CERTIFICATION OF APPROVAL

PROBABILITY AND STATISTICS SOFTWARE FOR AN ENGINEERING APPLICATION : PETROLEUM SUPPLY DEMAND MODELING

by

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CHAPTER 1: INTRODUCTION

1.1 Background of Study

The impact of computer technology on organization and society is increasing as new technologies evolve and current technologies expand. Interaction and cooperation between people and machines are rapidly growing to cover more and more aspects of organizational activities. The increased use of computing facilities and the application of concepts and theories from different disciplines (like operational research, management science, artificial intelligence) have resulted in various types of computer based systems. The use of models to support decision making is common-place, particularly since the emergence of personal computer. These models have progressively been used more and more by decision makers themselves

In this project, a software that incorporates a statistical model is being developed. This model will be able to assist the users in carrying out forecasting activities. The proposed models for the courseware include a multiple regression analysis and the time series models. The purpose of this software is to allow easy and painless interaction between the user and the software. The supply and demand aspects has been carefully studied to provide a better understanding of the industry. The output of the software will be used to improve engineers' and managers' decisions on topics such as whether petroleum production be increased or whether alternative energy resources development should be accelerated.

1.2 Problem Statement

Although modeling activities have been useful in many areas, there has been discussion in the literature of the misuse, disuse and nonuse of models by managers. Most reasons can be traced to the lack of a set of integrated models and an easy way to manage their use in the decision-making processes. Among the problems are; the unavailability of the necessary input data or parameters, difficulties in understanding big, complex models and minimum interaction between the decision maker and the model (Turban and

Aronson 2001). For these and other reasons, there has been great emphasis placed on developing systems with easy to use interfaces to produce models that may be easily accessed by the users and to enable the output from the models to be assimilated easily. Thus the growth in computational technologies, seem to lead to the proposition that a system which leveraged quantitative models, data and interactive interfaces would be materially useful to decision makers.

The area of application for this project's software is Petroleum Supply Demand Modeling. This is because world crude oil prices have been very volatile due to the booming economic growth of China and unsettling issues in various parts of the world particularly the Middle East for the past few years. This has caused a lot of doubts and fears among consumers hence directly affecting its prices and indirectly affecting world economic growth. Moreover, it has been much debated about the amount of reserves left in the world to support our livelihood.

After careful consideration, we find that it is feasible to develop a modeling and forecasting software for Crude Oil Prices using Visual Basic Programming 6.0. A user friendly interface which assist users to perform their modeling tasks efficiently has been developed. After performing probability and statistics calculations using SPSS software, the output is used as an input for the Visual Basic Programming software in order to develop the final product.

1.3 Objectives and Scope of Study/Work

The main objective of the study is to develop a software which incorporates a statistical model to assist its users in forecasting aspect of planning. The model that is developed will be used to forecast the price of crude oil .In order to achieve this objective, the research will focus on:

(i) Identifying the key variables in the model.

(ii) Constructing the forecasting model

(iii) Simulations of the results and

(iv) Development of a user-friendly software using Visual Basic Programming language.

Feasibility of the Project within the Scope and Time frame:

- The allotted time frame is sufficient to develop a comprehensive modeling software.

Scope of Study:

The scope of study is divided into three parts, understanding and identifying key variables, probability and statistical modeling and software development.

CHAPTER 2: METHODOLOGY/PROJECT WORK

2.1 Procedure Identification

The work flow of this project is as follows. Researches will be done via library books and the internet. As key variables have been identified, quantifying process will be done in the future, relating the variables to crude oil prices. Subsequently, Petroleum Industry companies personnels who have knowledge of this particular matter will be contacted and possibly interviews will be performed to obtain extra information. When enough knowledge has been attained, mathematical modeling will be started with the supervision of lecturers. Note that although efforts are concentrated on petroleum industry knowledge and variables for this semester, the software programming section will be focused next semester as there will be no final output if the software were not to be developed successfully.

Please refer to the Gantt Chart below.

	WEEK (SEMESTER 1)												
	3	4	5	6	7	8	9	10	11	12	13	14	15
Project Title Research													
Review of Petroleum Supply Demand and Macroeconomics Relationship													
Research on Petroleum Supply													
Research on Petroleum Demand													
Research on Variables													
Research on Probability and Statistical Modelling													

Table 1 : FYP 1 Gantt Chart

	WEEK (SEMESTER 2)												
	3	4	5	6	7	8	9	10	11	12	13	14	15
Search for Database	■	■	■										
Modification of Database				■	■	■							
Smoothing of Database							■	■	■				
Modelling							■	■	■	■	■		
Development of Software										■	■	■	■

Table 2 : FYP 2 Gantt Chart

Conceptual Development of Software:

The project consists of three main parts, the first part is doing intensive research on the Petroleum Industry so that an in depth understanding of the possible variables may be attained. Next, the probability and statistical modeling part where the probability and statistical knowledge is applied to develop the mathematical model. Last but not least, the application of visual basic programming in development of the software, providing users with a user friendly environment to perform their tasks.

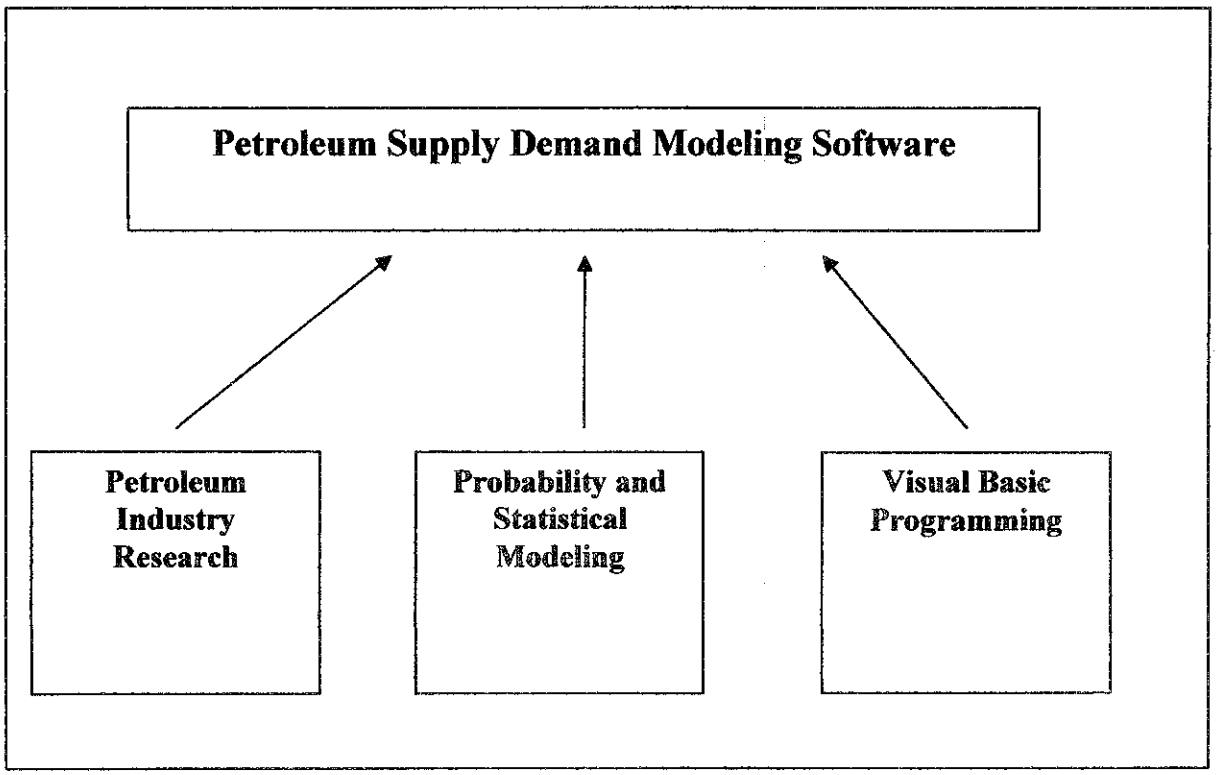

Figure 1 : Software Development Structure

Software development

The software that will be developed will make use of Visual Basic programming language. It consists of the following components:

1. Database component

The database will consist of past data on the variables that was identified in the model. This data will form the input to the statistical model.

2. Model component

This component will consist of the quantitative models that will be used by the system for forecasting and calculation purposes. In this project, the model component will include multiple regression analysis and time series models as discussed in chapter 3.

3. User interface

This component is responsible for the interaction between the user and the system. A user friendly interface is developed. Users can insert values for parameters which they have such as Gross Domestic Product, Crude Oil Production of Iran and the program will take these values to compute out the forecasted crude price. If the user lack values for certain variables which are needed to compute the Crude Price, the program will automatically forecast those independent parameters via methods such as Moving Averages or Exponential Smoothing which will then be used in the equation. Besides forecasting, the system is able to generate plots of the given variables.

2.2 Development of Mathematical Model Methodology

After attaining the database, we firstly have to modify the database as some of them have intervals of days, and some of them have intervals of months. After this, we proceed to smoothing using various methods via SPSS. We find that the most effective way of smoothing is via lags. After this, we proceed to linear regression, selecting the variables which have a strong relation with the dependent variable Crude Oil Prices via SPSS. After selecting these variables, we perform linear regression and last but not least we obtain our equation with their corresponding equations.

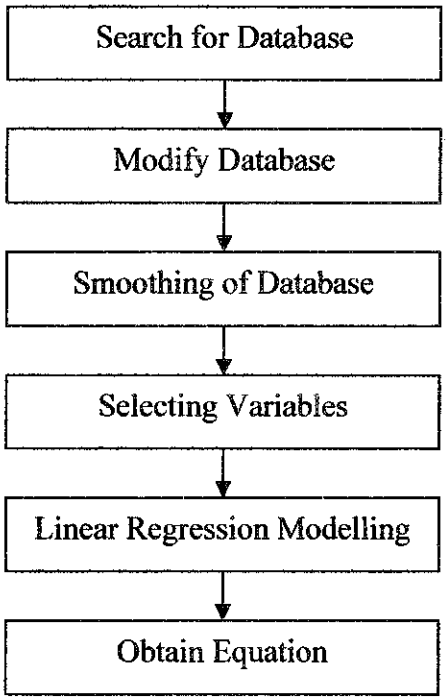

Figure 3 : Project Flowchart

2.3 Resources Required

As this is a research project, the only resources required are Internet Explorer, Visual Basic, Library books and experienced personnels.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

The days of crude oil trading in the mid-$20 per barrel range may well be over. In 2004, crude oil averaged $41.50 per barrel, fully $10 above the 2003 average and more than $13 above the upper end of the traditional $22-$28 "price basket" targeted by the Organization of Petroleum Exporting Countries (OPEC). In January 2005, OPEC announced that it has temporarily suspended the $22-28 price band, which was essentially ignored in 2004 anyway.

