BUREAU OF BUSINESS AND ECONOMIC RESEARCH
SCHOOL OF BUSINESS AND ECONOMICS
UNIVERSITY OF MINNESOTA-DULUTH

Working Paper No. 86-23

TOURISM, FORECASTING, AND THE DEATH OF OPEC*

by

DONALD N. STEINNES+

To be presented at the annual conference of the Travel and Tourism Research Association, Memphis, Tennessee, June 15-18, 1986.

* This research was supported by grants from the Legislative Commission on Minnesota Resources/Minnesota Department of Natural Resources and the University of Minnesota Computing Center. The cooperation and assistance of Joshua Ku and Marcia Hauser in obtaining data and providing able computational assistance were greatly appreciated. Nonetheless, all opinions and conclusions expressed herein are solely the author's.

+ Professor of Economics and Director of the Bureau of Business and Economic Research, University of Minnesota-Duluth.

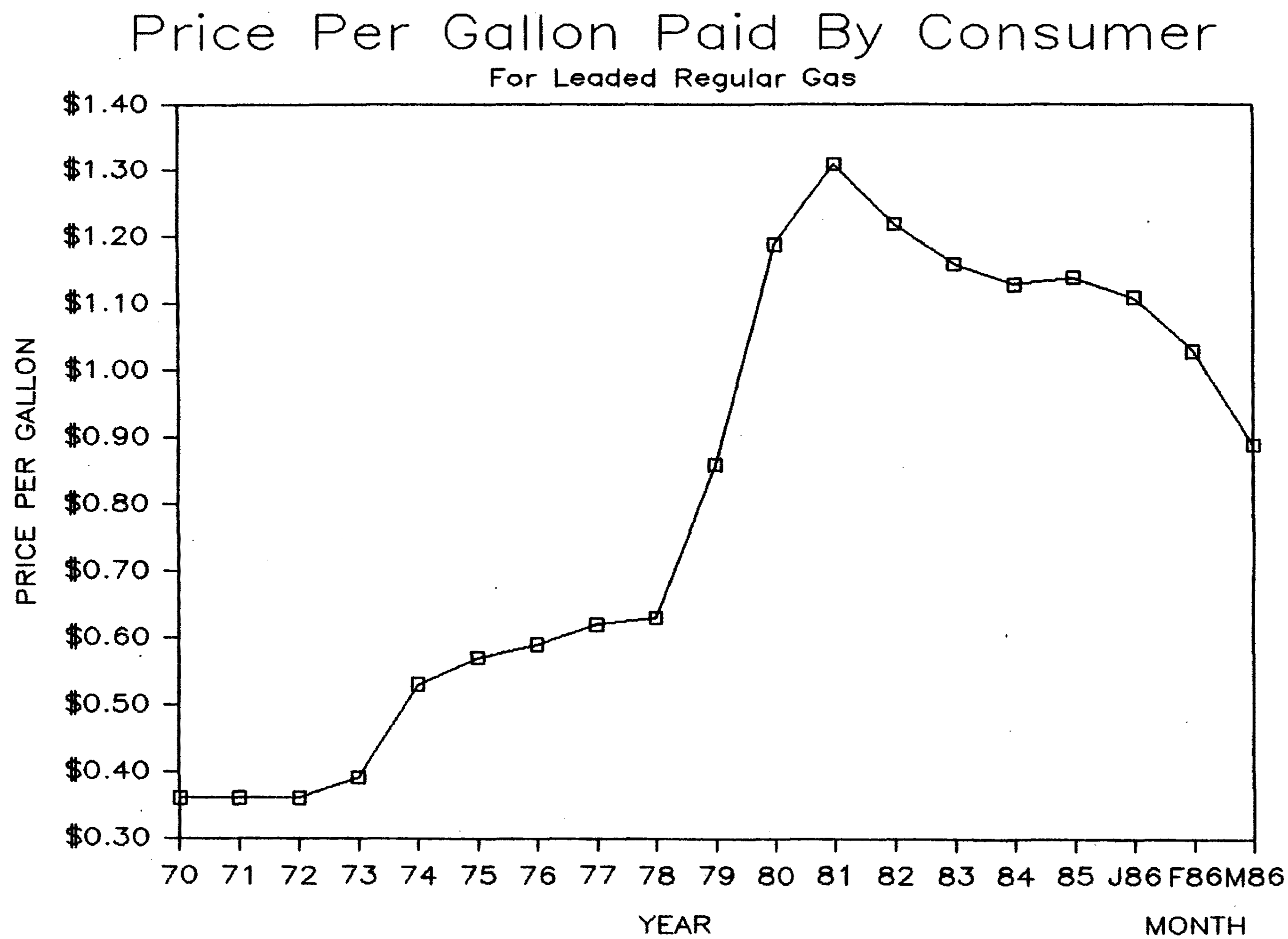
I. INTRODUCTION

Ever since 1973 when OPEC shocked the world by raising the price of oil, economists and others have been trying to measure the consequences. Since then we have gone through an almost continuous period of rising oil prices (see Figure 1) and this has become both an accepted fact of life and used as an assumption by those engaged in forecasting. However, in recent years the power of OPEC to raise oil prices has diminished and the death of OPEC has been predicted by many as a result of their plans to no longer set, or defend, prices in 1986. There is reason to believe that this change in posture will precipitate a price war and that oil prices may fall dramatically in 1986 and beyond.

