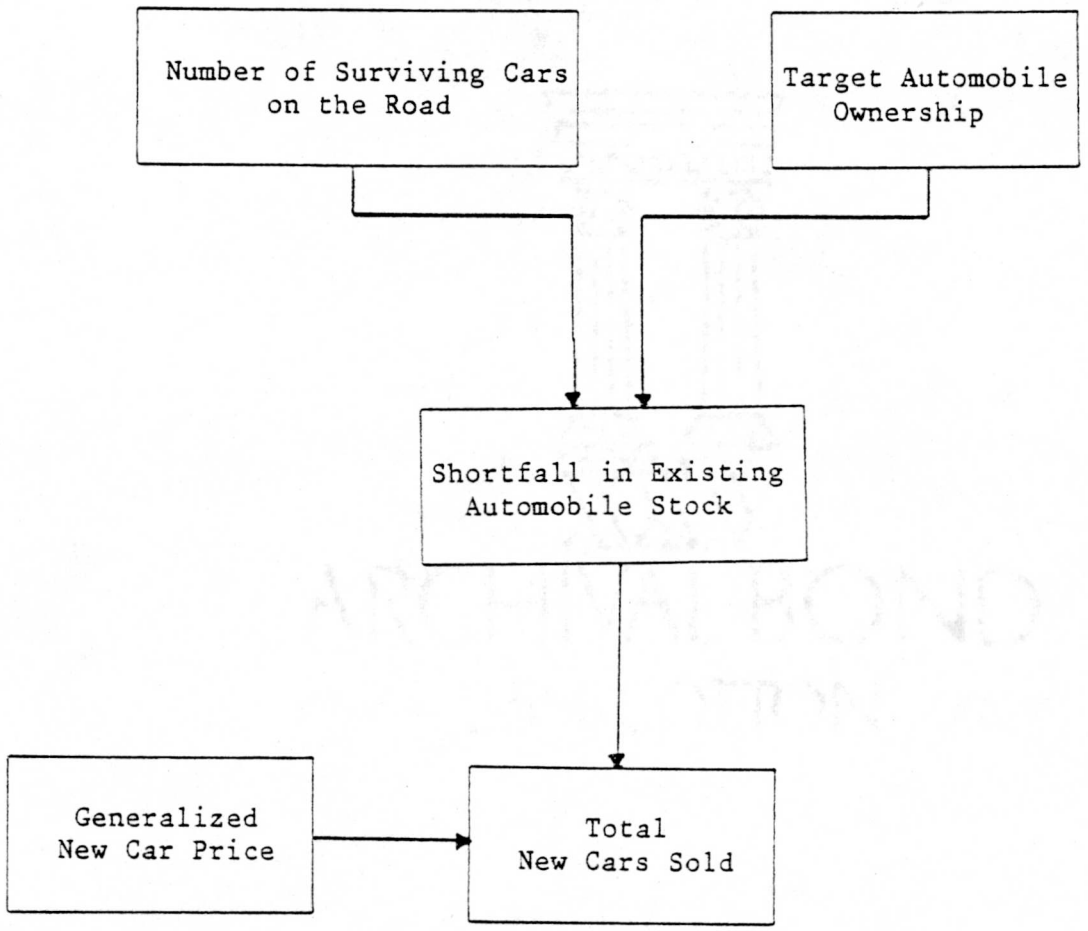

FIGURE 5.-SCHEMATIC STRUCTURE OF TOTAL NEW CAR DEMAND

generalized price for vehicles in adjacent shares, and the (single period) lagged share of the same class. The shares thus estimated are normalized so that their total is exactly one, and these shares are then multiplied by the total sales estimated earlier in order to calculate the number of units sold by share. These numbers then form the current period's entry within the model's representation of the vehicular stock by class and vintage.

Vehicle Miles of Travel (VMT)

The total number of vehicle miles of travel per household is computed from an estimated relationship based upon one exogenous factor (the disposable income per household) and two endogenous factors (automobile ownership per household and the gasoline portion of vehicle cost per mile). The operating cost is computed from the harmonic mean of the fleet's fuel economy, calculated across all size classes and vintages. This mean fuel economy is then combined with the appropriate price of gasoline (an exogenous input) to compute the gasoline cost per mile.

Petroleum Product Consumption

The quantity of petroleum products consumed in any projection year can be computed directly from the projections developed in previous steps as described above. However, one further behavioral relationship is introduced by the Auto Sector Forecasting Model in this computation, namely the observed decline in VMT which accompanies vehicle age. The total VMT computed above is first of all allocated to vintage groups in proportion to their observed relative miles of use, weighted according to the number of vehicles in each vintage group. On this basis, VMT by class and vintage are computed. These VMT estimates are then combined with fuel economies by class and vintage to deduce petroleum product consumption by class and vintage. (Different petroleum-type requirements can be specified as an attribute of new cars.) The total petroleum product consumption (and its composition by fuel type) can then be calculated from the detailed consumption calculations described above.

Vehicle Price and Fuel Economy

The price and fuel economy of new cars, by size class and model year, is computed from a set of curves describing the potential combinations of cost and fuel

economy which are projected to be achievable by the auto industry in future years. The derivation of these curves is described in a separate report.[1] They are applied here by assuming that the vehicle manufacturers, acting independently, seek to minimize the generalized price of the vehicles which they sell, taking into account the cost of the automobile itself, the discounted lifetime gasoline operating costs of the vehicle, and any special payments due to fuel economy excise taxes, rebates, or penalties for not meeting standards. The combination of price and fuel economy which minimize this generalized price (including consideration of penalties, etc.) is used by the model as the price and fuel economy "input" for a given year. Alternatively, provision has been made for users to override this automated setting of price and fuel economy "input." If the user elects to exercise this option, he must enter his own vehicle prices and fuel economies for each vehicle size class and model year.

C. PREPARATION OF MODEL INPUT

Before executing the model described here, it is necessary to prepare the inputs needed to describe the federal policy to be analyzed. These required inputs are summarized in Table 3 and are described briefly below.

One of three alternative policy approaches may be specified by the program user. To indicate which policy option is in effect, the user will input one of the capitalized words in parentheses shown after the policy descriptions below:

- No federal intervention (NONE),
- The imposition of mandatory fuel economy standards and associated penalties (STANDARDS), and
- The levy of an excise tax/rebate program for new car sales (EXCISE).

Regardless of the policy alternative selected, the user will also need to input the gas price for 1976 and subsequent years. If the price of gasoline is expected

[1] *Hittman Associates, Inc., Fuel Economy/Cost Relationships for Future Automobiles, report prepared for Jack Faucett Associates, Inc, submitted to the Federal Energy Administration, January 1976.*

TABLE 3.-DATA PREPARATION CHECK LIST

Input Description	Policy		
	No Federal Standards or Excise Taxes (NONE)	Statuatory Fuel Economy Standards (STANDARDS)	Excise Tax/Rebate Program (EXCISE)
① NUMBER OF YEARS OF ANALYSIS REQUIRED FOR THIS RUN (no. needed = final forecast year minus 1975)	X	X	X
② INTERVAL AT WHICH OUTPUT IS TO BE PRINTED	X	X	X
③ 1976 GASOLINE PRICE[a]	X	X	X
④ ANNUAL PERCENTAGE GROWTH IN GASOLINE PRICE	X	X	X
⑤ GASOLINE PRICE SERIES, 1976-2000. NEEDED IF GROWTH RATE IS NOT CONSTANT[a]	X (optional)	X (optional)	X (optional)
⑥ ANNUAL NEW CAR FUEL ECONOMY AND PRICES,[a] 1976-2000. NOT NEEDED IF INTERNAL DEVELOPMENT IS SELECTED.	X (optional)	X (optional)	X (optional)
⑦ ANNUAL FUEL ECONOMY STANDARDS AND ASSOCIATED PENALTIES (AFTER-TAX EFFECT)		X	
⑧ ANNUAL EXCISE TAX OR REBATE FOR EACH MPG LEVEL			X

X = Input required by model.

[a]*All dollar inputs are required in terms of 1974 dollars.*

to grow at a constant rate, the 1976 value and the rate of growth are sufficient to describe this input; if not, an annual gas price series for 1976-2000 must be prepared. New car prices and fuel economies may be determined automatically within the program or the user may elect to use an exogenously-input set. If an exogenous set is utilized, prices should reflect 1974 dollars and fuel economy should be in miles per gallon.

The program is able to produce annual output between 1976 and 2000. However, the user may select less than the full 25 year period and/or a periodic output at a less-than-annual interval.

The price, fuel economy and output inputs are required regardless of the policy alternative being examined. No additional data are needed for the no federal-intervention (NONE) alternative. If STANDARDS are to be analyzed, the user will need for each year a fuel economy standard in MPG and the associated penalty. If EXCISE is selected, the user will need the tax or rebate for each year and MPG level.

II. INPUT PROCEDURES

A. GENERAL ORGANIZATION AND PROCEDURES

From the user's point of view, the model may be thought of as comprising four branches:

- the main branch
- the standards branch
- the excise tax branch
- the external price/fuel economy branch.