On the demand side, the international market has changed in the past several years, with considerable crude oil demand being generated in both India and China. This has placed additional pressure on the crude oil market and reduced the availability of excess capacity in the major oil-producing regions of the world. Rather than competing with already industrialized societies primarily in Europe for its oil supply, the United States must now compete for supply with booming industrial revolutions in east Asia. This has already had a significant impact on domestic acquisition prices and the market remains extremely volatile entering 2005. In fact, crude oil prices on the spot market swung day to day ?from a penny to two dollars per barrel ?demonstrating a still unstable international oil market.

Some analysts predict that the Chinese industrialization strategy will not last, that recession may hit the mainland and the increased demand for raw materials will cease. This may be true for traditional building materials, such as steel, but crude oil and motor fuels are required to maintain the operations of the already completed industrial gains.

Transportation fuels demand has also substantially increased; China has abandoned its traditional bicycle transportation infrastructure and fully adopted the internal combustion engine. Whether further industrialization continues or not, the need for motor fuels will only continue to increase. Therefore, despite the future economic health of the Chinese economy (which grew 9.5 percent in 2004 and 9.3 percent in 2003),

its demand for international crude oil and refined petroleum products is unlikely to diminish in the near future. The U.S. Energy Information Administration predicts that world demand will increase by about 2.1 million barrels per day in 2005, down slightly from the 2.6 million barrels per day increase in 2004.

This means that the international demand for existing proven oil reserves will continue to grow and the suppliers to the world will be able to receive top dollar for their product. In January 2005, crude oil prices hit an eight-week high and were again flirting with $50 per barrel. Given recent market conditions and the apparent intentions of OPEC to keep prices high, it is likely that spot prices will remain above the $40 per barrel marker and may in fact increase higher than that. In fact, the U.S. Energy Information Administration's Short-Term Energy Outlook, released in January 2005, predicts that crude oil prices for the first quarter of 2005 will average $43, about $8 more than the same period in 2004, and are likely to be around $42-43 throughout 2005 and 2006. This may contribute to higher than historically average retail prices for gasoline due the vital nature of crude oil to the motor fuels market.

Oil analysts do say the international situation affects petroleum prices, along with gasoline, fuel oil and everything else made from it. Analysts often refer to a "risk premium" built into prices when there's fighting.

3.2 Instability in critical oil-producing regions

The United States is increasingly dependent on exports to satisfy its demand for petroleum. In 2004, exports increased 4.0 percent to top 10 million barrels per day, while domestic production dropped 3.8 percent to 5.5 million barrels per day.

In addition to the increased international demand boosting the price of crude oil on the spot market, there is also the continued risk of disruption to the system posed by international instability. The Middle East (which supplies 19.3 percent of U.S. imports) remains a hotbed of activity and tension, characterized by the continued hostilities in Iraq

and the targeting of its oil infrastructure by terrorists. In addition, two of the United States' primary suppliers, Nigeria (9.0 percent of U.S. oil imports) and Venezuela (11.8 percent of U.S. imports), continue to struggle with internal instability that remains a threat to the uninterrupted flow of product. A disruption in any one region has a significant impact on overall supply ?and prices. For example, in December 2002, the Venezuelan petroleum industry went on strike, causing crude oil prices to increase $10 per barrel. Given the increased volatility of the spot market in recent months, it's likely that any type of disruption could result in similar ?if not more extreme ?market movement. Many analysts estimate that a $10-15 "fear premium" already is built into today's oil prices ?which translates into roughly 25-38 cents/gallon more for the price of gasoline.

Another situation that has the oil industry concerned involves events in Russia. The oil reserves in eastern Russia are so significant that they are sometimes considered the only competitor to OPEC's hold on the market. Many observers were beginning to look to Russia to supply the incremental barrels required to offset the increased international demand and provide a backstop to the impact of instability. However, the decision by the Russian government to break up the oil giant Lukoil has put the future of the Russian oil supply in doubt. How the transition proceeds within that region, and within that company specifically, will have a significant impact on the international market. In the past, Russian oil production has served as a counter to OPEC production decisions. For example, several years ago when international crude oil prices had dropped to extremely low levels, OPEC relied upon Russian cooperation to reduce output and restore prices to an acceptable level. What the impact of the Russian decision will be in 2005 remains to be seen, but it is definitely something to watch.

3.3 Refining capacity

In addition to the international crude oil market, a primary factor influencing retail gasoline prices is the refining sector. The last domestic refinery was built in 1976 and since 1981 the number of domestic refineries has dropped by more than 50 percent. Meanwhile, U.S. demand increased 35.6 percent and imports grew 229 percent. While

It's unlikely the situation will improve in 2005. Only two developments can ease the pressure on the refining system: reduced consumer demand for refined petroleum products or increased domestic refining capacity. The first component is a long-term problem that will not be resolved in the near future. It will require a national change in consumer behavior, characterized by a much more deliberate approach to enhancing fuel economy or reducing vehicle miles traveled. The second option is likewise a long-term problem. Historically, the refining industry has earned a five percent return on investment, far below the 10 percent required by many market analysts and investors in New York. The cost of expanding or building a new facility is often reported in the billions, not to mention the difficulty in obtaining permits for such work.

Many point to the high upstream (exploration/production and refining) profits earned by the industry in 2004 and suggest that now might be the time for the industry to invest in new capacity. Unfortunately, 2004 profits will likely be used to fund regulatory enhancements required by the U.S. Environmental Protection Agency for the reduction of sulfur from both gasoline and diesel fuel. Combined with improvements to comply with stationary source emissions rules like the New Source Review program, the industry is facing upwards of $20 billion in capital expenditures over the next 10 years simply to stay in business.

Consequently, the market in 2005 will remain tightly balanced with strong demand for refined petroleum products and limited spare capacity to ensure the uninterrupted, efficient operation of the nation's refining system. Should there be a refinery fire or other unexpected disruption, the results could be significant for the market immediately served by that refinery and other markets whose supply may be compromised by the diversion of product to mitigate regional shortages. There remains no excess capacity to compensate for such disruptions, and regions could experience price volatility in excess to the normal course of operations.

3.4 Unexpected disruption impact

There has been little achieved in recent years to adjust the systemic challenges that could cause or compound the effects of supply disruption. The international crude oil market is under constant threat of civil disruption and terrorist attack. In Iraq, terrorists continually target pipelines and storage facilities; in Nigeria, a long-running civil war always threatens that supply; in Venezuela, President Chavez continues to face unrest in the population and continued stability remains far from certain; and in Russia, the future of the oil production infrastructure formerly owned and operated by Lukoil in unclear. And, there is always the possibility that OPEC could agree to production cuts.

Domestically, refineries will continue to operate at maximum capacity in an attempt to satisfy consumer demand, leaving them more apt to experience an unanticipated event forcing them to reduce their production for a period of time. The pipeline systems, constantly under strain and pressure to satisfy the demand of the multiple markets throughout the nation, have experienced breakdowns in the past several years and may experience more in the near future. The proliferation of boutique fuels has rendered the system less able to adjust to such unanticipated disruptions, and may lead to more significant shortages and price spikes.

All of these challenges remain in a year that opened with the average retail price of regular grade gasoline at more than $1.70 per gallon, the highest ever recorded at the beginning of a year.

3.5 Alternative fuels

As consumers face the threat of ever-rising gas prices, alternative fuels are gaining prevalence across the state.

Although there are more than half a dozen forms of alternative fuels for vehicles, few choices are available to area residents and each choice requires after-market conversion systems or the purchase of a specially equipped vehicle. Examples of alternative fuel are:

• Liquefied petroleum gas, or propane, is produced as a byproduct of natural gas processing and petroleum refining.

• Compressed natural gas is a mixture of hydrocarbons and is produced either from gas wells or in conjunction with crude oil production.

• E85, or 85 percent ethanol, is an alcohol-based alternative fuel produced by fermenting and distilling starch crops that have been converted into simple sugars.

3.6 Two different sides of opinion

The perception of future crude oil prices and reserves can generally be divided into two parts - the geologists' and engineers' opinion and the economists' opinion.

Geologists and engineers generally believe that world reserves are depleting fast and supply peak will occur in a few more years. By then, crude oil prices will have skyrocketed and will remain at that level if not higher forever. The main opinions and ideas are from people such as M. King Hubbert. Please refer to appendix A.

Economists on the contrary believe that all natural resources in this world will never be depleted. Technological advancement will be capable of finding replacement energy or improve the efficiency of using these resources. Therefore, crude oil prices will go down on the long run as other natural resources have done so for the past centuries. Please refer to appendix A.

3.7 Time Series

A time series is a sequence of observations which are ordered in time (or space). If observations are made on some phenomenon throughout time, it is most sensible to display the data in the order in which they arose, particularly since successive observations will probably be dependent. Time series are best displayed in a scatter plot. The series value X is plotted on the vertical axis and time t on the horizontal axis. Time is called the independent variable (in this case however, something over which you have little control). There are two kinds of time series data:

1. Continuous, where we have an observation at every instant of time, e.g. lie detectors, electrocardiograms. We denote this using observation X at time t, X(t).

2. Discrete, where we have an observation at (usually regularly) spaced intervals. We denote this as Xt.

Components of a Time Series

Trend Component

We want to increase our understanding of a time series by picking out its main features. One of these main features is the trend component. Descriptive techniques may be extended to forecast (predict) future values.

Trend is a long term movement in a time series. It is the underlying direction (an upward or downward tendency) and rate of change in a time series, when allowance has been made for the other components.

A simple way of detecting trend in seasonal data is to take averages over a certain period. If these averages change with time we can say that there is evidence of a trend in the series.

Cyclical Component

In weekly or monthly data, the cyclical component describes any regular fluctuations. It is a non-seasonal component which varies in a recognisable cycle.

Seasonal Component

A seasonal effect is a systematic and calendar related effect. Some examples include the sharp escalation in most Retail series which occurs around December in response to the Christmas period, or an increase in water consumption in summer due to warmer weather. Other seasonal effects include trading day effects (the number of working or trading days in a given month differs from year to year which will impact upon the level of activity in that month) and moving holidays (the timing of holidays such as Easter varies, so the effects of the holiday will be experienced in different periods each year).

Irregular Component (Error)

each newly-generated series, it may succeed in removing most of any cyclical variation present. What is left of the original series after early smoothings to remove seasonal and random or irregular components is a successor series retaining some combination of trend and cyclical behavior. If no trend or cyclical behavior are present in the time series, the smoothings may leave a successor series which plots as a nearly horizontal line against time on the horizontal axis. Assuming the presence of trend and cyclical behavior in the original series, the moving average process provides a method of isolating it.

While successive applications of an efficient moving-average routine may result in filtering out all variation other than the trend and cyclical behavior from an original series, this may not be the objective. Rather, the analyst may wish to filter out only the seasonal or only the irregular variation. Either may be targeted by judiciously selecting the number of elements to be included in the moving average subset, and by designing an appropriate weighting system to accomplish his objective. For example, the U.S. Department of Commerce typically uses an unweighted moving average to filter out the seasonality from a series, then a judiciously designed weighted moving average to filter out the irregular variation.