The tourism industry is one that should be directly affected by changes in oil prices since the most popular forms of travel (air and auto) are oil dependent. While in the energy crises of the 1970's, which were the result of drastic OPEC actions to raise prices in 1973 and 1979, there was intense interest in the effects of these oil shocks on travel and tourism[1], in the 1980's an increasing amount of tourism and travel research has been focused on forecasting using time-series analysis[2]. The purpose of this paper will be to demonstrate, using the death of OPEC as an example, the weakness of such forecasting methodology in contrast to the alternative of multiple regression analysis.

With rising oil prices, both regression and extrapolation (time-series analysis) have been successful. Now, however, we may be going into an era of declining oil prices. If this occurs extrapolation will not be useful to forecast in 1986 and beyond, whereas, a regression analysis with oil price as an explanatory variable should be capable of answering, as its forte, the "what-if" question of what will happen to tourism if oil prices decline. This paper will

FIGURE 1



Source: Survey of Current Business, various issues discuss the differences between time-series and regression methods and use both to analyze tourism volume for one area (Duluth, Minnesota) since the last OPEC oil shock (1979). The emphasis will be on the regression analysis which uses oil prices (at the gasoline pump) and other variables to explain variations in the volume of tourism over time. It will be shown that if oil prices decline in 1986 the regression approach will have a distinct advantage over time-series analysis in correctly forecasting the volume of tourism.

II. ALTERNATIVE TOURISM MODELS

Many of the studies of tourism which have considered the impact of gasoline shortages and price changes have been based on surveys of tourist attitudes (e.g., Corsi and Harvey (1979), Kamp et al. (1979), and Williams et al. (1979)). While useful, such efforts rely on those surveyed to correctly and truthfully state how they will behave. An alternative, or complimentary, approach is to collect data on the actual behavior of tourists and use this information to develop a model. The focus of this paper is on this latter approach, in general, and on time-series vs. regression models, in particular.

For such models, one of the first considerations is the specification of tourism behavior. While the models could be developed based on individual tourist behavior (e.g., Mak, Moncur and Yonamine (1977)) more often aggregate data are used for a single area (destination) over several time periods. When data for individual tourists are collected, separate models are often developed to analyze tourist expenditures and length of stay, which are two aspects of tourist behavior. For aggregate data, equivalent models can be developed for total expenditures and tourist days (or visitors), which are alternative ways of measuring the volume of tourism in an area over time. In this paper expenditures will be used to measure monthly tourism volume in a city (Duluth, Minnesota) during the last decade, though, as will be explained later, the tourist days specification may make the regression analysis a more direct estimate of what economists refer to as a demand relation.

Given a way of measuring tourism volume or activity in an area, such information could be used to perform either a time-series or a regression analysis. While there are many single variable time-series techniques available[3], they all are based on only information (history) of the single variable being modeled whereas a regression model would be built using information on the histories of other (independent) variables. As will be explained, this difference can be an advantage or a disadvantage in forecasting.

Perhaps the most fundamental difference between the two approaches is that regression analysis, by using directly information on variables believed to influence the (dependent) variable being modeled (tourism activity or volume), attempts to provide an explanation. That is, the coefficients of a regression model estimate the effect of an independent variable (gasoline price or income) on the dependent variable (tourism activity). With a time-series model no such explanation is being provided; rather, the underlying pattern in the variable is modeled and used to forecast, or extrapolate, into the future. This sort of extrapolation works well for stable patterns (e.g., seasonal variation) and when there are no sudden shifts in the underlying structure.

Such stability existed with respect to gasoline prices before 1973 and even since then there has been an almost continuous period of increase (see Figure 1). During such periods, time-series analysis can provide very accurate forecasts. When, however, there is a sudden shift in a variable like gasoline prices it will take some time for this change to be reflected in a time-series forecast. For example, if a time-series model were developed based on tourism data through 1985, before oil prices dropped in 1986, it would yield the same forecasts for

1986 whether or not one wanted to assume that prices were going to drop in 1986.

In many cases this may not be a shortcoming since it may be just as difficult to forecast changes in gasoline prices as in tourism. If, however, there is reason to believe that gasoline prices will fall in 1986 then it may be useful to estimate what effect this would have on tourism. It is this sort of "what-if" forecasting which can be best done using a regression model as will be demonstrated in the next section.