User communication with each of these branches is described in separate sections below. Before beginning these descriptions, however, it will be helpful to note several general procedures and conventions which apply throughout all four branches.

Each section contains a schematic diagram of communications issued by and required by a particular branch. For example, Figure 6 shows the prompts printed by the main branch (in solid-line boxes), the legal responses for verbal responses (shown in script), and the formats for numerical responses (shown as FORTRAN format specifications). The experienced user may find these schematic summaries sufficient to guide his program responses; more detailed illustrations from actual usage are provided to initiate users to the program.

Alphanumeric responses (i.e., verbal inputs such as "YES," "NO," "STANDARDS," etc.) which do not conform to input requirements will generally be ignored by the program and will cause the prompt to be repeated. This is not the case with errors in numeric data inputs which may cause the program to abort or incorrectly interpret the input. Except in two cases (years and excise tax/rebate table entries), all numeric values must include a decimal point and all must be typed in the assigned character position. Where several values are included in a single line they must be separated by a comma.[1] All responses must start in column one.

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[1] *The comma may be replaced by a blank or any other delimiter to separate multiple inputs.*

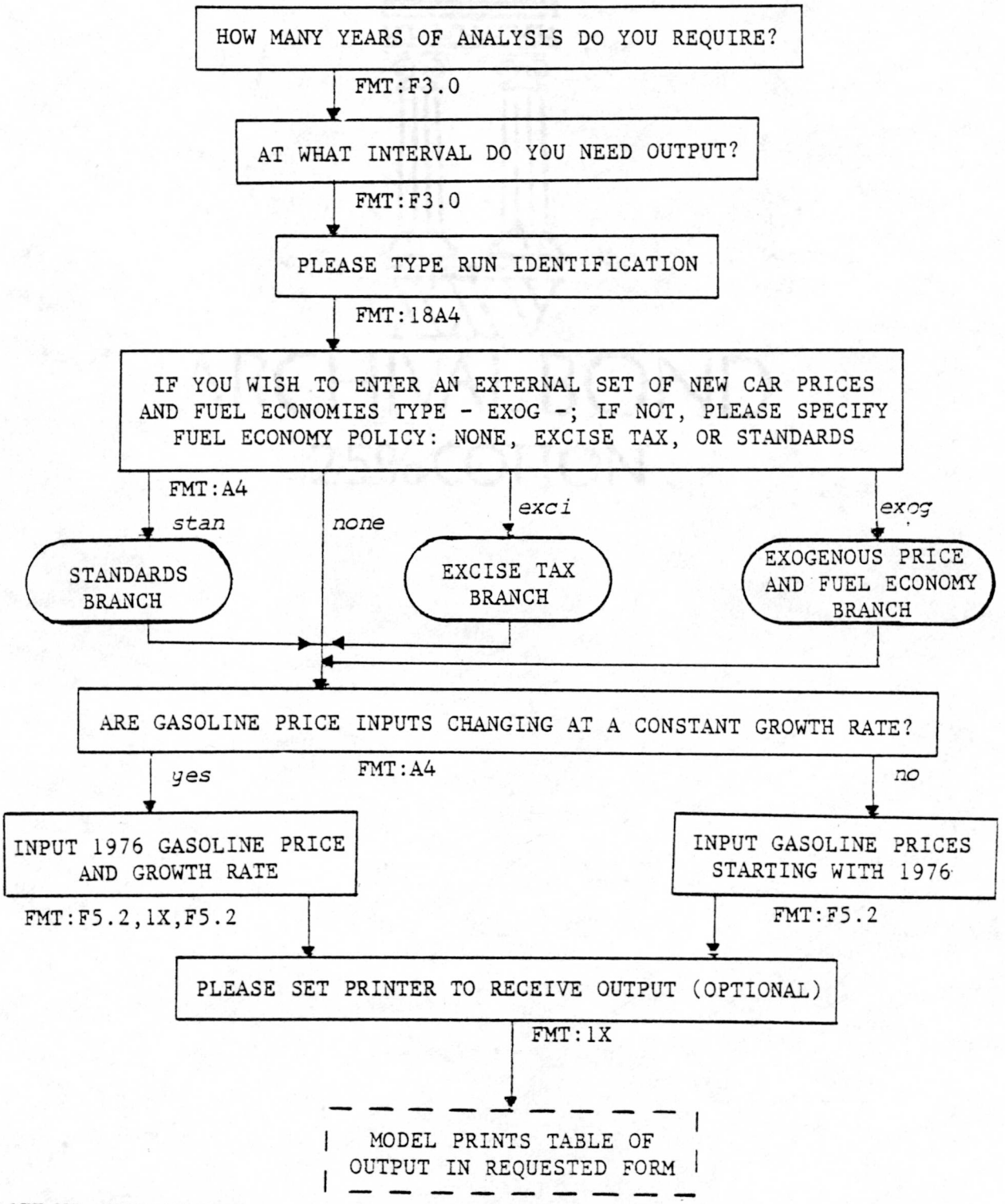


FIGURE 6: AUTOMOBILE SECTOR FORECASTING MODEL
FLOW CHART OF USER PROMPTS AND RESPONSES

Corrections to previous inputs may be made by the user in many situations without returning to the program start. If the carriage return has not been depressed, backspacing over the erroneous input and retyping the remaining portion of the line will "erase" the error prior to its transmission to the program. If an error is discovered in the input of standards, excise taxes, new car prices or new car fuel economies after the carriage return has been depressed (but prior to completion of input), the error may be corrected by retyping the entry for the year in question. For several inputs the program allows the inputs to be printed at the terminal so that they may be checked for errors and corrections made where necessary.

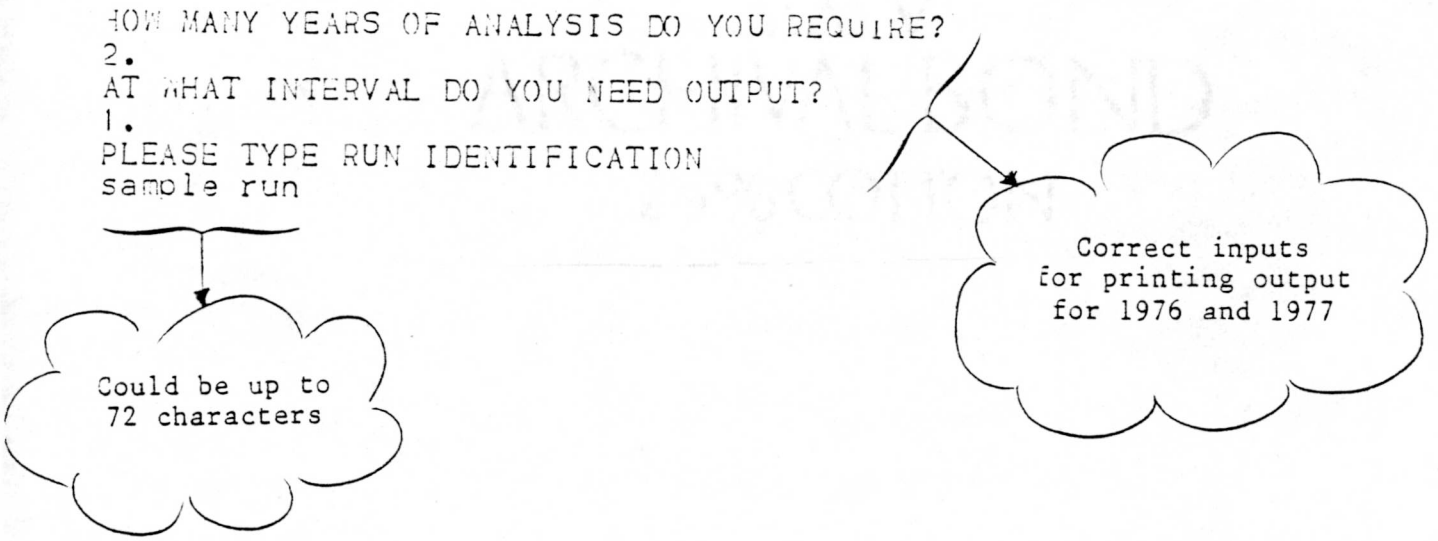
B. MAIN BRANCH PROCEDURES

The Main Branch calls for user inputs which are common to all policy types, i.e., output identification material, length of the analysis period, desired frequency of program output, and the gasoline price projection. It also monitors the execution of the projections themselves, and it supervises the printing of the model output. The overall structure of the Main Branch is shown in Figure 6. Its execution is described in the sequence in which it occurs below. Upper case letters are printed by the program and lower case and numerical entries are typed by the user on his terminal in response to the prompts.