An unweighted moving average with a relatively small number of elements (say five to seven) will have its smoothing effect without destroying the seasonality present in a series. A moving average with a larger number of elements (eleven or more) with weights designed to emphasize the elements toward the center of the subset will likely be even more efficient in removing the irregular variation, but will tend also to destroy any seasonality still present.

If the analyst's intention is to deseasonalize a time series, a number of moving-average elements in the neighborhood of eleven to thirteen is called for. An odd number of elements is more easily handled than is an even number due to the need to center the moving averages relative to the object series. Also, an appropriately-designed weighting scheme applied to the elements of the moving average may serve to improve the efficiency of the seasonality removal process.

Here is an example of a series which appears to exhibit random fluctuations around a slowly-varying mean.

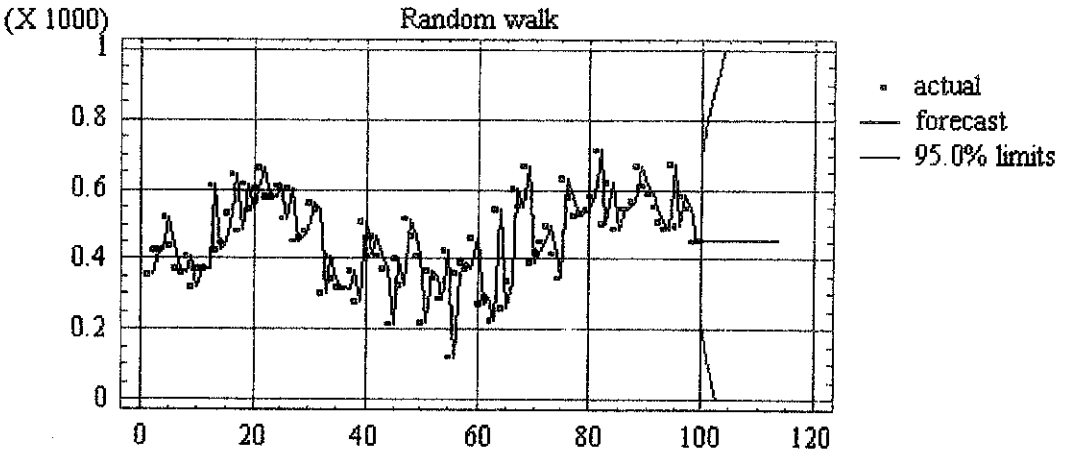

Figure 5 : Moving Averages with Random Fluctuations

We attempt to find the trend by trying a simple moving average of 5 terms, thus we get a smoother-looking set of forecasts:

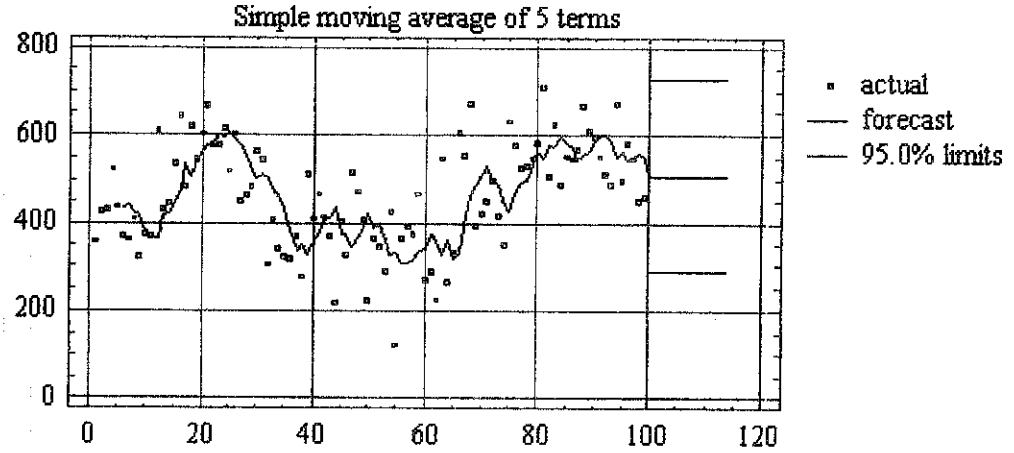

Figure 6 : Simple Moving Average of 5 Terms

The 5-term simple moving average yields significantly smaller errors than the random walk model in this case. The average age of the data in this forecast is 3 (=(5+1)/2), so that it tends to lag behind turning points by about three periods. (For example, a downturn seems to have occurred at period 21, but the forecasts do not turn around until several periods later.)

$\hat{Y}(t+1) = \alpha[Y(t) + (1-\alpha)Y(t-1) + ((1-\alpha)^2)Y(t-2) + ((1-\alpha)^3)Y(t-3) + \ldots]$
...forecast=*exponentially weighted (i.e. discounted) moving average* with discount factor $1-\alpha$

The preceding four equations are all *mathematically equivalent*--any one of them can be obtained by rearrangement of any of the others. The first equation above is probably the easiest to use if you are implementing the model on a spreadsheet: the forecasting formula fits in a single cell and contains cell references pointing to the previous forecast, the previous observation, and the cell where the value of is stored.

Note that if $\alpha=1$, the SES model is equivalent to a random walk model (without growth). If $\alpha=0$, the SES model is equivalent to the mean model, assuming that the first smoothed value is set equal to the mean.

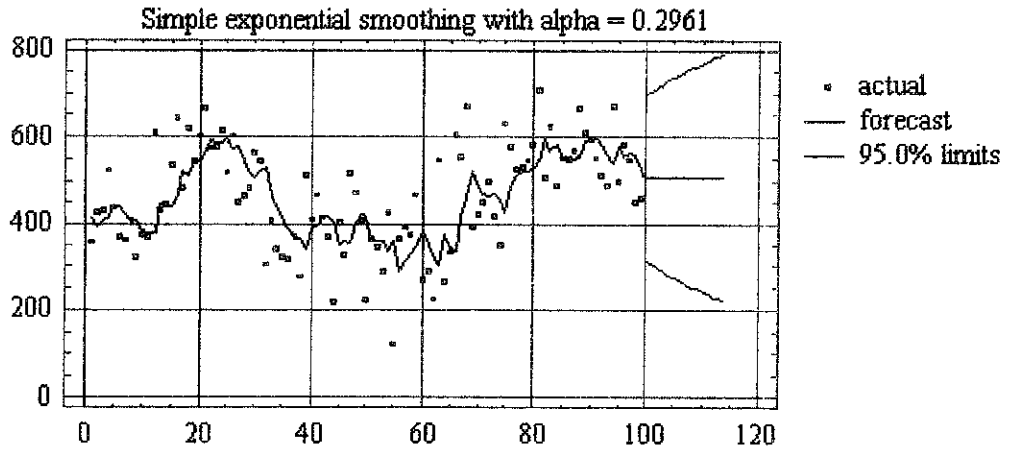

Figure 7: Simple Exponential Smoothing with alpha = 0.2961

3.10 Lags

Smoothing the database via lags simply means lagging the database by a number of intervals. For example, lag by 1 means we lag the whole time series by 1 interval, therefore values which originally occur at January will be transferred to the month of February.

3.11 Linear Regression

Linear regression is used to make predictions about a single value. Simple linear regression involves discovering the equation for a line that most nearly fits the given data. That linear equation is then used to predict values for the data.

When two variables are displayed in a scatterplot and one can be thought of as a response to the other (here, muscles produce strength), standard practice is to place the response on the vertical (or Y) axis. The names of the variables on the X and Y axes vary according to the field of application.

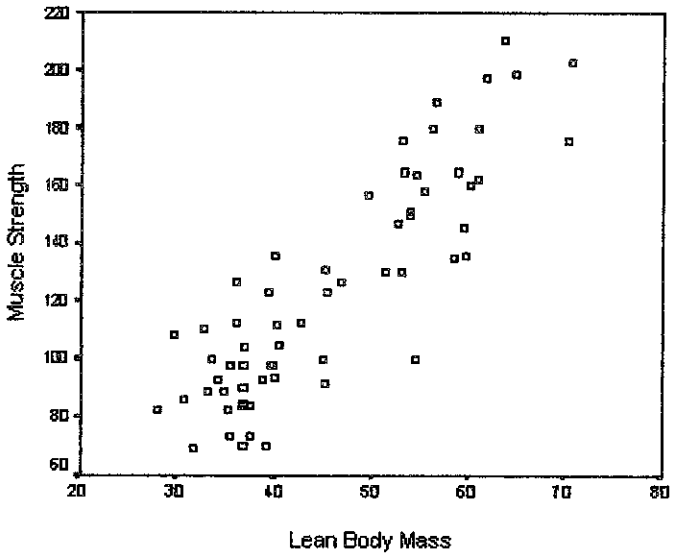

Figure 8 : Lean Body Mass

The association looks like it could be described by a straight line. There are many straight lines that could be drawn through the data. How to choose among them? On the one hand, the choice is not that critical because all of the reasonable candidates would show strength increasing with mass. On the other hand, a standard procedure for fitting a straight line is essential. Otherwise, different analysts working on the same data set would produce different fits and it would make communication difficult. Here, the fitted equation is Strength = -13.971 + 3.016 LBM .

It says an individual's strength is predicted by multiplying lean body mass by 3.016 and subtracting 13.971. It also says the strength of two individuals is expected to differ by 3.016 times their difference in lean body mass.

There are two primary reasons for fitting a regression equation to a set of data--first, to describe the data; second, to predict the response from the carrier. The rationale behind the way the regression line is calculated is best seen from the point-of-view of prediction. A line gives a good fit to a set of data if the points are close to it. Where the points are not tightly grouped about any line, a line gives a good fit if the points are closer to it than to any other line. For predictive purposes, this means that the predicted values obtained by using the line should be close to the values that were actually observed, that is, that the residuals should be small. Therefore, when assessing the fit of a line, the vertical distances of the points to the line are the only distances that matter. Perpendicular distances are not considered because errors are measured as vertical distances, not perpendicular distances.

Interpolation is making a prediction within the range of values of the predictor in the sample used to generate the model. Interpolation is generally safe. One could imagine odd situations where an investigator collected responses at only two values of the predictor. Then, interpolation might be uncertain since there would be no way to demonstrate the linearity of the relationship between the two variables, but such situations are rarely encountered in practice. Extrapolation is making a prediction outside the range of values of the predictor in the sample used to generate the model. The more removed the prediction is from the range of values used to fit the model, the riskier the prediction becomes because there is no way to check that the relationship continues to be linear. For example, an individual with 9 kg of lean body mass would be expected to have a strength of -4.9 units. This is absurd, but it does not invalidate the model because it was based on lean body masses in the range 27 to 71 kg.

3.12 Visual Basic Programming

3.12.1 Introduction to Visual Basic Programming

Visual Basic (VB) is an event driven programming language and associated development environment prototyped by Alan Cooper as Project Ruby, then bought and vastly improved upon by Microsoft. In business programming, it has one of the largest user bases.