Aside from forecasting advantages, the regression approach can, by providing an estimate of the effect of gasoline price changes on tourism activity, be useful in other respects. For example, the author is engaged in a project to measure the recreational value of water in Minnesota. Part of the analysis is to be based on two recreational surveys: one done in 1978 which is very comprehensive and another which is ongoing. One problem is how to "blow up" the sample from 1978 to totals for 1986. Part of this would be the same problem as occurred in 1978 when it was necessary to "blow up" the sample to 1978 totals. This was done based on population totals (by area) for 1978 and the same type of adjustment could be made based on current population figures. To simply do this raises potential questions as to what other changes have occurred between 1978 and 1986.

Inasmuch as such a survey is measuring tourists' behavior (i.e., choices of activities and expenditures), questions are bound to arise as to whether underlying shifts in attitudes or behavior have taken place. To determine this a small survey may be necessary to assess whether the previous survey can be considered valid. If shifts are noted (e.g., a new emphasis on running as a recreational activity) then a new survey may be necessary to adjust or supplement the previous survey information.

In considering using a 1978 survey to estimate 1986 tourism/recreational activity relevant changes in economic conditions should also be considered. Probably the most important of these were dramatic changes in the price of gasoline. During the 1970's, gasoline prices tripled because of the increasing effectiveness of OPEC and by 1985 prices were well over $1 a gallon (see Figure 1). To not recognize this in attempting to adjust a 1978 survey to 1986 is apt to raise valid questions. The regression results which will be discussed, while only for tourism in part of the state, can, nonetheless, provide a basis for adjusting the 1978 survey to 1986 based on both changes in population and changes in gasoline prices. While the adjustment for a larger population will yield a larger estimate for 1986 than 1978, higher gas prices will result in a lowering of the estimate for 1986.

Another related issue has to do with the ongoing survey which began in the fall of 1985. This survey of tourists is taking place over 12 months and is designed to update and supplement the 1978 survey previously discussed. While the 1978 survey was conducted over a similar period (one year), gasoline prices were relatively stable. However, since the fall of 1985 prices have fallen dramatically (see Figure 1) and may either fall or rise again by the time surveying stops in the fall of 1986. A question arises as to whether differences in the level/type of recreation during this period may not be the result of shifts in gasoline prices and, if so, what adjustments need to be made. As an aside, it should be noted that the same question could be raised with respect to changes in population but this can be assumed to be a minor factor over a period of one year. Likewise, prices have been fairly stable during this period, except for gasoline, and so adjustment for inflation is of little concern.

However, the fact that gasoline prices have moved so dramatically means that such shifts can be affecting levels of recreation and if this is not recognized the changes may be falsely attributed to other things (e.g., seasonal patterns of activity). One way to avoid this problem is to adjust the estimates of tourism activity derived from the survey for fluctuations that resulted from shifts in gasoline price. By finding the elasticity (i.e., % change in tourism activity resulting from a 1% change in gasoline price), it would be possible to adjust the survey results monthly to some constant level of gasoline prices (e.g., the price when the survey began or a definite amount, like $1/gallon).

All of the things suggested can be done if one estimates a regression model with gasoline price as an explanatory variable of tourism activity but would be impossible with a single variable time-series forecasting model. In addition to being able to do these other things, the regression equation will even prove superior to a time-series model in a forecasting situation where sudden shifts occur in factors (e.g., the changing price of gas) that determine the variable being forecast.

III. ESTIMATING A TOURISM REGRESSION MODEL

Having discussed in general terms the advantages and disadvantages of regression and time-series analyses, this section will specify and estimate, using 69 months (January 1978 to September 1983) of data, a regression model of tourism expenditures for Duluth, Minnesota. A discussion will follow in the next section as to the usefulness of such estimation results for analyzing the impact of dramatic shifts in gasoline prices as have occurred in recent months. Then the model will be used to forecast tourism assuming various prices of gasoline and these forecasts will be compared to forecasts made with exponential smoothing[4], a time-series method.

As noted, tourism volume for an area can be measured by either the number of tourist days or expenditures per time period. The model to be estimated uses real tourist expenditures[5] (RTE) as the dependent variable, and takes the following general form:

(1) $RTE_t = F(GAS_{t-i}, EMP_{t-i}, SEAS_t)$

where RTE_t = real tourist expenditures in month t

GAS_{t-i} = pump price regular gasoline/gallon in month t-i

EMP_{t-i} = Minnesota State Employment in month t-i

$SEAS_t$ = seasonal variable for month t

This model is similar to those which have been used by Johnson and Suits (1983) and Morgan (1985) to analyze the effects of gasoline prices and the energy crises in the 1970's on tourism. Both of these other studies considered visits to national parks and so may have less general applicability than the model in this paper which considers tourist expenditures for a city. While these studies purport to estimate the demand for tourism (i.e., national park visits), to define tourism in strict economic terms is somewhat difficult[6]. Nonetheless, the equation estimated can be viewed as providing an explanation of variation in tourism expenditures using economic variables.