1. The first three prompts request information that will be used to title and structure the program output. The user will determine the number of years of analysis required by taking the last year required and subtracting 1975. The output may also be selected at a less than annual interval. To input these two values start in column one, enter the number requested and follow it with a decimal point. In response to an identification request, any title of less than 73 characters, including spaces, may be used to head the output.

```
HOW MANY YEARS OF ANALYSIS DO YOU REQUIRE?
2
AT WHAT INTERVAL DO YOU NEED OUTPUT?
3
PLEASE TYPE RUN IDENTIFICATION
sample run
```

These two inputs are incorrect since no decimal point was typed. The model would read this as twenty years of analysis printed at thirty year intervals!



2. Answering the next prompt will determine how future new car prices and fuel economies will be set. The user may input these himself by responding EXOG or he may select one of three government policies:

- if no federal fuel economy standards or tax systems are to be imposed, the user responds with NONE,
- if a set of MPG standards and associated penalties are to be imposed, the user types STAN,
- if an excise tax/rebate program is to be imposed, the user types EXCI.

In each case the program will shift to the selected branch. Each of these branches is described later in a separate section. After the model runs through the selected branch (or, immediately, if NONE is specified) it will return control to the main branch for the gasoline price inputs.

```
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
no
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
prices
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
stop
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
no policy
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
tax
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
ex tax
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
exc
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
std
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
sta
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
s
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
st
```

All of these responses are incorrect so the program will repeat the prompt. The only acceptable user inputs are none, exog, stan, or exci.

IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY: NONE,EXCISE TAX, OR STANDARDS
excise tax

IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY: NONE,EXCISE TAX, OR STANDARDS
exci

IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY: NONE,EXCISE TAX, OR STANDARDS
stan

IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY: NONE,EXCISE TAX, OR STANDARDS
exog

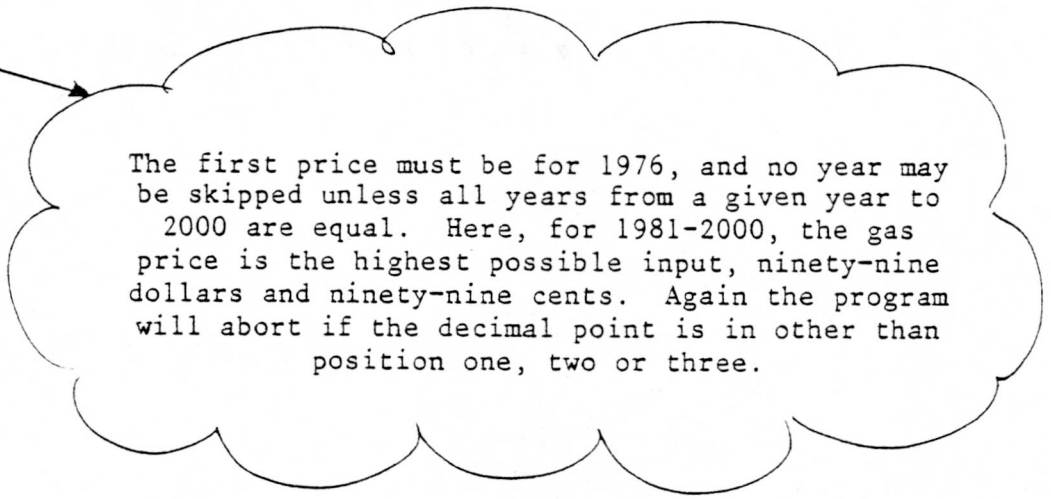
These are examples of correct responses. The next prompt will depend on the branch selected. Note that only the first four letters are read by the program. Any additional material is ignored.

3. After the policy branches have been completed and control returns to the main branch of the program, the next input requested relates to gasoline prices. If the price is to remain constant or to grow at a constant rate, only the 1976 price and the growth rate need to be input. Alternately, if some other growth pattern is to be assumed, a price for each year from 1976 to 2000 can be input. If the constant growth rate option is desired, this intention is entered to the model by typing, starting in column one, a four digit gasoline price with a decimal, a comma, and the percentage growth rate followed by a decimal point. Thus a constant gasoline price of sixty cents would be input as 00.60,0. . If the growth rate is not constant, the 1976 price is input as before, but it is followed by a carriage return and then the 1977 price. The series is terminated by a zero in column one and a carriage return. If the zero appears prior to the year 2000's price input, all years not typed are set equal to the highest-numbered year for which specific input was entered.

```
ARE GASOLINE PRICE INPUTS CHANGING AT A CONSTANT GROWTH RATE?
yes
INPUT 1976 GASOLINE PRICE AND GROWTH RATE
00.60,3.
```

These responses will cause the gasoline price to grow at 3% per year. If the first prompt were answered by other than YES or NO, it would have repeated. In answering the second prompt, the most critical aspect is the position of the numbers. The comma must be in the sixth position. A decimal point may appear only in positions one, two, three, seven, eight, and nine. An error in these positions will cause the program to abort.

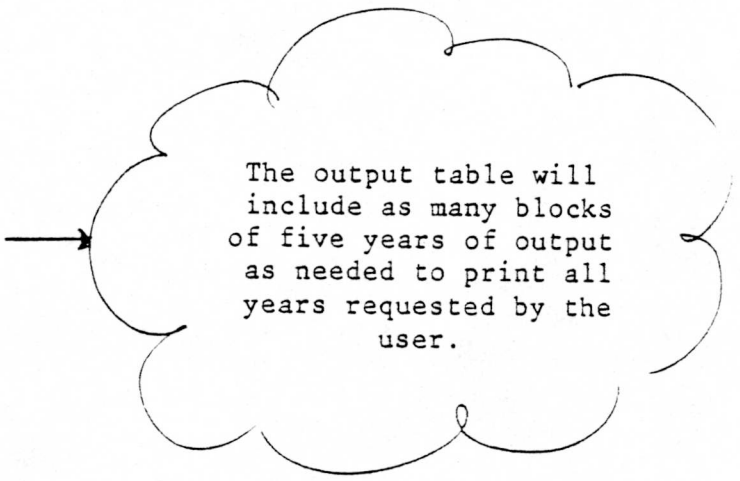
```
ARE GASOLINE PRICE INPUTS CHANGING AT A CONSTANT GROWTH RATE?
NO
INPUT GASOLINE PRICES STARTING WITH 1976
00.60
00.70
00.75
00.80
17.89
99.99
0
```



4. The final prompt allows the user to align a fresh sheet of paper in the terminal printer. This step is optional and is included to allow printers which use 60-line paper to be set so that output is not divided in the middle of a block by page perforations. The user may align the paper by rotating the paper feed until a new sheet appears in typing position and then striking a carriage return. The following output table will then be printed.

SAMPLE RUN

YEAR	1976
TOTAL SALES	12129529.
SMALL SHARE	0.217
MEDIUM SHARE	0.276
LARGE SHARE	0.507
AVG. NEW CAR MPG	15.919
SMALL MPG	22.540
MEDIUM MPG	16.800
LARGE MPG	13.790
NEW CAR PRICES	
SMALL	3051.
MEDIUM	3476.
LARGE	4575.
CARS IN USE	96320785.
SMALL SHARE	0.270
MEDIUM SHARE	0.184
LARGE SHARE	0.546
SCRAPPAGE	8078674.
GAS PRICE	0.600
VMT	1070330.
GAS CONSUMED	79186.
AVG. GEN. PRICE	5933.