It is derived heavily from BASIC and enables rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using DAO, RDO, or ADO, and creation of ActiveX controls and objects. A programmer can put together an application using the components provided with Visual Basic itself.

According to some sources, as of 2003, 52 percent of software developers used Visual Basic, making it the most popular programming language at that time (although consider this figure does not come close to the amount of software written in Visual Basic). 43 percent of those Visual Basic developers, however, planned to move to other languages.[1] The popularity of Visual Basic perhaps results from its easy to understand syntax. Like all other Turing complete programming languages, it can also be used to create arbitrarily complex applications. Programs written in Visual Basic can use the Windows API, but doing so requires external function declarations.

In its latest version, Visual Basic 9.0 introduces several language extensions that build on Visual Basic 2005 to support the creation and use of higher order, functional style class libraries. The extensions enable construction of compositional APIs that have equal expressive power of query languages in domains such as relational databases and XML. Visual Basic 9.0 offers radical improvements in its ability to work with data in all its forms: as objects, as XML, as relational data.

3.12.2 Visual Basic Programming Features

Visual Basic was designed to be usable by all programmers, whether novice or expert. The language is designed to make it easy to create simple GUI applications, but

also has the flexibility to develop fairly complex applications as well. Programming in VB is a combination of visually arranging components on a form, specifying attributes and actions of those components, and writing additional lines of code for more functionality. Since default attributes and actions are defined for the components, a simple program can be created without the programmer having to write many lines of code. Performance problems were experienced by earlier versions, but with faster computers and native code compilation this has become less of an issue.

Although programs can be compiled into native code executables from version 5 onwards, they still require the presence of runtime libraries of approximately 2 MB in size. This runtime is included by default in Windows 2000 and later, but for earlier versions of Windows it must be distributed together with the executable.

Forms are created using drag and drop techniques. A tools palette is used to place controls (e.g., text boxes, buttons, etc.) on the form (window). Controls have attributes and event handlers associated with them. Default values are provided when the control is created, but may be changed by the programmer. Many attribute values can be modified during run time based on user actions or changes in the environment, providing a dynamic application. For example, code can be inserted into the form resize event handler to reposition a control so that it remains centered on the form, expands to fill up the form, etc. By inserting code into the event handler for a keypress in a text box, the program can automatically translate the case of the text being entered, or even prevent certain characters from being inserted.

A Visual Basic application can consist of one or more windows, or a single window that contains MDI child windows, as provided by the operating system. Dialog boxes with less functionality (e.g., no maximize/minimize control) can be used to provide pop-up capabilities. Controls provide the basic functionality of the application, while programmers can insert additional logic within the appropriate event handlers. For example, a drop-down combination box will automatically display its list and allow the user to select any element. An event handler is called when an item is selected, which can

that when US currency depreciates, oil producing countries will want to increase crude oil prices so that they will get back the profits that they desire.

3. Price in turn affects willingness of producing countries to fund new capacity and produce more oil

High crude oil prices will be an incentive to produce more oil because profit will be higher. Investments will also be done in the long term so that more production will be available. This will however take a few years to see results thus less influential to current crude oil prices. Low crude oil prices will cause production to be less intense. With less supply, the author assumes prices will increase to a certain level as well. Investments in alternative resources will also be less because crude oil will be economical enough for world consumption.

4. Price affects feasibility of harder to extract petroleum resources, thereby increasing output to offset

High crude oil prices spur development of alternative energy resources such as solar energy, biofuel. Aside from that, production of crude oil from non-conventional resources such as oil sands which Canada massively has and ultra-heavy oil will also become economically feasible due to high oil prices thereby providing adjustments to prices in the longer term.

5. Natural Disasters – Typhoon, hurricane

Hurricane Katrina and Rita which occurred around Texas and New Orleans are examples of natural disasters which may cause disruption in oil supply. Natural disasters may cause severe damage to production or refining facilities thus reducing supply. Note that supply disruption is definite, the only question is whether production will be down for only a few days, a few months or even longer. This depends on the damage caused. Production facilities are generally constructed so as to withstand severe natural disasters though. As discussed above, the assumptions that people generally have will already cause prices to deviate from original levels. Logically, real damages to facilities will cause even severe price increases.

4.4 Probability and Statistics

By doing bivariate correlation we find that the values below show a stronger relation with Crude Oil Prices than the other variables we have. Therefore, they have been adopted for equation construction. The Linear Regression Model has an R Square of 0.687. This means that 68.7% of the crude oil prices can be explained by the variables provided. The coefficients and constants provided by the SPSS software are as follow. Please refer to appendix for figures.

Crude Oil Price = 39.859 + 0.005*LAGS(CPIR,5) -0.001*LAGS(CPOPC,5) + 0.001* LAGS(GDPW,5) + 0.059 * LAGS(GDPCN,5) – 0.01 * LAGS(GDPUS,5)

Correlations

		PRICE	LAGS(CPIR,5)
PRICE	Pearson Correlation	1	.310(**)
	Sig. (2-tailed)		.000
	N	273	268
LAGS(CPIR,5)	Pearson Correlation	.310(**)	1
	Sig. (2-tailed)	.000	
	N	268	268

** Correlation is significant at the 0.01 level (2-tailed).

Table 3 : LAGS(CPIR,5) Bivariate Correlation

		PRICE	LAGS(CPOPC,5)
PRICE	Pearson Correlation	1	.300(**)
	Sig. (2-tailed)		.000
	N	273	268
LAGS(CPOPC,5)	Pearson Correlation	.300(**)	1
	Sig. (2-tailed)	.000	
	N	268	268

** Correlation is significant at the 0.01 level (2-tailed).

Table 4 : LAGS(CPOPC,5) Bivariate Correlation

		PRICE	LAGS(CPNOPC,5)
PRICE	Pearson Correlation	1	.654(**)
	Sig. (2-tailed)		.000
	N	273	268
LAGS(CPNOPC,5)	Pearson Correlation	.654(**)	1
	Sig. (2-tailed)	.000	
	N	268	268

** Correlation is significant at the 0.01 level (2-tailed).

Table 5 : LAGS(CPNOPC,5) Bivariate Correlation

		PRICE	LAGS(GDPW,5)
PRICE	Pearson Correlation	1	.502(**)
	Sig. (2-tailed)		.000
	N	273	268
LAGS(GDPW,5)	Pearson Correlation	.502(**)	1
	Sig. (2-tailed)	.000	
	N	268	268

** Correlation is significant at the 0.01 level (2-tailed).

Table 6 : LAGS(GDPW,5) Bivariate Correlation

		PRICE	LAGS(GDPCN,5)
PRICE	Pearson Correlation	1	.655(**)
	Sig. (2-tailed)		.000
	N	273	268
LAGS(GDPCN,5)	Pearson Correlation	.655(**)	1
	Sig. (2-tailed)	.000	
	N	268	268

** Correlation is significant at the 0.01 level (2-tailed).

Table 7 : LAGS(GDPCN,5) Bivariate Correlation

		PRICE	LAGS(GDPUS,5)
PRICE	Pearson Correlation	1	.529(**)
	Sig. (2-tailed)		.000
	N	273	268
LAGS(GDPUS,5)	Pearson Correlation	.529(**)	1
	Sig. (2-tailed)	.000	
	N	268	268

** Correlation is significant at the 0.01 level (2-tailed).

Table 8 : LAGS(GDPUS,5) Bivariate Correlation

The Linear Regression Equation that we have found is as follow:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.829(a)	.687	.681	5.26885

a Predictors: (Constant), LAGS(GDPUS,5), LAGS(CPIR,5), LAGS(CPOPC,5), LAGS(GDPCN,5), LAGS(GDPW,5)

Table 9 : Model Summary

The second diagram below is the second form of the software. Here, users may view graphs of historical data that they wish to examine by simply clicking the command buttons on the left. The corresponding programming codes are provided in the appendices.

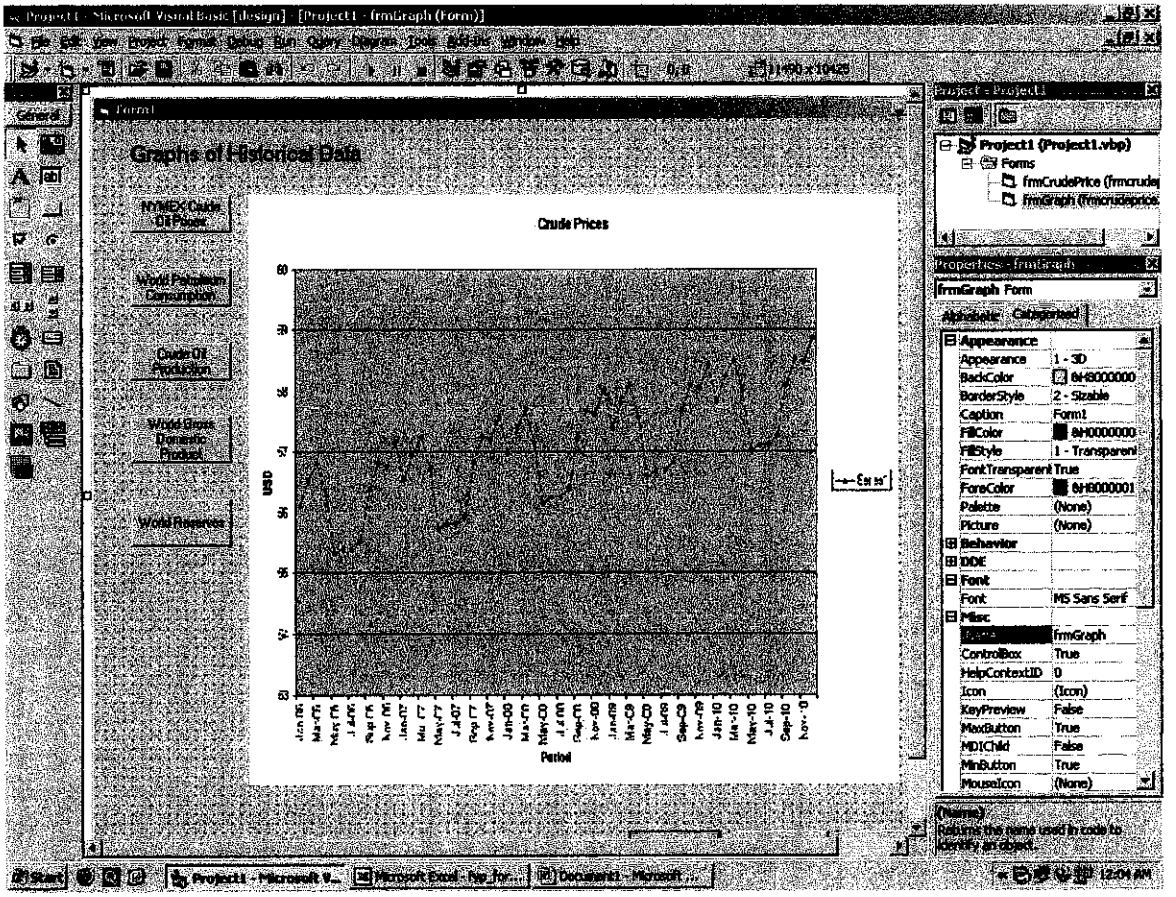

Figure 10 : Software Display Form 2

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

In conclusion, we can see that the petroleum industry involves high risk and return. Moreover, with the findings of new reservoirs and oil fields diminishing visibly and political unrest throughout the world, we can see what key variables are affecting its supply and demand. Relevant variables have been identified and used to create the Linear Regression Model as below:

Crude Oil Price = 39.859 + 0.005*LAGS(CPIR,5) -0.001*LAGS(CPOPC,5) + 0.001* LAGS(GDPW,5) + 0.059 * LAGS(GDPCN,5) – 0.01 * LAGS(GDPUS,5)

Although this model is inadequate to forecast crude oil prices due to the limitations of knowledge of the author, this project can serve as a prototype for further developments in the future via more sophisticated modeling techniques. This project has been completed successfully. Please refer to appendix for the programming codings, figures and database.