Gasoline price (GASP) is specified as the pump price of regular gasoline (per gallon) and was obtained from the Survey of Current Business. This variable is hypothesised to have a negative impact on the dependent variable, real tourist expenditures (RTE). The other economic independent variable used is Minnesota State Employment (EMP), which is expected to have a positive coefficient, and is an alternative to income, which Johnson and Suits (1983) and Morgan (1985) used in their studies to measure economic conditions. An advantage of using employment is that it varies more over time and so it proved to be uncorrelated with the trend variable[7].

Aside from the economic variables, GASP and EMP, the model uses a seasonal variable, SEAS. This variable, which assumes tourism goes up and down once during the year, takes on a value of 1 for the month (November) of lowest real tourist expenditures, and then increases by 1 for each month preceding or succeeding November. This seasonal variable proved significant and is a simpler alternative than using monthly seasonal dummy variables[8]. As noted, a trend variable was tested but proved insignificant.

Given the variables, the model was estimated in linear and log form and comparable results were obtained. Hence, only the log results are presented in Table 1 since this specificiation yields coefficients that can be interpreted directly as elasticities (i.e., % change in RTE for a 1% change in one of the independent variable (GASP or EMP)) and the log form was used by both Johnson and Suits (1983) and Morgan (1985).

Another distinction between these previous studies and the results in Table 1 is that various lag lengths (t-i) were tested for the variables GASP and EMP. While the correct sizes are found for both variables for lags of 0 and 1, the variables are most significant when a two-period lag (i.e., $GASP_{-2}$ and EMP_{-2}) is employed[9]. This suggests that travel plans, at least for Duluth, Minnesota, are made based on economic conditions (GASP and EMP) that exist two months prior to the trip and, hence, the observed expenditures (RTE). Such a lead time is less than the three months Morgan (1985) assumed, based on survey information, in specifying part of his model. The approach taken in this paper was to not assume a lead time but to estimate it using various lags (t-i) for the economic variables. The results in Table 1 suggest that this is both possible and necessary (i.e., using the current (no lag) values for the variables provides less explanation of RTE).

Another advantage of using lagged values for the economic variables is in terms of forecasting. If a model is specified with current values ($GASP_t$ and EMP_t) then in order to forecast ahead j periods (RTE_{t+j}) it would be necessary to have values for $GASP_{t+j}$ and EMP_{t+j}. Since this is not possible, forecasts of

TABLE 1

REGRESSION RESULTS FOR LOG FORM OF EQUATION (1)

Independent Variables	Dependent Variable = Real Tourist Expenditures (RTE) (t-values in parentheses)		
Lag Length	0	1	2
Constant	-3.21 (-.26)	7.80 (.56)	-25.50 (-1.93)
GASP	-.26 (-2.09)		
$GASP_{-1}$		-.17 (-1.19)	
$GASP_{-2}$			-.35 (-3.09)
EMP	.89 (1.02)		
EMP_{-1}		.13 (.13)	
EMP_{-2}			2.44 (2.66)
SEAS	.16 (3.82)	.15 (3.40)	.19 (4.28)
R^2	.948	.950	.955
Durbin-Watson Statistic	1.64	1.74	1.76
F-value	383	397	442
Sample Size	69	68	67

GASP and EMP would have to be used which, as will be shown in the next section, allows for "what if" forecasts of RTE_{t+j} to be made assuming values for $GASP_{t+j}$ and EMP_{t+j}. However, with a model which uses lagged (t-i) variables it is possible to forecast ahead (up to i periods) using known, rather than assumed, values for the independent variable. For example, the third equation (with two period lags) in Table 1 could be used to forecast RTE_{t+2} using current ($GASP_t$ and EMP_t) values.

As noted, the coefficients for $GASP_{-2}$ and EMP_{-2} are both elasticities, given the log specification. The -.35 for $GASP_{-2}$ is somewhat lower than the results obtained by Johnson and Suits (1983) and Morgan (1985) for national parks, which seems reasonable. Nonetheless, the t-value is significant and indicates that Duluth tourism expenditures definitely respond to changes in gasoline prices. The other elasticity of -2.44, for EMP_{-2}, suggests that a 1% increase in employment, which is comparable to a 1% reduction in unemployment, will result in a 2.44% increase in tourism expenditures. While not directly comparable to the previous studies which use income, the use of EMP provides an alternative, and interesting, way of measuring the impact of economic conditions on tourism. In fact, the income variable yielded the wrong sign (negative) and proved insignificant for both Johnson and Suits (1983) and Morgan (1985), for reasons discussed earlier (see footnote 6).