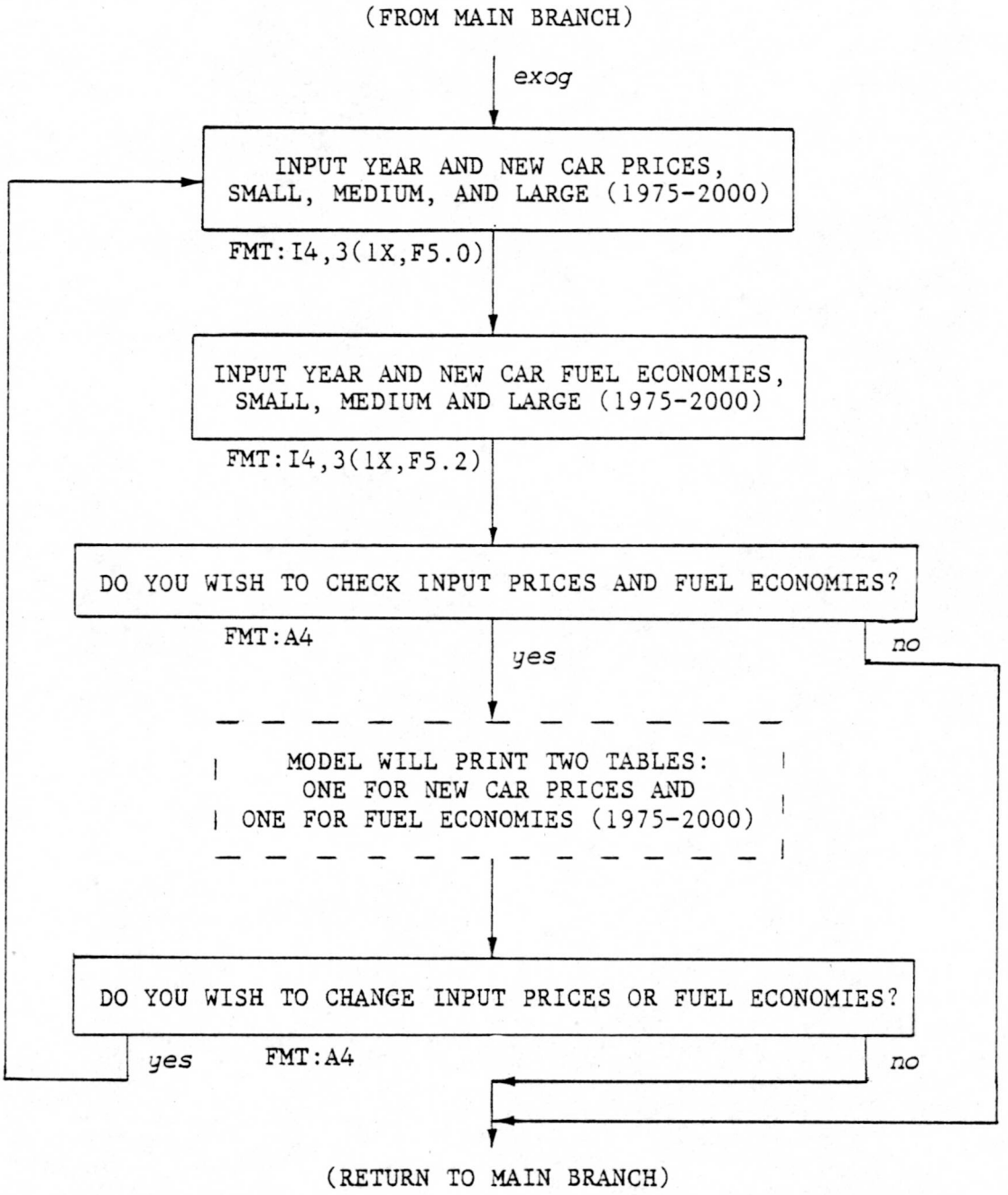


C. EXOGENOUS PRICE AND FUEL ECONOMY BRANCH

This branch collects the user-input information needed to describe a set of exogenously-entered vehicle prices and fuel economies. These characteristics are specified by vehicle size class and by vehicle model year for each year of the analysis period. The overall structure of this branch is set out schematically in Figure 7 and described in the order of execution below.

1. If the user selects EXOG for the policy response, the program switches to this branch. Here the user will be asked to input a series of new car prices and fuel economies for all years from 1975 to 2000. These characteristics are entered by typing the year (1975) in columns one through four, skipping a space or entering a comma, and then typing the new car prices for each class in the following order: small, medium, and large. Each price must be a four digit number followed by a decimal point. Entries should be separated by commas. Upon entry of the price for the large share, the user strikes the carriage return, and the above procedure is repeated to input vehicle prices for the next year. The series is terminated by typing a zero in column one and striking a carriage return. When a zero entry of this sort appears prior to the input for year 2000 prices, entries for all years not input are set equal to those for the latest year which was input specifically. New car fuel economies are input in similar fashion by typing the starting year (1975), followed by a space or comma, and then followed by the fuel economies for each class: small, medium, and large. Each fuel economy entry will take five spaces: two digits, a decimal point and two more digits. Leading zeros are essential and failure to include them will result in input errors. As with vehicle prices, entries should be separated by commas. The series is terminated in the same way as above, i.e., by typing a line with a zero and a carriage return. As before, if the zero appears prior to the entry for year 2000, entries for all years after the latest input are set equal to those for the latest year which was input specifically.

EXOGENOUS PRICE AND FUEL ECONOMY BRANCH



KEY: SOLID LINE BOX = PROGRAMMED PROMPT
BROKEN LINE BOX = REQUESTED OUTPUT TABLE
FMT = FORTRAN FORMAT FOR USER RESPONSE
SCRIPT CASE TYPE = POSSIBLE USER RESPONSE

FIGURE 7: AUTOMOBILE SECTOR FORECASTING MODEL
FLOW CHART OF USER PROMPTS AND RESPONSES

```
INPUT YEAR AND NEW CAR PRICES,SMALL,MEDIUM,AND LARGE
 975 4000.,5000.,6000.,
,976 4100.,5100.,6100.,
19774100. ,5100.,6200.,
0
INPUT YEAR AND NEW CAR FUEL ECONOMIES,SMALL,MEDIUM,AND LARGE
1975 25.00,20.00,15.00
1976 26.00,21.00,16.00
1977 27.00,22.00,  17
0
```

The series must begin in 1975 and if a year is skipped its entries will take on zero values. The position of all characters is most important. If the user noted the error in 1977 for either prices or fuel economies, he could have corrected the error by retyping the year prior to entering the zero.

```
INPUT YEAR AND NEW CAR PRICES,SMALL,MEDIUM,AND LARGE
1975 4000.,5000.,6000.,
1976 4100.,5100.,6100.,
1977 4200.,5200.,6200.,
1978 4300.,5300.,6300.,
0
INPUT YEAR AND NEW CAR FUEL ECONOMIES,SMALL,MEDIUM,AND LARGE
1975 25.00,20.00,15.00,
1976 26.00,21.00,16.00
1977 27.00,22.00,17.00
0
```

These inputs appear to have no error. The program will ignore the trailing commas. It is, however, always important to check the output by having it printed as explained in the next section.

2. The user may now elect to print out the inputs listed above. A NO response to the "check" prompt will return control to the main program. A YES will print the following tables for the inputs listed in 1. above. Two examples of output are listed below, one for each set of inputs discussed in 1. above.

```
DO YOU WISH TO CHECK INPUT PRICES AND FUEL ECONOMIES
yes
```

NEW CAR PRICES

YEAR	SMALL	MED	LARGE
1975	4000.	5000.	6000.
1976	4100.	5100.	6100.
1977	100.	5100.	6200.
1978	100.	5100.	6200.
1979	100.	5100.	6200.
1980	100.	5100.	6200.
1981	100.	5100.	6200.
1982	100.	5100.	6200.
1983	100.	5100.	6200.
1984	100.	5100.	6200.
1985	100.	5100.	6200.
1986	100.	5100.	6200.
1987	100.	5100.	6200.
1988	100.	5100.	6200.
1989	100.	5100.	6200.
1990	100.	5100.	6200.
1991	100.	5100.	6200.
1992	100.	5100.	6200.
1993	100.	5100.	6200.
1994	100.	5100.	6200.
1995	100.	5100.	6200.
1996	100.	5100.	6200.
1997	100.	5100.	6200.
1998	100.	5100.	6200.
1999	100.	5100.	6200.
2000	100.	5100.	6200.

NEW CAR FUEL ECONOMIES

YEAR	SMALL	MED	LARGE
1975	25.00	20.00	15.00
1976	26.00	21.00	16.00
1977	27.00	22.00	0.17
1978	27.00	22.00	0.17
1979	27.00	22.00	0.17
1980	27.00	22.00	0.17
1981	27.00	22.00	0.17
1982	27.00	22.00	0.17
1983	27.00	22.00	0.17
1984	27.00	22.00	0.17
1985	27.00	22.00	0.17
1986	27.00	22.00	0.17
1987	27.00	22.00	0.17
1988	27.00	22.00	0.17
1989	27.00	22.00	0.17
1990	27.00	22.00	0.17
1991	27.00	22.00	0.17
1992	27.00	22.00	0.17
1993	27.00	22.00	0.17
1994	27.00	22.00	0.17
1995	27.00	22.00	0.17
1996	27.00	22.00	0.17
1997	27.00	22.00	0.17
1998	27.00	22.00	0.17
1999	27.00	22.00	0.17
2000	27.00	22.00	0.17

```
DO YOU WISH TO CHECK INPUT PRICES AND FUEL ECONOMIES
YES
          NEW CAR PRICES                NEW CAR FUEL ECONOMIES

      YEAR SMALL  MED  LARGE        YEAR SMALL  MED  LARGE
      1975 4000. 5000. 6000.        1975 25.00 20.00 15.00
      1976 4100. 5100. 6100.        1976 26.00 21.00 16.00
      1977 4200. 5200. 6200.        1977 27.00 22.00 17.00
      1978 4300. 5300. 6300.        1978 27.00 22.00 17.00
      1979 4300. 5300. 6300.        1979 27.00 22.00 17.00
      1980 4300. 5300. 6300.        1980 27.00 22.00 17.00
      1981 4300. 5300. 6300.        1981 27.00 22.00 17.00
      1982 4300. 5300. 6300.        1982 27.00 22.00 17.00
      1983 4300. 5300. 6300.        1983 27.00 22.00 17.00
      1984 4300. 5300. 6300.        1984 27.00 22.00 17.00
      1985 4300. 5300. 6300.        1985 27.00 22.00 17.00
      1986 4300. 5300. 6300.        1986 27.00 22.00 17.00
      1987 4300. 5300. 6300.        1987 27.00 22.00 17.00
      1988 4300. 5300. 6300.        1988 27.00 22.00 17.00
      1989 4300. 5300. 6300.        1989 27.00 22.00 17.00
      1990 4300. 5300. 6300.        1990 27.00 22.00 17.00
      1991 4300. 5300. 6300.        1991 27.00 22.00 17.00
      1992 4300. 5300. 6300.        1992 27.00 22.00 17.00
      1993 4300. 5300. 6300.        1993 27.00 22.00 17.00
      1994 4300. 5300. 6300.        1994 27.00 22.00 17.00
      1995 4300. 5300. 6300.        1995 27.00 22.00 17.00
      1996 4300. 5300. 6300.        1996 27.00 22.00 17.00
      1997 4300. 5300. 6300.        1997 27.00 22.00 17.00
      1998 4300. 5300. 6300.        1998 27.00 22.00 17.00
      1999 4300. 5300. 6300.        1999 27.00 22.00 17.00
      2000 4300. 5300. 6300.        2000 27.00 22.00 17.00
DO YOU WISH TO CHANGE INPUT PRICES OR FUEL ECONOMIES
NO
```