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Julian: "No, it's not, it's 80 cents a pound. It's in the newspaper, take a look."

Father: "I don't have to look. I know it's 8 cents a pound."

Julian: "Do you want to bet? I'll bet you it's not 8 cents a pound."

His father would never take the bet, but Julian would go to the library anyway, look things up in books, and come back with a ream of facts and data. His father, however, couldn't care less.

"I clearly didn't like my father," says Simon.

It's an attitude that drives him crazy to this day - people who know in advance what the truth is, who don't need to avail themselves of any "facts." But Simon loves facts and figures, he loves tables, charts, graphs, information arranged in rows and columns. Tabulations, the slopes of curves, diagrams, pie charts, histograms - he's a regular Mr. Data.

Of course, since people don't particularly like to have their cherished beliefs contradicted by heaps of facts served up on a platter, Simon has never been Mr. Popularity. He got fired from jobs in the navy because he hated the customary ass-kissing, sucking-up, and yessir requirements. Nor has he ever been much for schmoozing, glad-handing, or the latter-day manners of get-along, go-along.

"Socially I was always a bit marginal," he admits. "Also, there always lurked inside me some irreverence for authority and orthodoxy."

None of this held him back academically. He got a bachelor's in experimental psychology from Harvard, an MBA from the University of Chicago, and, two years later, in 1961, a PhD in business economics from the same school.

He was not one of those MBAs whose closest contact with the gritty business world was going down to the corner newsstand to purchase a copy of The Wall Street Journal. The year he got his doctorate he started and operated his own business, a mail-order firm that sold quality teas, coffees, and a book on how to make beer at home. The enterprise was successful enough, but not so much as the book he later wrote about it, How to Start and Operate a Mail-Order Business (McGraw-Hill, 1965), still in print and currently in its fifth edition.

He got married and had three kids and wound up, successively, as professor of advertising, of marketing, and of business administration and economics at the University of Illinois at Urbana-Champaign. Then in 1966 or so, he had his big idea about how to solve the airline overbooking problem. Anticipating no-shows, airlines routinely oversold their flights. But when more people showed up at the gate than the plane had seats, pandemonium ensued. Well, why not pay people to get off the plane? he wondered. Offer

them enough to make it attractive. It would be a voluntary system, and everyone would win.

So in his practical, down-to-earth, this-is-only-reasonable fashion, he submitted his suggestion to the airlines. The idea was laughed at, mocked, and ridiculed as unrealistic and unworkable. An official at Pan American replied: "Of course, we instituted the procedure immediately, after having the instructions translated into 18 languages." Ha ha ha, thank you, and goodbye.

Eleven years later, in 1977, Simon hadn't given up on the scheme. He published it in The Wall Street Journal, in an op-ed piece titled "Wherein the Author Offers a Modest Proposal." And lo and behold, a year after that, when economist Alfred Kahn headed up the Civil Aeronautics Board, Simon's proposal was put into practice. It was a raging success from the start, remains so to this day, and anyone who's ever voluntarily offloaded themselves from a plane for cash or free miles owes a nod of thanks to Julian Simon.

Still, that was a mere flash in the pan, and Simon's overall impact on the world at large was rather less massive than he desired. He was not making a name for himself, not setting the world on fire.

But there were those who were - Paul Ehrlich, for example.

Ehrlich, a Stanford University entomologist who as a youth had seen his best butterfly hunting grounds churned under the real estate developer's plow, wrote the runaway best-seller The Population Bomb. Published in 1968, the book was solidly Malthusian.

"The battle to feed all of humanity is over," it began. "In the 1970s and 1980s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now. At this late date nothing can prevent a substantial increase in the world death rate, although many lives could be saved through dramatic programs to 'stretch' the carrying capacity of the earth by increasing food production and providing for more equitable distribution of whatever food is available. But these programs will only provide a stay of execution unless they are accompanied by determined and successful efforts at population control." And so on, The Complete and Authoritative Litany, for the next 200 pages.

This late-breaking Malthusian out-burst, strangely enough, did set the world on fire. The book sold 3 million copies, became the best-selling environmental tract of all time, and got the author on The Tonight Show.

At home in Illinois, Simon watched Ehrlich on the Johnny Carson show, and he went bananas. In fact, more bananas than he'd ever before gone in his life. Simon had by that time decided that the Malthusian stuff was the purest mythology, an invention out of whole cloth, a theory that was entirely controverted by every available empirical fact.

Fact: Per capita food production has been increasing at roughly 1 percent yearly - 25 percent during the last quarter century.

Statement: Urban sprawl is paving over the United States, including much "prime agricultural land" and recreational areas.

Fact: All the land used for urban areas plus roadways totals less than 3 percent of the United States.... Each year 1.25 million acres are converted to efficient cropland by draining swamps and irrigating deserts.... A million acres yearly goes into additional wilderness recreation areas and wildlife refuges, and another 300,000 acres goes for reservoirs and flood control.

So on and so forth, fact piled upon fact, paragraph after paragraph, all of it buttressed by tables, charts, graphs, and diagrams, plus 42 footnotes, many of them containing additional data.

Letters to the editor poured into Science in an unseemly rush. A few of them expressed partial agreement, but the majority were heavily critical. Many of them repeated statutory items of The Litany - "human beings, like any other species, have the biological capacity to overrun the carrying capacity of their habitat" - and there were even some feeble attempts at humor: in extrapolating from past trends, said one writer, Simon is like "the person who leaped from a very tall building and on being asked how things were going as he passed the 20th floor replied, 'Fine, so far.'" (Simon's response: "I think the better story is about somebody who has a rope lifeline and falls off the 15th floor. Somewhere about 30 feet above the ground, she lets go of the rope. You ask her, 'Why did you let go of the rope?' And she answers, 'It was going to break anyway.' That's how many activists would like us to behave.")

Anne and Paul Ehrlich, along with two energy and natural resource experts, John Holdren and John Harte, wrote their own letter to the editor. After charging Simon with various "errors about the economics of scarcity," they went on to make some new doomsday predictions: "If deforestation for agriculture proceeds on a large enough scale, the resulting pulse of carbon dioxide may combine with that from increasing fossil-fuel combustion to alter global climate in a way that undermines food production to an unprecedented degree." They also corrected one of Simon's data points having to do with electricity, which Simon claimed had gotten cheaper. "The fact is," they said, "that real electricity prices bottomed in 1971 and were already up 18 percent from that low point in 1972." An 18 percent increase where Simon said there'd been a decline!

"I was taken aback," said Simon in his published reply. "Holdren and Harte are energy scholars. I checked Fig. 1 and other sources but could see no sign of their 18 percent." So he placed a phone call to the coauthor of the report cited by Holdren, Harte, and the Ehrlichs. "He, too, was puzzled. Upon investigation, the 1971 number (80.2) proved to be a typographical error and should have been 93.3. So much for Holdren et alia's 'fact.'"

A more perfect resolution of the Ehrlich-Simon debate could not be imagined. All of the former's grim predictions had been decisively overturned by events. Ehrlich was wrong about higher natural resource prices, about "famines of unbelievable proportions" occurring by 1975, about "hundreds of millions of people starving to death" in the 1970s and '80s, about the world "entering a genuine age of scarcity."

In 1990, for his having promoted "greater public understanding of environmental problems," Ehrlich received a MacArthur Foundation "genius" award.
By the time he'd won the bet, Simon and his family had moved back to the East Coast, he to take up a position as professor of business administration at the University of Maryland, and his wife, Rita Simon, a sociologist, to become professor of criminal justice at the American University in Washington, DC. They moved into a red brick house in Chevy Chase, Maryland, an upper-middle-class community inside the Beltway.

The house had computers on every floor, two Xerox copiers, and an assortment of exercise machines on which Julian Simon read books or newspapers while trying to keep his spare and straight body in fighting trim. When it wasn't raining, snowing, or more than 100 degrees outside, he did his research and writing out on the deck, sometimes with a wet sponge covering his shaved bald head. He'd sit there in the shade of the mulberry tree, binoculars nearby to stare at birds - particularly hummingbirds that came to a feeder. And with battery-acid coffee from a thermos that looked as if it came over on the Mayflower, he'd tilt at new windmills.

He always found it somewhat peculiar that neither the Science piece nor his public wager with Ehrlich nor anything else that he did, said, or wrote seemed to make much of a dent on the world at large. For some reason he could never comprehend, people were inclined to believe the very worst about anything and everything; they were immune to contrary evidence just as if they'd been medically vaccinated against the force of fact. Furthermore, there seemed to be a bizarre reverse-Cassandra effect operating in the universe: whereas the mythical Cassandra spoke the awful truth and was not believed, these days "experts" spoke awful falsehoods, and they were believed. Repeatedly being wrong actually seemed to be an advantage, conferring some sort of puzzling magic glow upon the speaker.

There was Lester Brown, for example, founder and president of the Worldwatch Institute, who in 1981 wrote: "The period of global food security is over. As the demand for food continues to press against the supply, inevitably real food prices will rise. The question no longer seems to be whether they will rise but how much."

All during the 1980s, however, wheat and rice prices declined; in mid-century, in fact, they reached all-time lows. But this made no difference, and in 1986, for his work on the "global economy and the natural resources and the systems that support it," Lester Brown, too, received

a MacArthur Foundation "genius" award.

Julian Simon never received a MacArthur award.

"MacArthur!" he says. "I can't even get a McDonald's!"

This did not discourage him. Doomslaying was a thankless task, but it had to be done, like taking out the garbage: it had to be carted to the dump today even if there'd be another big pile of it tomorrow.

So Simon penned tract after tract pleading his case: The Ultimate Resource (Princeton University Press, 1981), arguing that the most valuable resource of all was people; Theory of Population and Economic Growth in 1986; Population and Development in Poor Countries in 1992, and so on. In all, he wrote or edited a rough dozen such books, all of them aimed at demolishing one or another tenet of The Litany. But the nearest he got to that MacArthur was a senior fellowship from the conservative Cato Institute.