A final note on the results in Table 1 is that the F-values were all significant at the 1% level and the Durbin-Watson Statistics, which measure serial or autocorrelation, are all above the lower significance limits, indicating no serious autocorrelation problems are present.

IV. USING MODELS TO FORECAST TOURISM

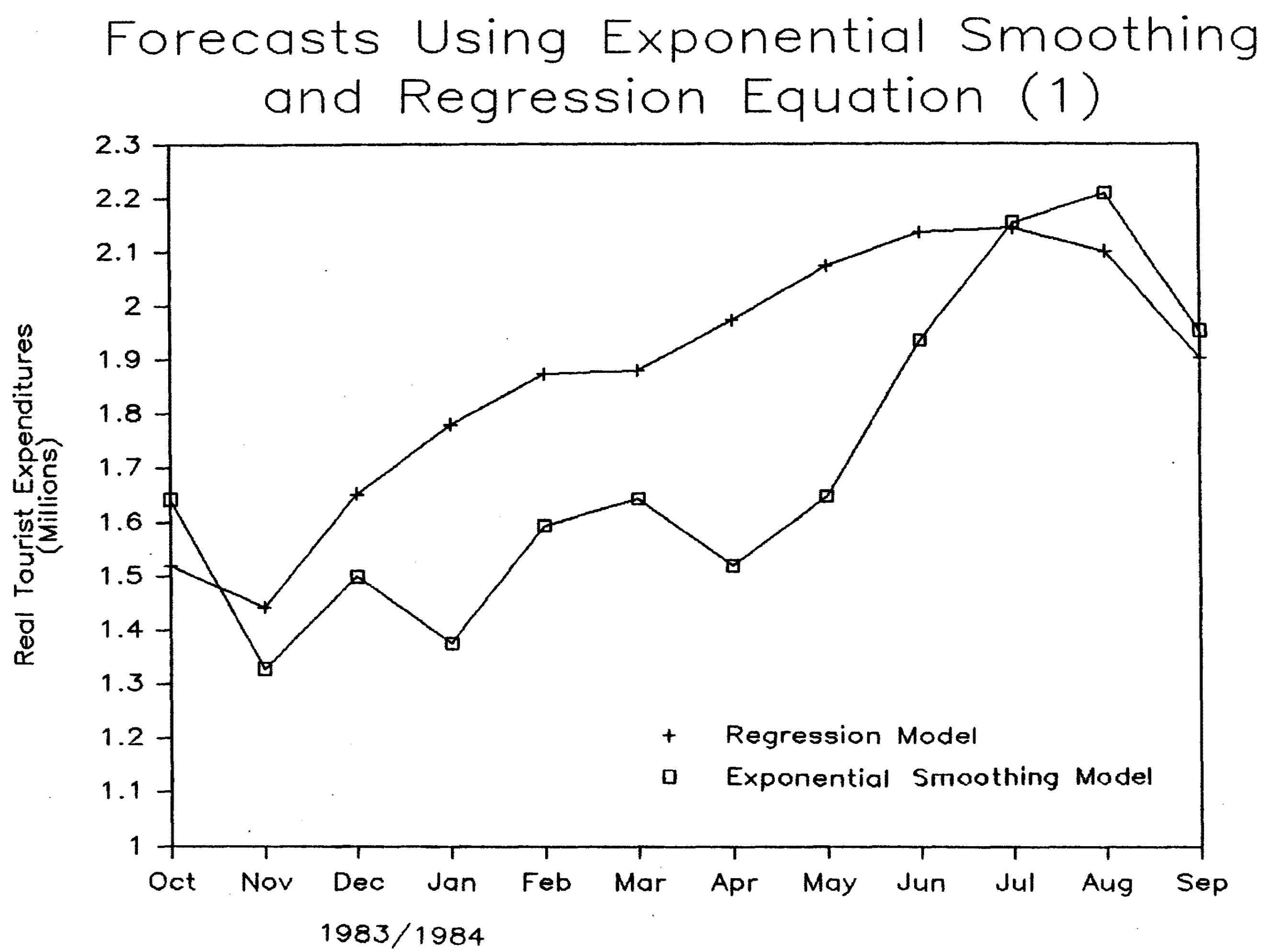
As an illustration of the advantages and disadvantages of time-series and regression models as forecasting tools, the regression results in Table 1 will be used to prepare various forecasts. These will be compared, to the extent possible, with forecasts obtained by Ku (1985) for the same variable (RTE) using an exponential smoothing model, which is a time-series approach.