We can see the difference in the two input examples from above. In the first example the 4 in 4100 was out of position and was ignored by the program. When 17 MPG was placed in the wrong columns it was read by the program as .17 MPG. After printing the inputs, the program will allow the user to go back and make changes as necessary. If the user does not wish to make changes, a NO response to the "change" prompt will return control to the main branch. A YES will start the EXOG branch from the beginning. The user need only type in entries for those years for which changes need to be made. If only price changes are necessary, a zero in the first line of the fuel economy inputs will leave these intact. Again the user will be able to check his new inputs or return to the main branch.

D. STANDARDS BRANCH

This branch collects the user-input information needed to describe the set of standards and penalties to be employed by the model in making forecasts. Standards may be specified separately for each model year.

A standard is defined by two elements:

- the MPG level specified as the "standard," and
- the penalty[1] (per MPG) for not meeting the standard.

Standards are assumed to be applied on the basis of each manufacturer's sales-weighted production.

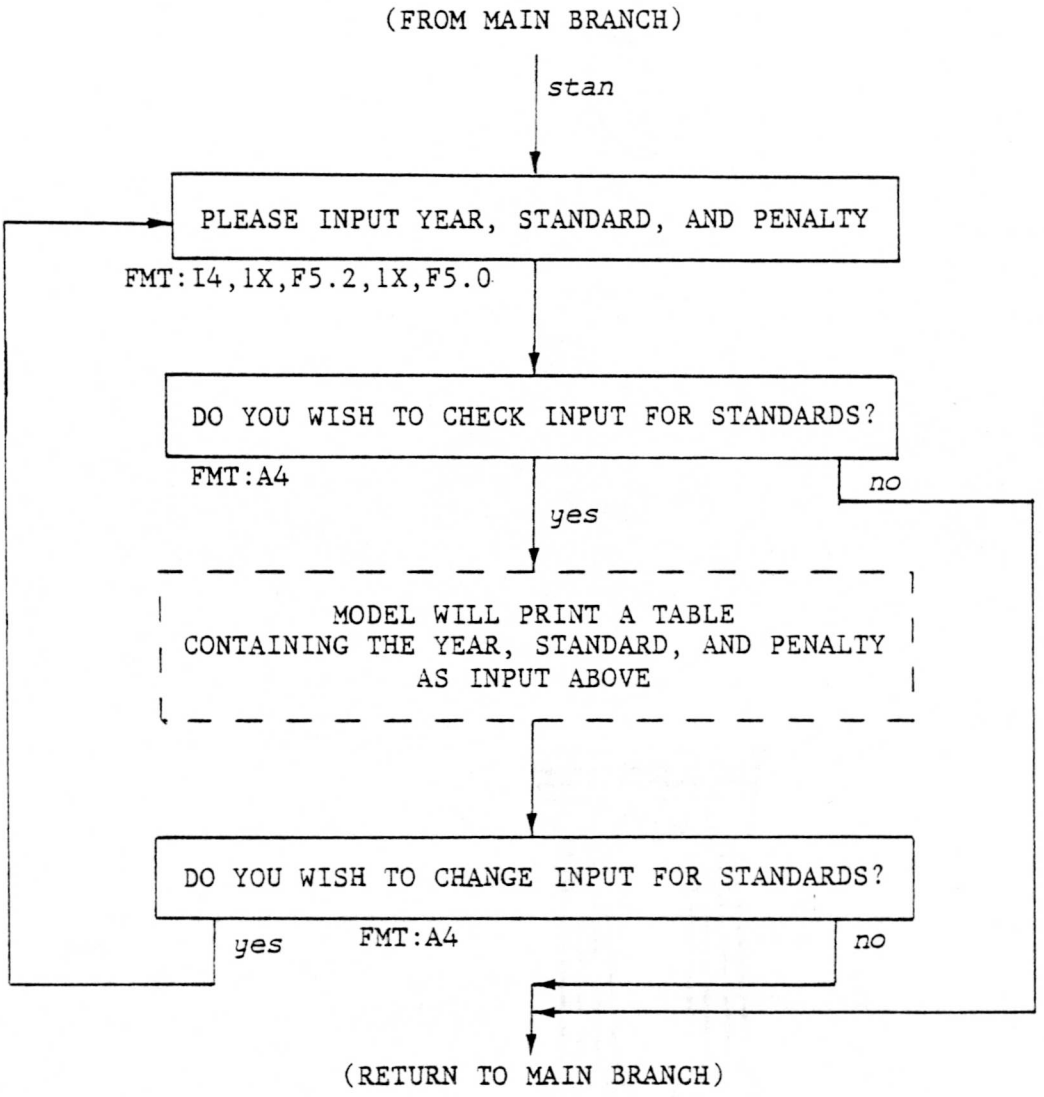
Figure 8 shows the schematic structure of the standards branch, and its operation is detailed below in order of program execution.

1. If the user selects STAN as a response to the policy prompt, the program switches to this branch. The user is asked to input the year, an MPG standard for that year, and the associated penalty per MPG for not meeting the standard. The user responds by typing the year in columns one through four, followed by a comma, a five-position MPG standard (two digits, a decimal point, and two digits), a comma, and the amount of the penalty (up to four digits) followed by a decimal point. The years do not need to be input in any particular order. Years prior to the earliest year typed will be assumed to have no standards in force. Years after the latest year typed will be assumed to have standards equal to those of the highest year entered. The user indicates that all standards have been entered by typing a zero and a carriage return.

---

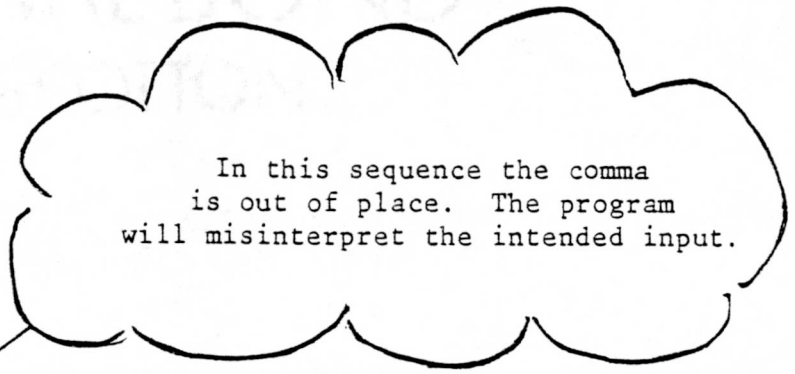
[1] *The penalty, as defined by the Energy Policy and Conservation Act (1975) is not tax-deductable by the manufacturer. Therefore, if a motor vehicle manufacturer is to increase revenues to cover the penalty outlay, the change in price must be twice that of the penalty assuming a 50 percent corporate tax rate. Thus, for program input, the penalty should be twice that written in the law.*

STANDARDS BRANCH

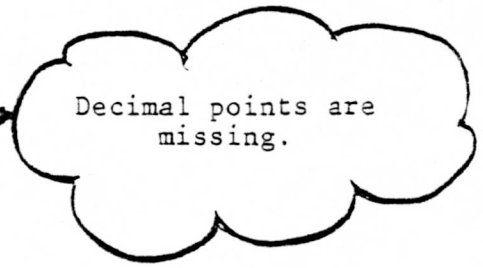


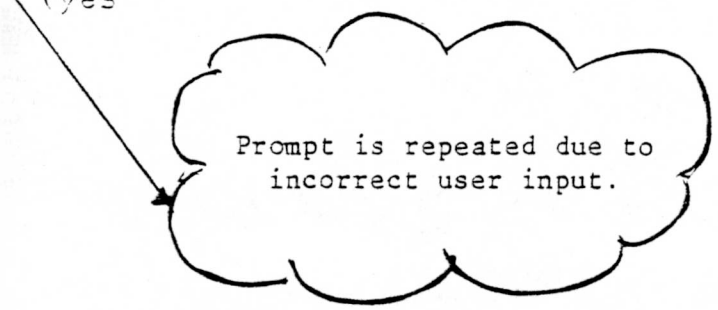
KEY: SOLID LINE BOX = PROGRAMMED PROMPT
BROKEN LINE BOX = REQUESTED OUTPUT TABLE
FMT = FORTRAN FORMAT FOR USER RESPONSE
SCRIPT CASE TYPE = POSSIBLE USER RESPONSE