Naturally, he received a fair amount of bad press for all this heresy, particularly for his pet claim that what the world needs most is lots of additional human beings. They're not just mouths to feed, he argued. Newborn babes grow up to be creative adults; they turn into individuals who contribute and achieve, who give back far more than they ever take.

But nobody could believe it.

"He's overly optimistic," said Peggy Rizo, then of the Washington, DC-based Population Crisis Committee, now called Population Action International. "He is an economist who is trying to transpose what he believes to be the American prairie experience into the experience of crowded areas like Africa, Central America, and Asia."

"What does it mean in terms of the quality of life of the people of the 21st century when cities are joined to cities and we have just several huge megalopolises?" asked Rupert Cutler, then executive director of the Environmental Fund, which became Population Environment Balance, headquartered in Washington, DC. "I think we can predict a pall of brown air over these cities. We can predict water shortages, joblessness ... and crime."

Well, it wasn't as if Julian Simon hadn't heard that before.

Finally, in 1995 he came out with his crowning fact-feast and catalog of bounty, a book he edited called The State of Humanity. Almost 700 pages of dense text plus charts and figures, the quantity of factual information in it was nothing short of amazing. Simon had data you didn't even know people track, such as:
World cereal yields, 1950-1990.
Declining crowding in American housing, persons per room, 1900-1987.
Northeast Brazil: apparent per capita daily consumption of major starchy staples among low-income classes,

1974-1975.

So go ahead and check his data! Enjoy!

Some of Simon's other claims, however, are so far from received opinion as to be hard to take seriously - his view on species loss, for example, regarding which he asserts that "the highest rate of observed extinctions is one species per year."

That was hard to accept. Harvard biologist Edward O. Wilson, the guru of global species extinction, said in 1991: "Believe me, species become extinct. We're easily eliminating 100,000 a year." A year later, in his 1992 book The Diversity of Life, he had modified that figure somewhat, saying: "The number of species doomed each year is 27,000." Apparently, these numbers were a tiny bit slippery. Still, both of them were a far cry from Simon's "one species per year."

Simon, on the other hand, pointed out that the higher estimates did not come from observation, they came from theory, specifically from Wilson's own theory of "island biogeography" which correlates species extinction with tropical forest destruction. The theory's "species-area equation," supposedly, predicts that for each additional unit of forest destroyed, so many more species die out.

This was another mathematical argument, reminiscent of the one made long ago by Malthus, and it was exactly the type of Neat Mathematical Certainty that Julian Simon took so much joy in shooting big holes through, which is what he proceeded to do now. The problem with the theory, he wrote in a paper on species loss with Aaron Wildavsky, is that it is not borne out by the empirical facts.

"The only empirical observation we found is by Lugo for Puerto Rico, where 'human activity reduced the area of primary forests by 99 percent.... This massive forest conversion did not lead to a correspondingly massive species extinction.'" Simon quoted Lugo to the effect that "more land birds have been present on the Island in the 1980s (97 species) than were present in pre-Columbian times (60 species)."

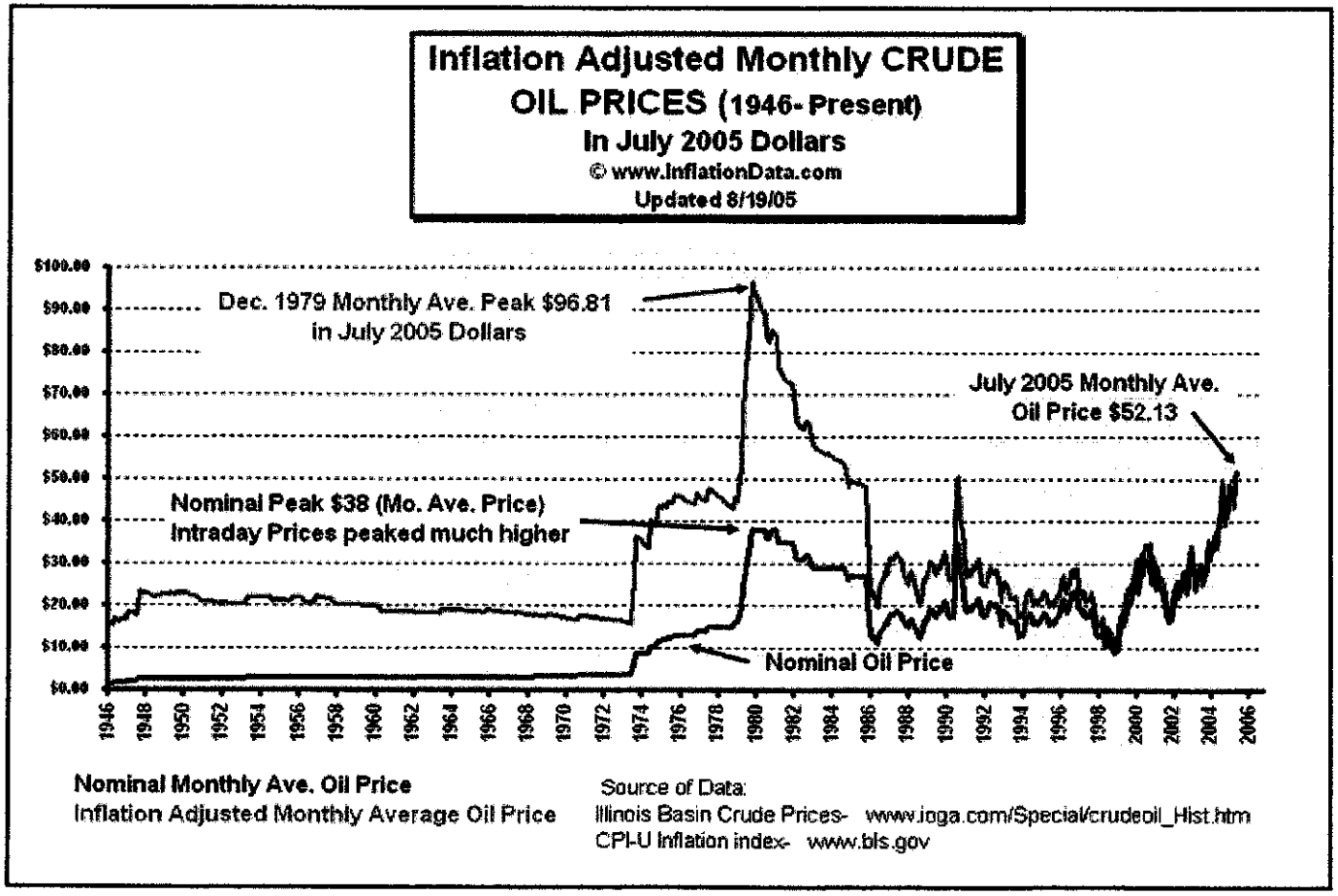
Say again? The forest was 99 percent demolished, and the number of bird species actually rose?

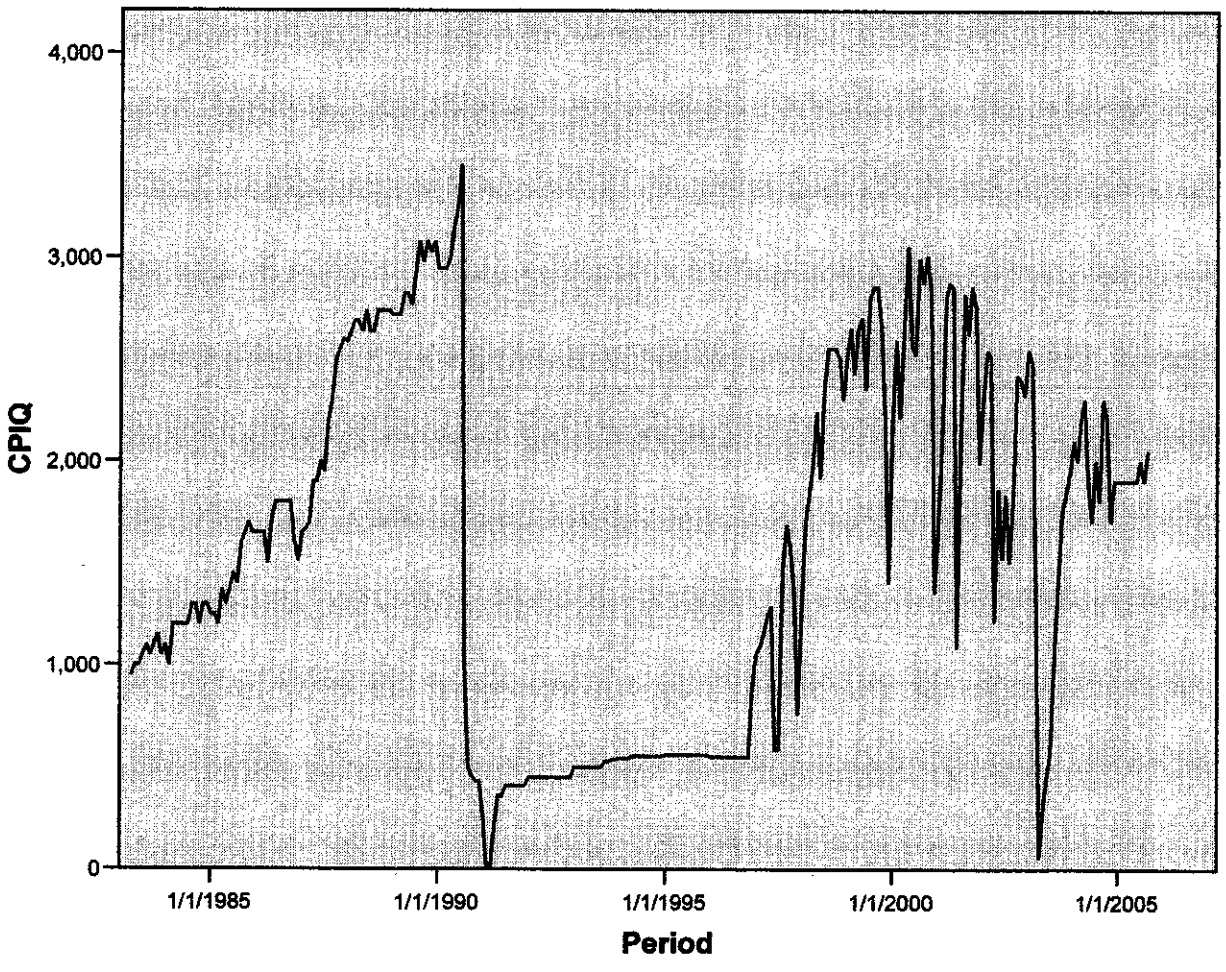
Even for me, this was too much.

The International Institute of Tropical Forestry, part of the US Forest Service, is located in an overgrown gray stone building in San Juan's Botanical Gardens. Ariel E. Lugo, a slim, gray-bearded man in a silver-green forest service uniform, is director.