The exponential smoothing forecasts were done for one year (October 1983 to September 1984) and so all forecasts prepared from the estimates of equation 1 in Table 1 were done for the same monthly time span. Figure 2 shows forecasts from October 1983 to September 1984 for exponential smoothing and equation (1) in Table 1 (with two-period lags). In order to forecast for this period (1983-84) actual values of EMP_{-2} and $GASP_{-2}$ were used, though this would not be possible if forecasts were made into the future. The two methods give comparable forecasts with both indicating a strong seasonal pattern in real tourist expenditures. Ku (1985) compares these results in terms of forecast accuracy and finds exponential smoothing to be somewhat more accurate. Part of the reason for this may be that by using SEAS, rather than monthly seasonal dummy variables, the seasonal pattern was somewhat oversimplified. However, the use of SEAS does reduce the degrees of freedom, as explained, and this can be seen as offsetting the somewhat less accurate seasonal forecasts obtained.

The primary point to be made in terms of using time-series vs. a regression model to forecast is how the two methods would, or can, adjust the forecast for expected changes. Taking specifically the death of OPEC, if one wanted to forecast its effect on tourism, or real tourist expenditures in Duluth, the exponential smoothing forecast would be unaltered if one wanted to assume changes in oil prices were to occur. Hence, no new forecasts, other than that shown in Figure 2, will be done for exponential smoothing.

On the other hand, if equation (1) is used to prepare forecasts, then different results will be obtained. One way of stating this is in terms of the

FIGURE 2


Forecasts Using Exponential Smoothing
and Regression Equation (1)
Real Tourist Expenditures
(Millions)
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
1983/1984
Regression Model
Exponential Smoothing Model

coefficient for $GASP_{-2}$, which is -.35. This is a measure of elasticity and it means that, given all other things equal, a 1% decrease in gasoline prices will increase tourism expenditures by .35%. For example, if gasoline were to fall from $1.25 to $1, a fall of 20%, the regression model would forecast a 7% increase in tourism expenditures in Duluth.

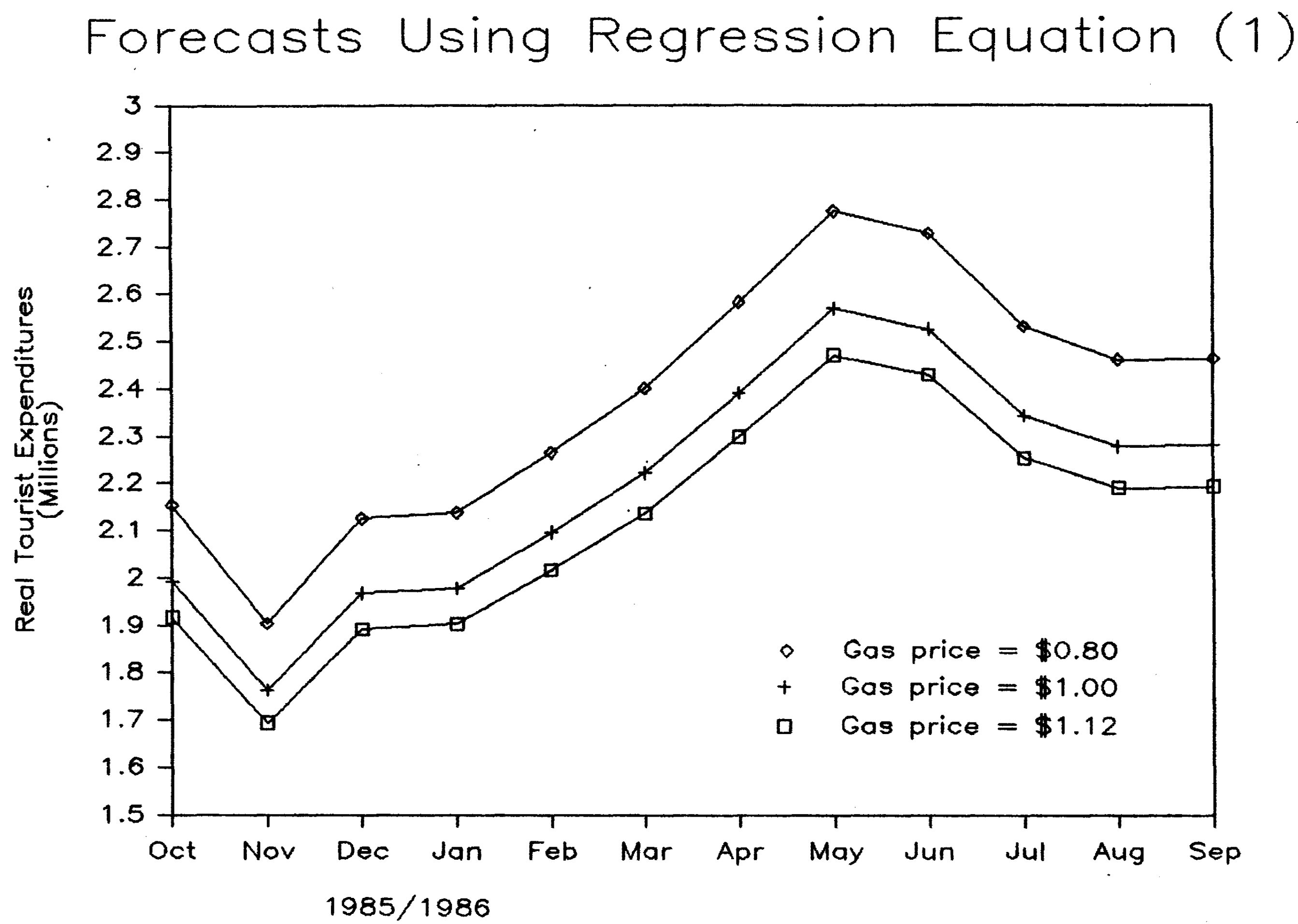
In Figure 3 forecasts are made for 1985-86 (i.e., the same format (months) as Figure 2) assuming gasoline continues at the 1985 average price of $1.12 or that gasoline falls (to $1 or 80¢) during the forecast period. For each set of forecasts it was assumed that employment would repeat the known values that occurred in the previous (October 1984 to September 1985) period. In actual forecasting practice one might obtain forecasts of employment rather than use the previous year values. However, since the main purpose of Figure 3 is to illustrate how regression forecasts vary with alternative assumptions made regarding gasoline prices, using previous, rather than forecast, values for EMP was considered acceptable.