FIGURE 8: AUTOMOBILE SECTOR FORECASTING MODEL
FLOW CHART OF USER PROMPTS AND RESPONSES

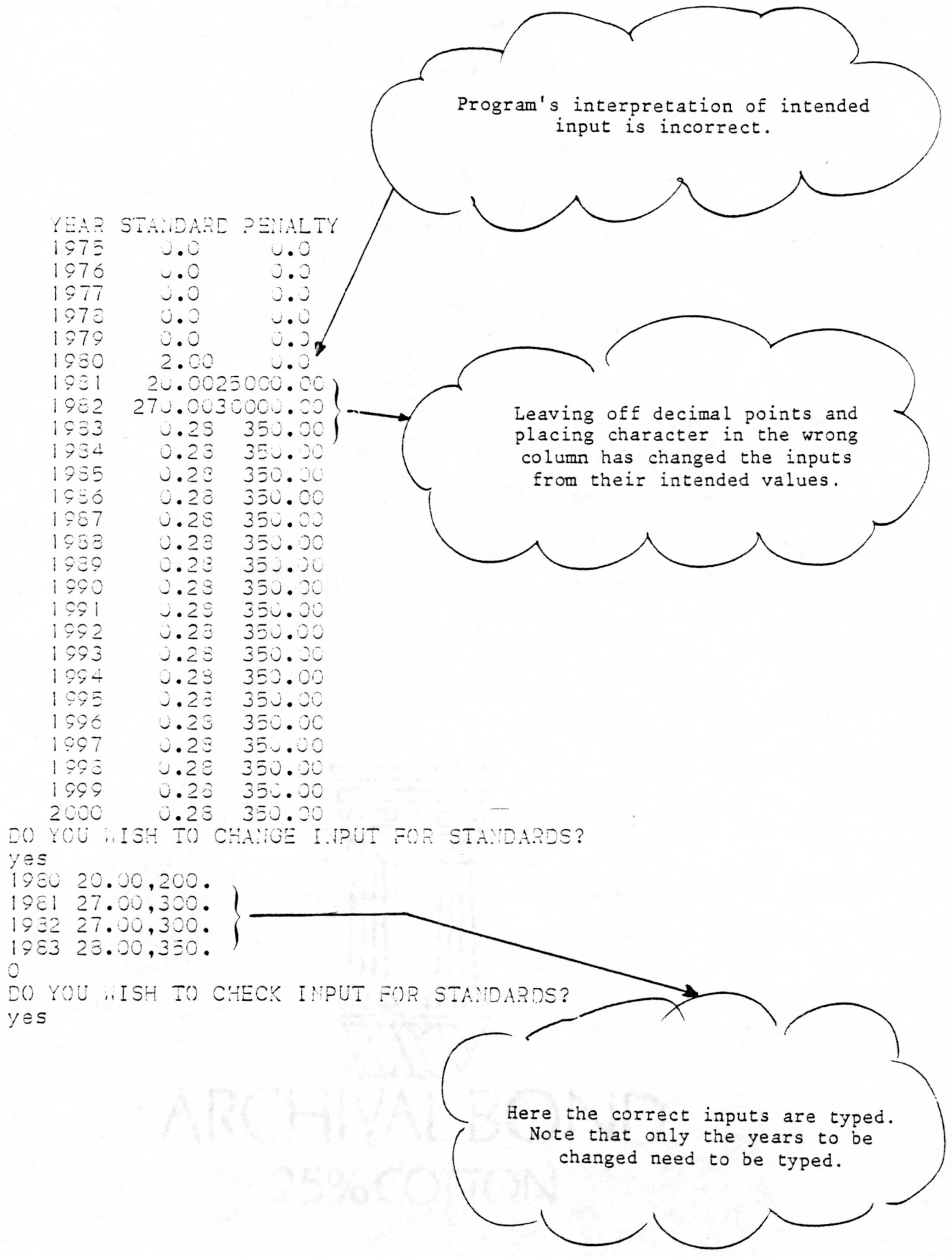



```
PLEASE INPUT YEAR, STANDARD, AND PENALTY
1980   20,200
IHN215I CONVERT - ILLEGAL   DECIMAL   CHARACTER ,
1980   20,200
TRACEBACK  ROUTINE  CALLED FROM ISN   REG.  14   REG.  15   REG.   0   R
EG.   1
           IBCOM                      000B47EC   0003793C   0000001A   0
00AF198
           POLICY                     420B0A3E   000B3538   00000001   0
00AF198
           MAIN                       0001DF38   000AF010   000A4E4C   0
00A4E70
ENTRY POINT=  000AF010
STANDARD FIXUP TAKEN , EXECUTION CONTINUING
1981  20.00,250
1982  27   ,300
1983    28,350.
0
DO YOU WISH TO CHECK INPUT FOR STANDARDS?
ok
DO YOU WISH TO CHECK INPUT FOR STANDARDS?
yes
```

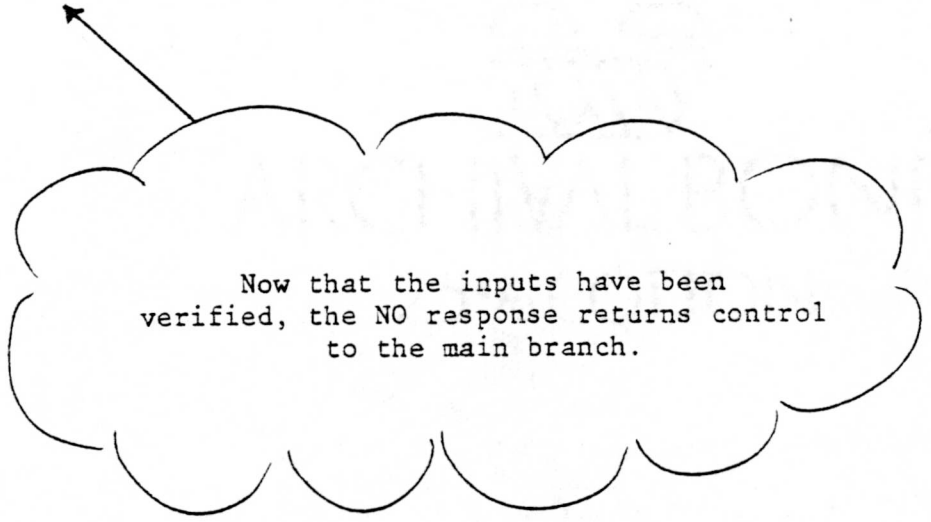




2. Upon completion of the input of the standards, the system allows the user to print the inputs at the terminal for inspection. The "check" prompt may be answered only by a YES or a NO. The prompt will repeat if other responses are entered. A NO response will return control to the main branch. A YES will print the following table and then return control.


Program's interpretation of intended input is incorrect.
YEAR STANDARD PENALTY
1978 0.0 0.0
1979 0.0 0.0
1980 2.00 0.0
1981 20.00 25000.00
1982 270.00 30000.00
1983 0.28 350.00
1984 0.28 350.00
1985 0.28 350.00
1986 0.28 350.00
1987 0.28 350.00
1988 0.28 350.00
1989 0.28 350.00
1990 0.28 350.00
1991 0.28 350.00
1992 0.28 350.00
1993 0.28 350.00
1994 0.28 350.00
1995 0.28 350.00
1996 0.28 350.00
1997 0.28 350.00
1998 0.28 350.00
1999 0.28 350.00
2000 0.28 350.00
Leaving off decimal points and placing character in the wrong column has changed the inputs from their intended values.
DO YOU WISH TO CHANGE INPUT FOR STANDARDS?
yes
1980 20.00,200.
1981 27.00,300.
1982 27.00,300.
1983 28.00,350.
0
DO YOU WISH TO CHECK INPUT FOR STANDARDS?
yes
Here the correct inputs are typed. Note that only the years to be changed need to be typed.

```
   YEAR STANDARD PENALTY
   1975     0.0      0.0
   1976     0.0      0.0
   1977     0.0      0.0
   1978     0.0      0.0
   1979     0.0      0.0
   1980    26.00   200.00
   1981    27.00   300.00
   1982    27.00   300.00
   1983    28.00   350.00
   1984    28.00   350.00
   1985    28.00   350.00
   1986    28.00   350.00
   1987    28.00   350.00
   1988    28.00   350.00
   1989    28.00   350.00
   1990    28.00   350.00
   1991    28.00   350.00
   1992    28.00   350.00
   1993    28.00   350.00
   1994    28.00   350.00
   1995    28.00   350.00
   1996    28.00   350.00
   1997    28.00   350.00
   1998    28.00   350.00
   1999    28.00   350.00
   2000    28.00   350.00
DO YOU WISH TO CHANGE INPUT FOR STANDARDS?
no
```