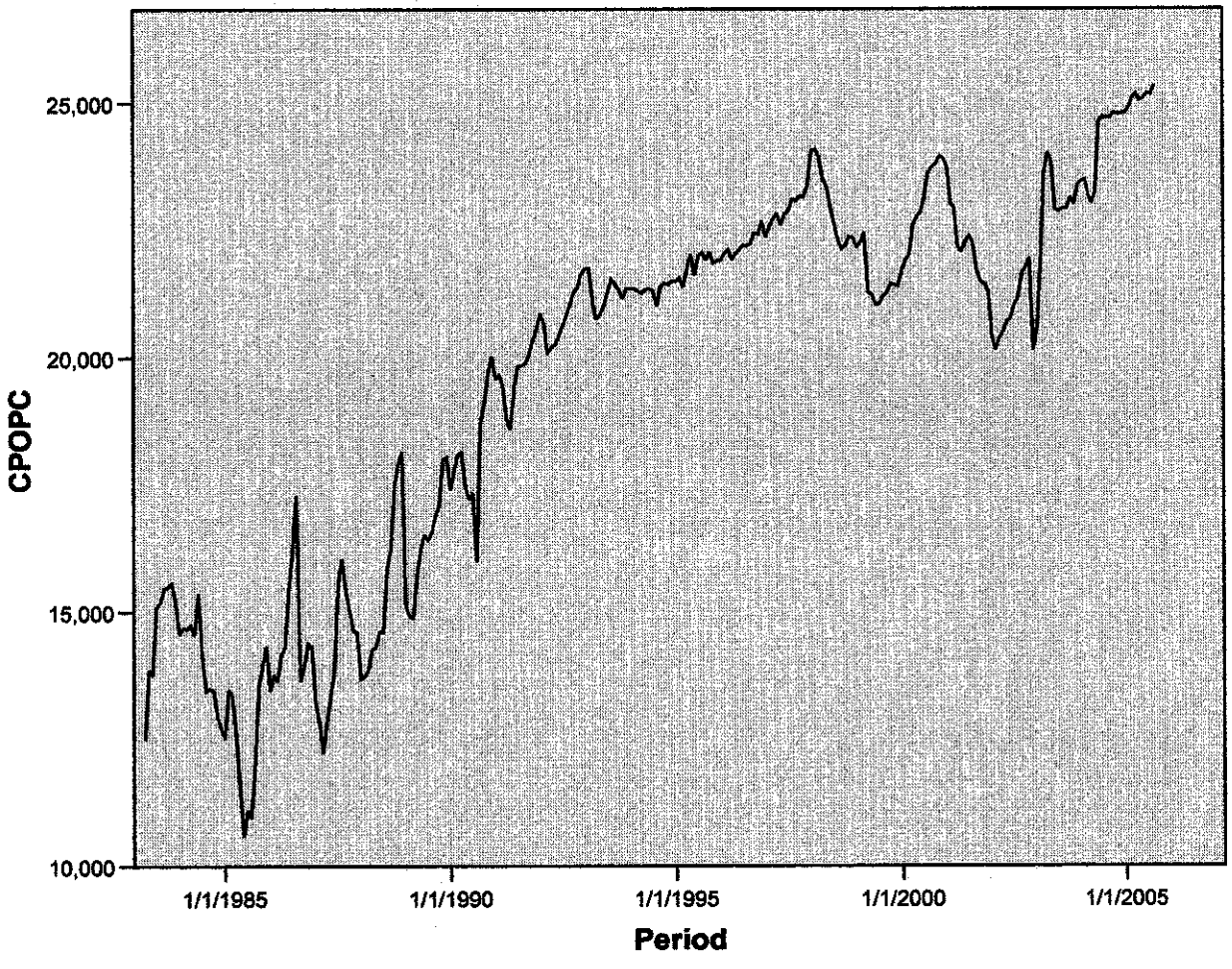
He's also a world-class expert on tropical forests and species extinction. A native of Puerto Rico, Lugo was educated in San Juan through his master's degree, came to the mainland, got a PhD in plant ecology from the University of North Carolina at Chapel Hill, then taught botany for 10 years at the University of Florida. He spent two years at the Puerto Rico Department of Natural Resources and two more years on Jimmy Carter's

APPENDIX B

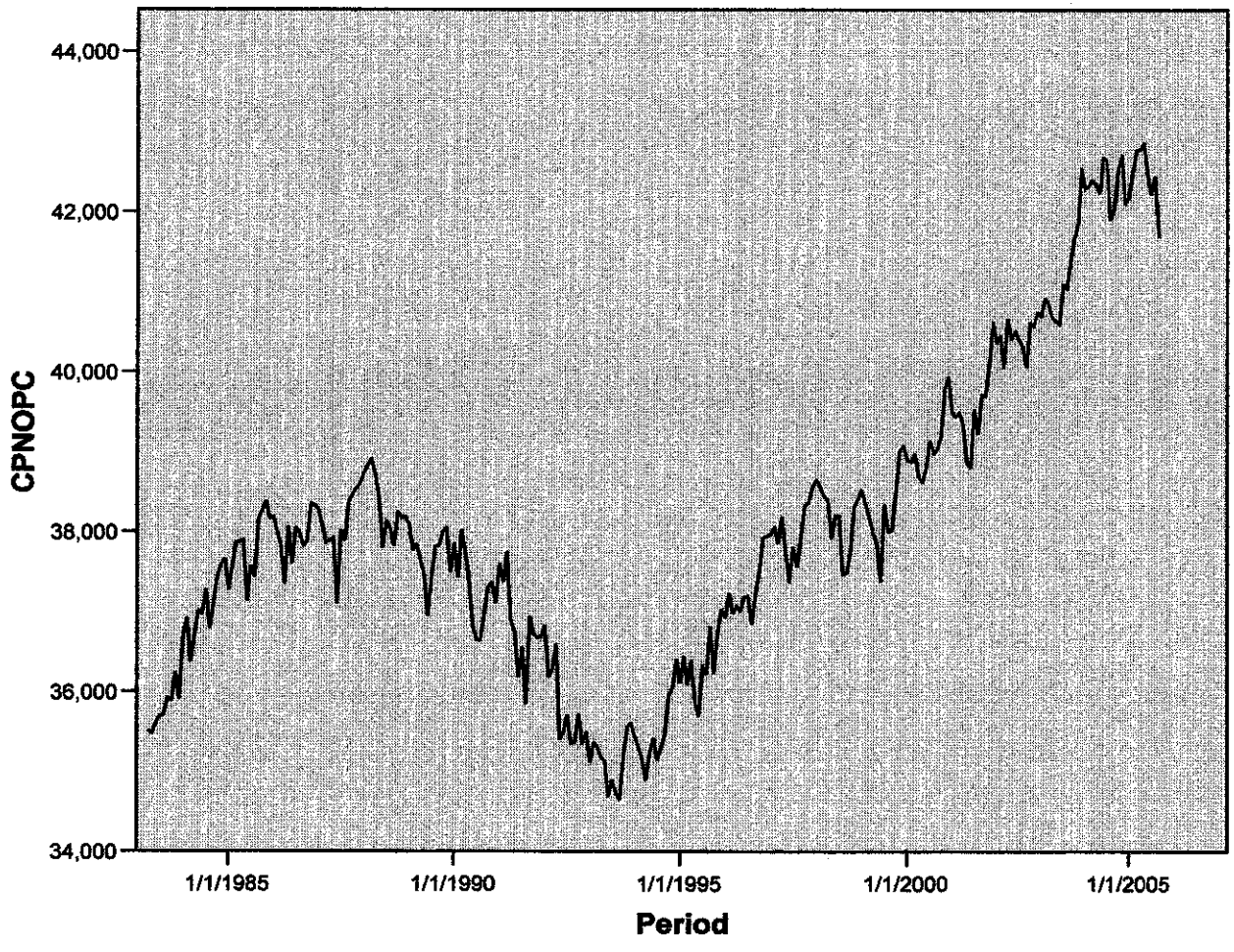

Inflation Adjusted Monthly CRUDE OIL PRICES (1946- Present)
In July 2005 Dollars
© www.InflationData.com
Updated 8/19/05
Dec. 1979 Monthly Ave. Peak $96.81 in July 2005 Dollars
July 2005 Monthly Ave. Oil Price $52.13
Nominal Peak $38 (Mo. Ave. Price) Intraday Prices peaked much higher
Nominal Oil Price
$100.00
$90.00
$80.00
$70.00
$60.00
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
1946 1948 1950 1952 1954 1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006
Nominal Monthly Ave. Oil Price
Inflation Adjusted Monthly Average Oil Price
Source of Data:
Illinois Basin Crude Prices- www.ioga.com/Special/crudeoil_Hist.htm
CPI-U Inflation index- www.bls.gov