At this point it is too early to decide whether the breakup of OPEC, and the consequent fall in oil prices, is temporary or permanent. If it should prove permanent, and prices stabilize at some lower level, then a time-series model like exponential smoothing, once reestimated with recent data, should prove quite accurate. On the other hand, if gasoline prices remain unstable then the regression model will have an advantage in that it can be used, as in Figure 3, to estimate tourism for alternative future gasoline prices. This would allow those engaged in tourism forecasting to at least suggest the range of values possible for expenditures given various gasoline prices.

V. CONCLUSION

While it may still be too early to determine if the energy euphoria of the

FIGURE 3


Forecasts Using Regression Equation (1)
Real Tourist Expenditures (Millions)
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
1985/1986
Gas price = $0.80
Gas price = $1.00
Gas price = $1.12

1980's has permanently replaced the energy crises of the 1970's, the current situation suggests that the death of OPEC is upon us. For those in the travel and tourism industry this should be good news, as the results of this paper suggest, and increasing attention will be paid to the implications and consequences of falling oil prices. At this point it is possible to forecast what the effects will be by surveying tourists as to their plans or to wait and see what they actually do.

The approach of this paper was to use existing data, including a period when gasoline prices had begun to fall in the early 1980's, to estimate a regression model relating tourism expenditures to gasoline prices. The advantages of such a model, as opposed to surveys and time-series models, were discussed, in general, and by examining the actual estimation results for a regression model of tourist expenditures in Duluth, Minnesota. This model was then used to illustrate how a regression model would be effective to forecast the consequences of falling gasoline prices.

While other studies have used a regression approach, this paper offered alternative specifications (e.g., the use of employment rather than income to measure economic conditions and testing for the lead time of travel plans with lagged variables) and data for a city. In the past almost all such models have been estimated for national parks. While important travel destinations, these are both rather unique and probably not as applicable to tourism throughout the country as are the results in this paper. In the future those engaged in tourism and travel research will hopefully broaden their attention to not just single destinations but cities and states as well.

Also, this paper has pointed out that it may be inappropriate, at this stage, to refer to tourism regression models as demand relations. In order to estimate a demand relation it will be necessary to carefully define tourism as an economic good with a price[10]. Nonetheless, hopefully the discussion and results indicate the potential richness of a regression model, as opposed to surveys or time-series models, as a tool for both understanding and forecasting tourism.

F O O T N O T E S

[1]See, for example, Corsi and Harvey (1979), Johnson and Suits (1983), Kamp, Crompton and Hensarling (1979), Morgan (1985), Sasco (1976), and Williams, Barke and Dalton (1979).

[2]See, for example, Archer (1980), Choy (1984), Geurts (1982), Geurts and Ibrahim (1975), and Uysal and Crompton (1985).

[3]The simplest type of time-series analysis would be a trend line while other techniques such as exponential smoothing and Box Jenkins analysis provide a model based on seasonal variation and underlying changes which are manifested in recent changes in the variable being modeled.

[4]The exponential smoothing model which will be used was developed by Ku (1985) who also estimated alternative regression equations from the same data sources.

[5]Tourist expenditures for Duluth, which are estimated by the Bureau of Business and Economic Research at the University of Minnesota-Duluth each month based on sales tax receipts, were adjusted to a 1967 base using the consumer price index.