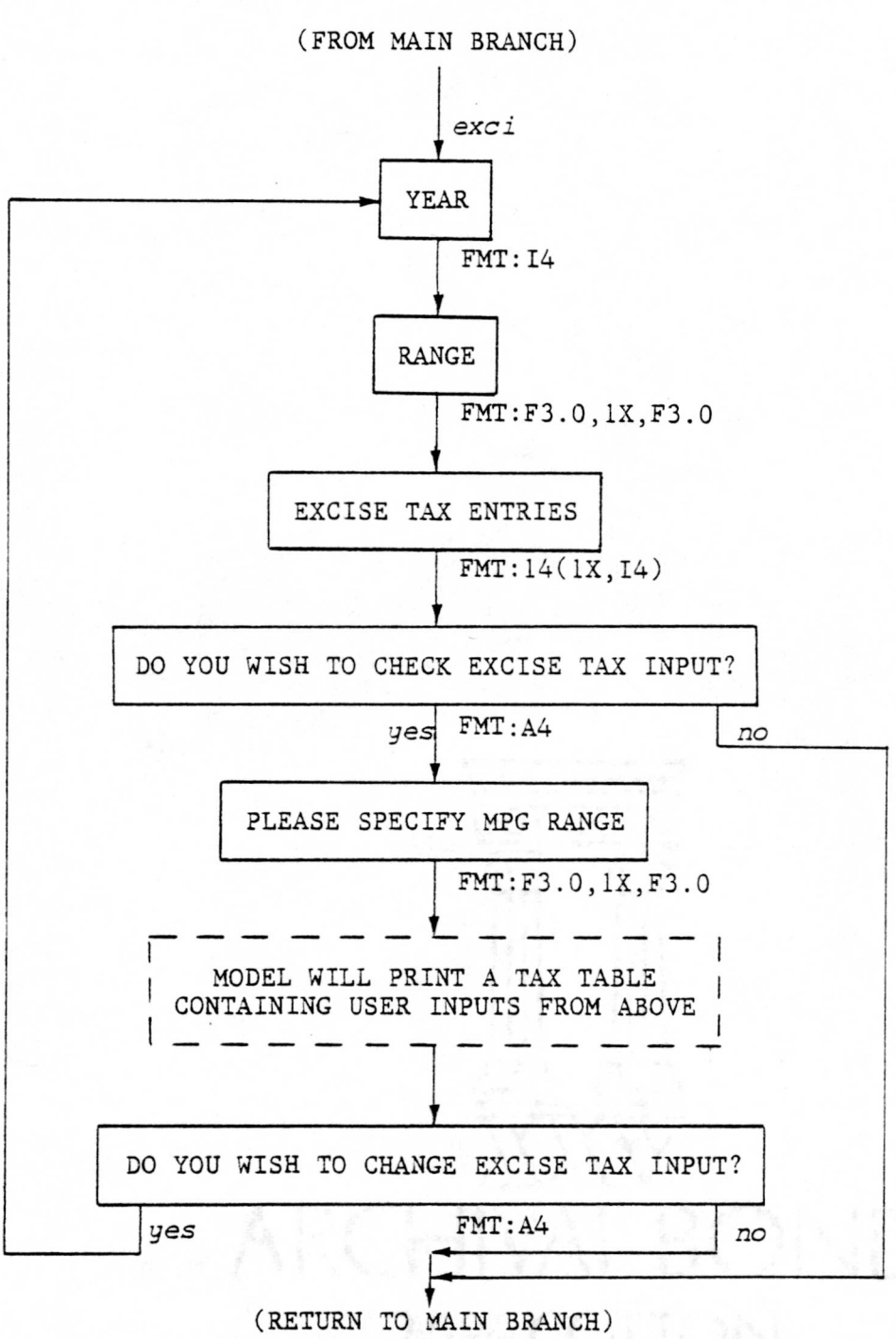
E. EXCISE TAX BRANCH

This branch collects the user-input information needed to describe the set of excise taxes and rebates to be employed by the model in making forecasts. An excise tax or rebate (negative excise tax) may be specified separately for:

- each model year, and
- each value of MPG.

Figure 9 shows the schematic structure in which this information is collected. The sequence of operations involved is detailed below.

1. If the user selects EXCI as the response to the policy prompt, the program switches to this branch, where the user is asked to input a series of excise taxes or rebates. The first prompt calls for the year for which excise tax description is to be entered. This is entered in columns one through four. Separate entries are required for each year's tax descriptions; no particular sequence of years is required. A carriage return results in the printing of the "Range" prompt, requesting the MPG values over which the tax/rebate is changing. Taxes for MPG values lower than the bottom of the range will be set equal to those defined at the bottom. Taxes for MPG values above the top of the range will be set equal to those at the top. Entries between the bottom and top of the range must be entered separately. To input the range itself, the user enters a two-digit bottom-of-range value followed by a decimal point and a comma, and then a two-digit top-of-range value followed by a decimal point and a carriage return. Blanks or leading zeros are required if single-digit values are entered. Following the range definition, the user then inputs the excise tax table itself. Its entries are input fourteen to a line, each separated by a comma and each occupying four columns. They must be right justified within each four-column field. Leading zeros or blanks are required. No decimal points are included and rebates should be entered with a minus sign preceding the entry.



KEY: SOLID LINE BOX = PROGRAMMED PROMPT
BROKEN LINE BOX = REQUESTED OUTPUT TABLE
FMT = FORTRAN FORMAT FOR USER RESPONSE
SCRIPT CASE TYPE = POSSIBLE USER RESPONSE

FIGURE 9: AUTOMOBILE SECTOR FORECASTING MODEL
FLOW CHART OF USER PROMPTS AND RESPONSES

```
YEAR
1980
RANGE
10  15
YEAR
1980
RANGE
10.,14
YEAR
```

Decimal points were left off range and prompt for year is repeated.

Here backspacing and typing over the error did not correct the mistake. Correction procedures vary from computer system to computer system, and the backspace procedures set out earlier may not apply.

```
YEAR
1980
RANGE
10.,14.,
EXCISE TAX ENTRIES
1000,5000, 500,0100,   0
IHN215I CONVERT - ILLEGAL   DECIMAL   CHARACTER
1000,5000, 500,10100,   0
TRACEBACK  ROUTINE  CALLED FROM ISN   REG.  14   REG.  15   REG.   0   R
EG.   1
           IBCOM                      000E40E8   000E790C   00000000   0
00000D5
           POLICY                     42UB0A3E   000B3638   00000001   0
C0AF198
           MAIN                       0001DFB8   000AF010   000A4E4C   0
00A4E70
ENTRY POINT=  000AF010
STANDARD FIXUP TAKEN , EXECUTION CONTINUING
```

No decimal point.
The "year" prompt repeats.

```
YEAR
1981
RANGE
15.,20
YEAR
1981
RANGE
15.,20.
EXCISE TAX ENTRIES
   0,-100,-200,-300,-400
YEAR
1981
RANGE
15.,20.
EXCISE TAX ENTRIES
 100,-100,-200,-300,-400
YEAR
0
```

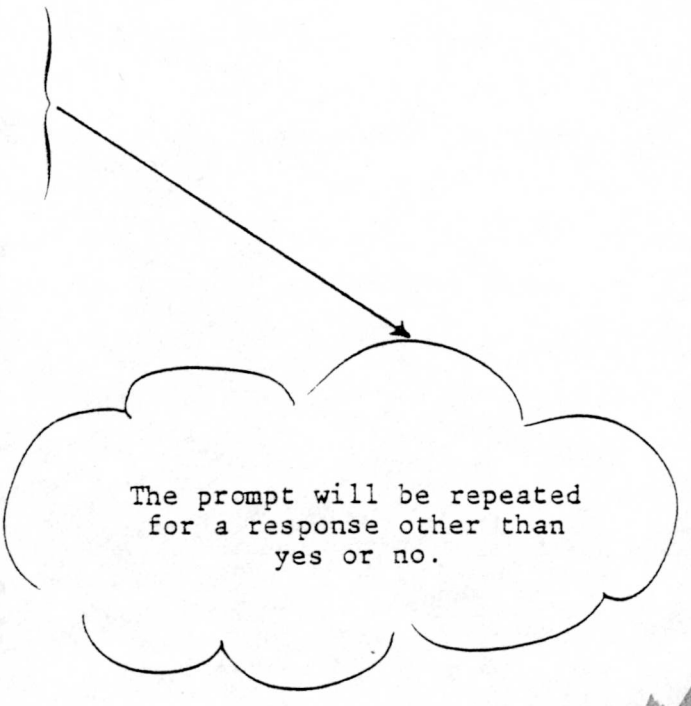
Here the user noticed an error the first time the excise tax was typed, so the year was repeated to correct the error.

All years prior to the lowest year typed are assumed to have no excise taxes or rebates. All years after the highest year typed will have values equal to those of the highest year. The user terminates excise tax input by typing a zero and a carriage return in response to the "year" prompt.

2. Upon completion of excise tax input, the user is asked if he wishes to check his inputs. A NO response transfers control to Step 3. A YES response will result in the printing (at the user's terminal) of the table of excise taxes and rebates. The user is asked to specify the range of the table which is to be examined. The bottom of this range is input as two digits followed by a decimal point and a comma, and then top of the range is specified by a two-digit entry, a decimal point, and a carriage return. The desired values will then be printed for inspection by the user.

3. At this point, the program allows the user to change previous excise tax entries if he so desires. If the user indicates a desire to do so, control returns to Step 1 and the user can make revised inputs. If the user does not elect to make changes, control returns to the main branch.

```
DO YOU WISH TO CHECK EXCISE TAX INPUT?
yeh
DO YOU WISH TO CHECK EXCISE TAX INPUT?
ok
DO YOU WISH TO CHECK EXCISE TAX INPUT?
please
DO YOU WISH TO CHECK EXCISE TAX INPUT?
yes
PLEASE SPECIFY MPG RANGE
10.,21.
```



```
   YEAR    10    11    12    13    14    15    16    17    18    19    20    21
   1976     0     0     0     0     0     0     0     0     0     0     0     0
   1977     0     0     0     0     0     0     0     0     0     0     0     0
   1978     0     0     0     0     0     0     0     0     0     0     0     0
   1979     0     0     0     0     0     0     0     0     0     0     0     0
   1980  1000  5000   500  1001     0     0     0     0     0     0     0     0
   1981   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1982   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1983   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1984   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1985   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1986   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1987   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1988   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1989   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1990   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1991   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1992   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1993   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1994   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1995   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1996   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1997   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1998   100   100   100   100   100   100  -100  -200  -300  -400     0     0
   1999   100   100   100   100   100   100  -100  -2 0  -300  -400     0     0
   2000   100   100   100   100   100   100  -100  -200  -300  -400     0     0
DO YOU WISH TO CHANGE EXCISE TAX INPUT?
ok
DO YOU WISH TO CHANGE EXCISE TAX INPUT?
yes
YEAR
1980
RANGE
10.,14.
EXCISE TAX ENTRIES
1000, 500, 500, 100,    0
YEAR
0
DO YOU WISH TO CHECK EXCISE TAX INPUT?
please
DO YOU WISH TO CHECK EXCISE TAX INPUT?
yes
PLEASE SPECIFY MPG RANGE
10.,20.
```

Note that zeros appear here because only five tax entries were input when the range of 15.,20. calls for six levels. The last level is interpreted as zero.

Again, only the correct response is accepted.

YEAR	10	11	12	13	14	15	16	17	18	19	20
1976	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0
1980	1000	500	500	100	0	0	0	0	0	0	0
1981	100	100	100	100	100	100	-100	-200	-300	-400	0
1982	100	100	100	100	100	100	-100	-200	-300	-400	0
1983	100	100	100	100	100	100	-100	-200	-300	-400	0
1984	100	100	100	100	100	100	-100	-200	-300	-400	0
1985	100	100	100	100	100	100	-100	-200	-300	-400	0
1986	100	100	100	100	100	100	-100	-200	-300	-400	0
1987	100	100	100	100	100	100	-100	-200	-300	-400	0
1988	100	100	100	100	100	100	-100	-200	-300	-400	0
1989	100	100	100	100	100	100	-100	-200	-300	-400	0
1990	100	100	100	100	100	100	-100	-200	-300	-400	0
1991	100	100	100	100	100	100	-100	-200	-300	-400	0
1992	100	100	100	100	100	100	-100	-200	-300	-400	0
1993	100	100	100	100	100	100	-100	-200	-300	-400	0
1994	100	100	100	100	100	100	-100	-200	-300	-400	0
1995	100	100	100	100	100	100	-100	-200	-300	-400	0
1996	100	100	100	100	100	100	-100	-200	-300	-400	0
1997	100	100	100	100	100	100	-100	-200	-300	-400	0
1998	100	100	100	100	100	100	-100	-200	-300	-400	0
1999	100	100	100	100	100	100	-100	-200	-300	-400	0
2000	100	100	100	100	100	100	-100	-200	-300	-400	0

DO YOU WISH TO CHANGE EXCISE TAX INPUT?
no

III. OUTPUT

A. ERROR MESSAGES

One error message is programmed into the model. It indicates that the inputs as applied by the program have somehow been mis-interpreted. This message is:

```
NEW CAR DEMAND SATURATED
1977
NEW CAR DEMAND SATURATED
1978
```

The year mentioned within the message may be any for which analysis is required. If this message should occur, it indicates that the size of the existing fleet exceeds the target stock of autos and that no new car purchases are required. This situation cannot occur with a reasonable and properly-specified set of inputs. It may result, for example, if a car price input is interpreted as a zero. To aid in locating the malfunctioning input, the program sets new car sales equal to one and continues to execute.

B. ILLUSTRATIVE OUTPUT

A sample run from start to finish is presented in this section. It reflects the following inputs:

(1) NUMBER OF YEARS OF ANALYSIS REQUIRED FOR THIS RUN: 20

(2) INTERVAL AT WHICH OUTPUT IS TO BE PRINTED: 5

(3) 1976 GASOLINE PRICE: $.60

(4) ANNUAL PERCENTAGE GROWTH IN GASOLINE PRICE: 3.

(5) ANNUAL FUEL ECONOMY STANDARDS AND ASSOCIATED PENALTIES (AFTER-TAX EFFECT)

Year	Standard	Penalty
1978	18 MPG	$150
1979	19 MPG	$150
1980	20 MPG	$200
1981	21 MPG	$200
1982	22 MPG	$250

```
HOW MANY YEARS OF ANALYSIS DO YOU REQUIRE?
20.
AT WHAT INTERVAL DO YOU NEED OUTPUT?
5.
PLEASE TYPE RUN IDENTIFICATION
****this is a sample run--policy selection is standards****
IF YOU WISH TO ENTER AN EXTERNAL SET OF NEW CAR PRICES AND FUEL
ECONOMIES TYPE-EXOG-,IF NOT,PLEASE SPECIFY FUEL ECONOMY POLICY:
NONE,EXCISE TAX, OR STANDARDS
stan
PLEASE INPUT YEAR, STANDARD, AND PENALTY
1978 18.00,150.
1979 19.00,150.
1980 20.00,200.
1981 21.00,200.
1982 22.00,250.
0
DO YOU WISH TO CHECK INPUT FOR STANDARDS?
yes


   YEAR STANDARD PENALTY
   1975     0.0      0.0
   1976     0.0      0.0
   1977     0.0      0.0
   1978    18.00   150.00
   1979    19.00   150.00
   1980    20.00   200.00
   1981    21.00   200.00
   1982    22.00   250.00
   1983    22.00   250.00
   1984    22.00   250.00
   1985    22.00   250.00
   1986    22.00   250.00
   1987    22.00   250.00
   1988    22.00   250.00
   1989    22.00   250.00
   1990    22.00   250.00
   1991    22.00   250.00
   1992    22.00   250.00
   1993    22.00   250.00
   1994    22.00   250.00
   1995    22.00   250.00
   1996    22.00   250.00
   1997    22.00   250.00
   1998    22.00   250.00
   1999    22.00   250.00
   2000    22.00   250.00
DO YOU WISH TO CHANGE INPUT FOR STANDARDS?
no
ARE GASOLINE PRICE INPUTS CHANGING AT A CONSTANT GROWTH RATE?
yes
INPUT 1976 GASOLINE PRICE AND GROWTH RATE
00.60,3.
PLEASE SET PRINTER TO RECEIVE OUTPUT(OPTIONAL)
```

****THIS IS A SAMPLE RUN--POLICY SELECTION IS STANDARDS****

YEAR	1980	1985	1990	1995
TOTAL SALES	12785068.	12680167.	12032881.	11976370.
SMALL SHARE	0.308	0.329	0.275	0.238
MEDIUM SHARE	0.194	0.183	0.181	0.164
LARGE SHARE	0.497	0.489	0.544	0.598
AVG. NEW CAR MPG	21.304	23.020	22.926	22.631
SMALL MPG	25.915	27.644	27.489	27.633
MEDIUM MPG	22.182	23.961	24.420	24.282
LARGE MPG	18.924	20.422	20.762	20.752
NEW CAR PRICES				
SMALL	2348.	2354.	2649.	2627.
MEDIUM	3596.	3741.	3933.	3966.
LARGE	5313.	5663.	5883.	5888.
CARS IN USE	107146672.	117537552.	121006366.	120012981.
SMALL SHARE	0.271	0.287	0.301	0.274
MEDIUM SHARE	0.201	0.213	0.192	0.177
LARGE SHARE	0.528	0.500	0.507	0.549
SCRAPPAGE	9775241.	10741377.	11968016.	12317219.
GAS PRICE	0.675	0.783	0.908	1.052
VMT	1211825.	1382496.	1513048.	1620392.
GAS CONSUMED	73866.	67277.	67352.	71310.
AVG. GEN. PRICE	5740.	6021.	6733.	7254.