[6]For example, economists define demand as a behaviorial relationship expressing what quantity of a good will be purchased (consumed) at various prices (of the good). For tourism it is difficult to define the good, let alone its price. The previous demand studies may be seen as measuring tourism quantity by the number of visitors but there is no direct measure of price; rather, gasoline price is used as an independent variable. If anything, gasoline and tourism are complimentary goods and the use of gasoline is indicating how the demand relation is shifted by changes in gasoline prices. More accurately, the relation estimated, like the one in this paper, is not a strict demand relation but is indicating the relation between gasoline prices and the equilibrium (of supply and demand) quantity (number of tourists) or quantity times price (tourist expenditures). These types of relations are what economists sometimes call reduced form (equilibrium) equations.

[7]It should be noted that both Johnson and Suits (1983) and Morgan (1985) found their income variable to be fairly insignificant, in part, because it was collinear with the trend variable. By using employment, little multicollinearity existed with the trend and, in fact, the trend was not used because it proved to be insignificant. Also, because this study includes more recent data than Johnson and Suits (1983), and Morgan (1985), whose data ended in 1981 and 1982, respectively, there is little multicollinearity between GASP and the trend. This is evident from Figure 1 which shows that this study, by beginning in 1978, covers, about equally, periods of rising and falling oil prices.

[8]Both Johnson and Suits (1983) and Morgan (1985) use twelve seasonal dummy variables, one for each month, in their studies. Such dummy variables use up twelve degrees of freedom while the SEAS variable uses only one. The dummy variable approach is only necessary if the seasonal pattern varies for each month, which neither Johnson and Suits (1983) nor Morgan (1985) test. Also,

Footnotes, continued

even if the dummy variable approach is used, only eleven such variables are necessary, with the final month being the base. The use of twelve dummy variables creates a multicollinearity problem between the dummy variables, which will generally lower their significance.

[9]For lags of over two periods the variables became less significant. Also, if more than one lagged (or current) value of a variable is used multicollinearity reduces the significance of both (e.g., $GASP_{-1}$ and $GASP_{-2}$).

[10]Over the last decade economists have shown increasing interest in determining the value of public goods, including recreation (e.g., fishing days or visits to parks). Some of these techniques are based on the concept of demand and may be useful in developing a regression model of tourism that would be closer to a demand relation than the approaches which have been used, including the one in this paper. The author is currently working on such a synthesis as a part of an ongoing project on water valuation in Minnesota.

R E F E R E N C E S

Archer, Brian (1980). "Forecasting Demand: Quantitative and Intuitive Techniques," International Journal of Tourism Management, 1 (March), 5-12.

Choy, Dexter (1984). "Forecasting Tourism Revisited," Tourism Management, (5), 171-176.

Corsi, Thomas and Milton Harvey (1979). "Changes in Vacation Travel in Response to Motor Fuel Shortages and Higher Prices," Journal of Travel Research, 17 (Spring), 7-11.

Geurts, Michael (1982). "Forecasting the Hawaiian Tourist Market," Journal of Travel Research, 21 (Summer), 18-21.

_______, and Ibrahim, I. (1975). "Comparing the Box-Jenkins Approach with the Exponentially Smoothed Forecasting Model Application to Hawaii Tourists," Journal of Marketing Research, 12 (May), 182-188.

Johnson, Rebecca and Daniel Suits (1983). "A Statistical Analysis of the Demand for Visits to U.S. National Parks," Journal of Travel Research, 22 (Fall), 21-24.

Kamp, B. Dan, John Crompton and David Hensarling (1979). "The Reactions of Travelers to Gasoline Rationing and to Increases in Gasoline Prices," Journal of Travel Research, 18 (Summer), 37-41.

Ku, Joshua C.S. (1985). "Duluth Tourism Forecasting," MBA thesis, School of Business and Economics, University of Minnesota-Duluth.

Mak, James, James Moncur, and Dave Yonamine (1977). "Determinants of Visitor Expenditures and Visitor Lengths of Stay: A Cross-Section Analysis of U.S. Visitors to Hawaii," Journal of Travel Research, 15 (Summer), 5-8.

Morgan, James (1986). "The Impact of Travel Costs on Visits to U.S. National Parks: Intermodal Shifting Among Grand Canyon Visitors," Journal of Travel Research, 24 (Winter), 23-26.

Sasco, John (1976). "Impact of the Energy Shortage on Travel Patterns and Attitudes," Transportation Research Record, 561, 1-11.

Silberman, Jonathan (1985). "A Demand Function for Length of Stay: The Evidence From Virginia Beach," Journal of Travel Research, 23 (Spring), 16-23.

U.S. Department of Commerce (various years), Survey of Current Business, Washington, D.C.: Government Printing Office.

Uysal, Muzaffer and John Crompton (1985). "An Overview of Approaches Used to Forecast Demand," Journal of Travel Research, 23 (Spring), 7-15.

Williams, Peter, James Burke, and Michael Dalton (1979). "The Potential Impact of Gasoline Futures on 1979 Vacation Travel Strategies," Journal of Travel Research, 18 (Summer), 3-7.