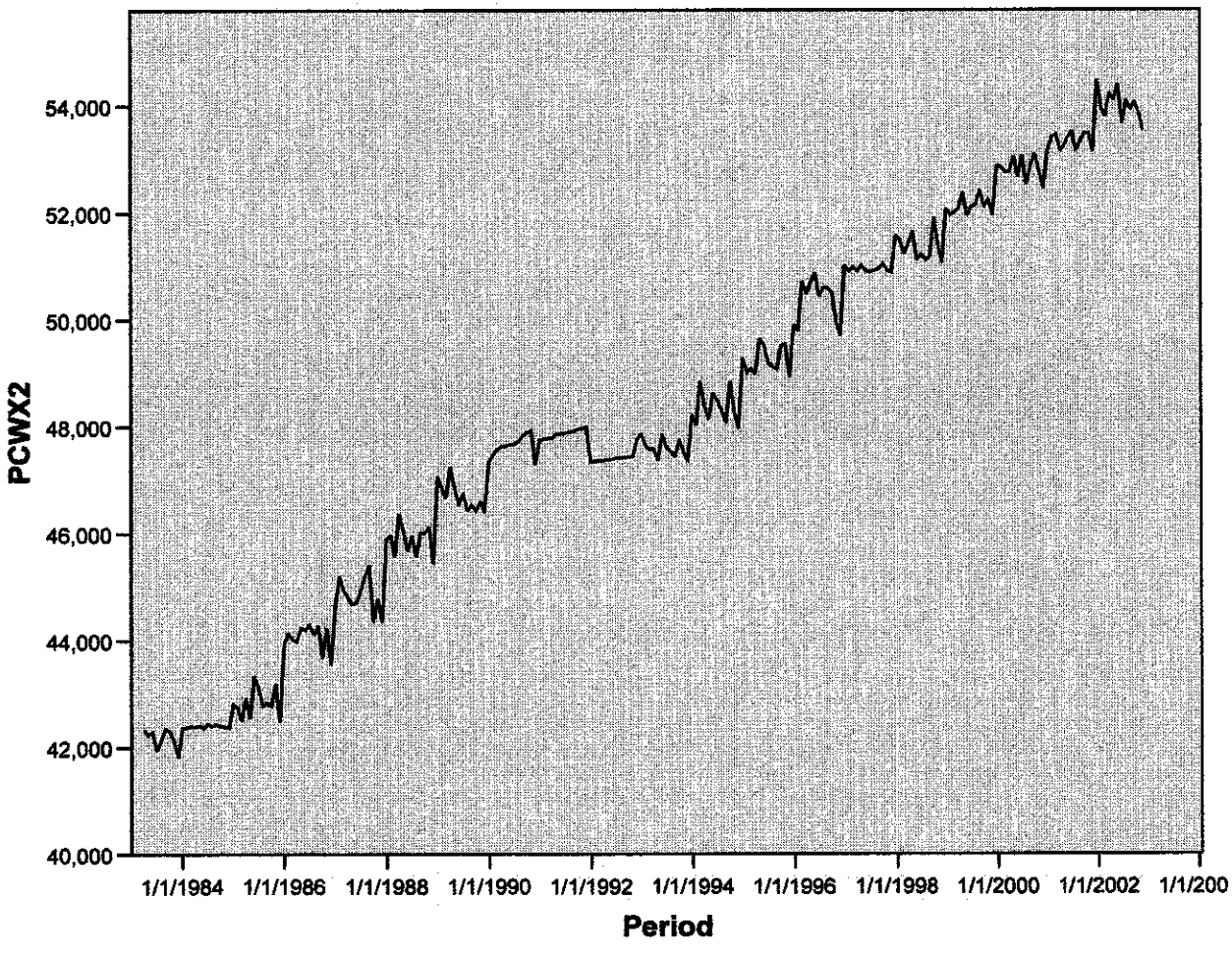
Iraq Crude Oil Production 1984-2005



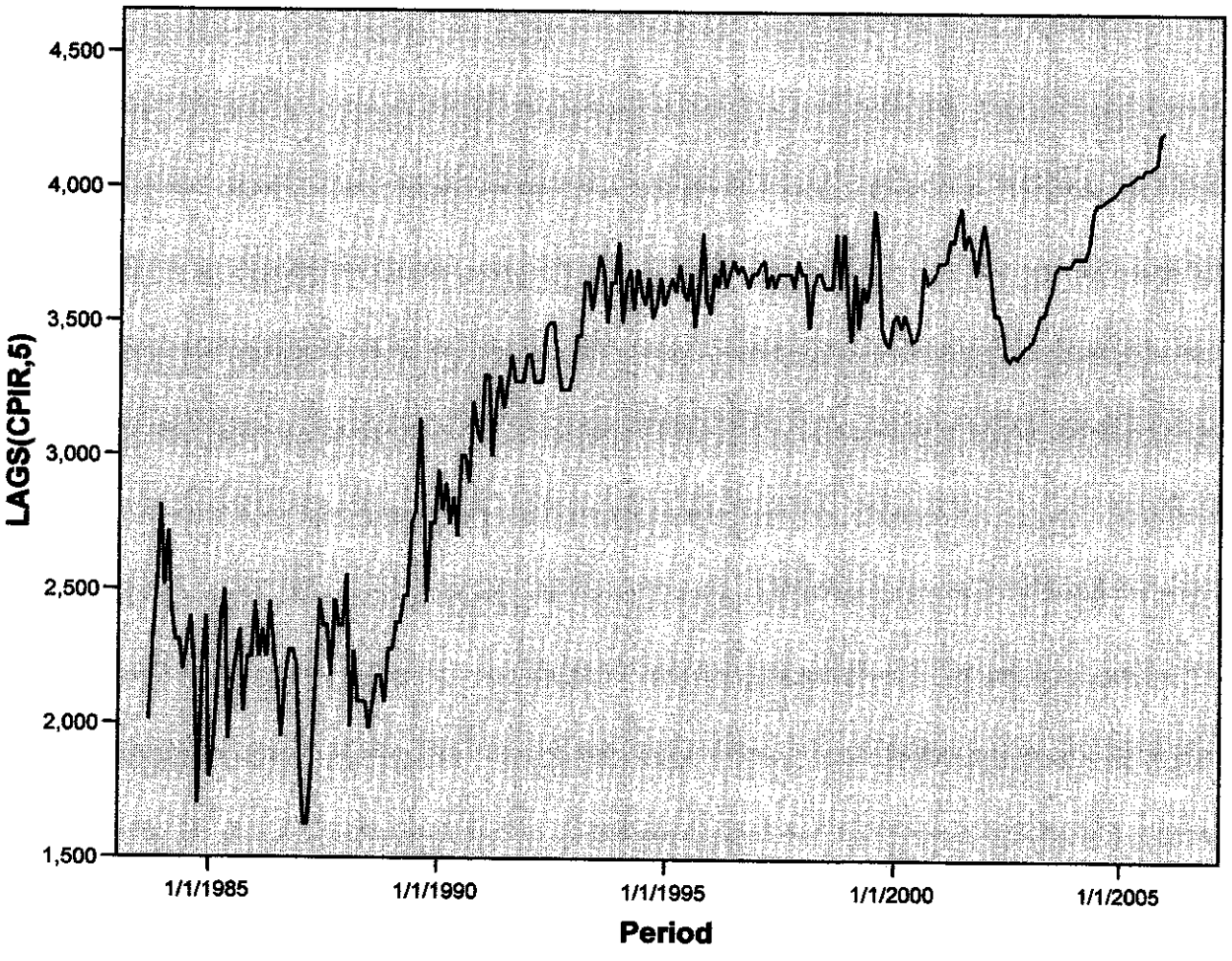
OPEC Crude Oil Production excluding Iran and Iraq 1984-2005



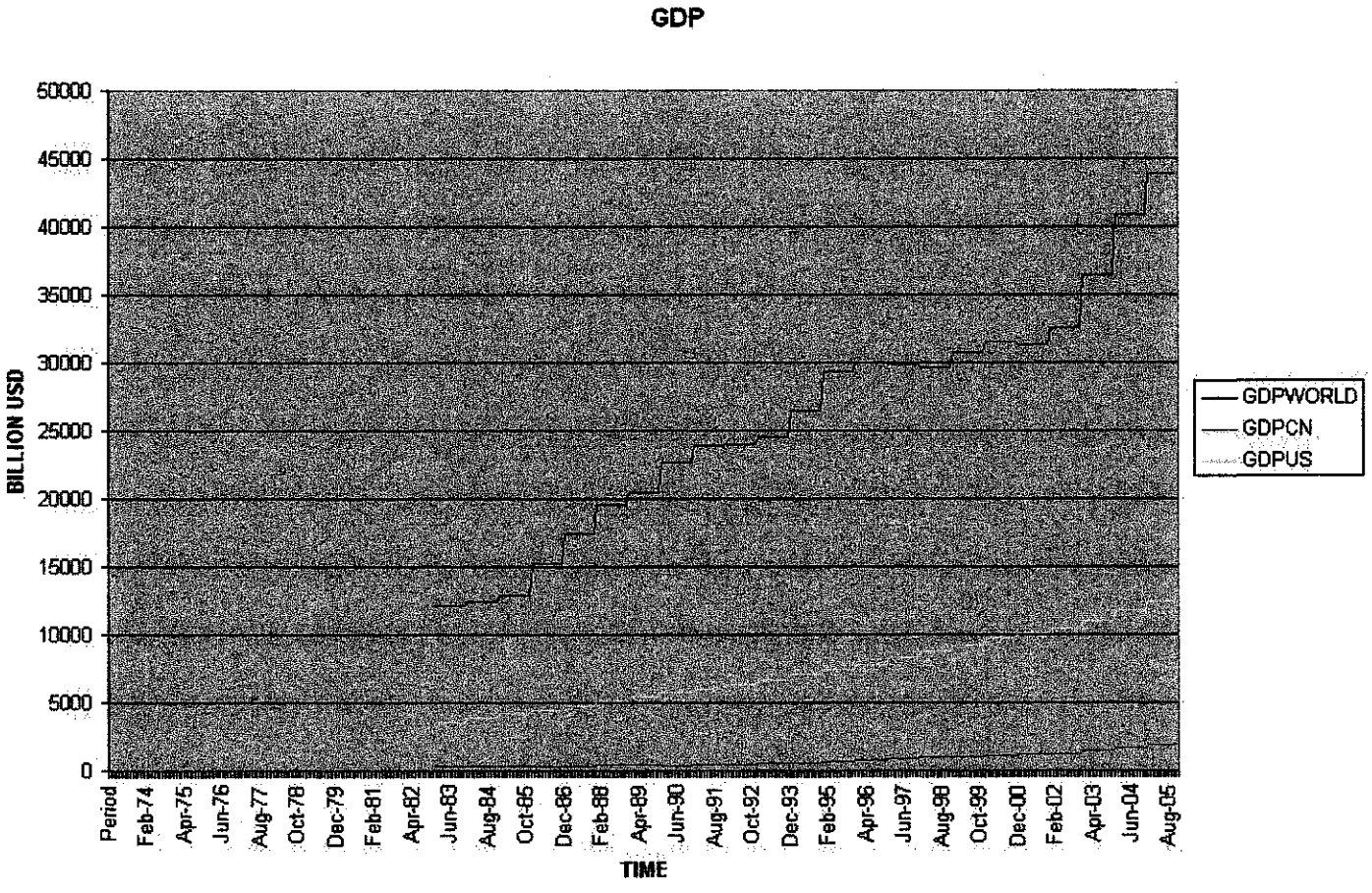
Non-OPEC Total Crude Oil Production 1984-2005



World Petroleum Consumption excluding China and US 1984-2005



Iran Crude Oil Production Lagged by 5 1984-2005



World, China and US Gross Domestic Product 1984-2005

riod	PRICE	CPIR	CPOPC	CPNOPC	GDPW	GDPCN	GDPUS
01-Apr-1983	29.44	2,012	12,486	35,516	12,092.007	300.378	3,536.675
01-May-1983	29.72	2,313	13,870	35,481	12,092.007	300.378	3,536.675
01-Jun-1983	30.33	2,514	13,750	35,610	12,092.007	300.378	3,536.675
01-Jul-1983	31.20	2,816	15,094	35,697	12,092.007	300.378	3,536.675
01-Aug-1983	31.53	2,514	15,185	35,705	12,092.007	300.378	3,536.675
01-Sep-1983	30.36	2,716	15,465	35,927	12,092.007	300.378	3,536.675
01-Oct-1983	29.92	2,414	15,496	35,887	12,092.007	300.378	3,536.675
01-Nov-1983	28.95	2,313	15,561	36,241	12,092.007	300.378	3,536.675
01-Dec-1983	28.38	2,313	15,194	35,903	12,092.007	300.378	3,536.675
01-Jan-1984	29.18	2,200	14,563	36,703	12,482.706	309.089	3,933.175
01-Feb-1984	29.63	2,300	14,694	36,923	12,482.706	309.089	3,933.175
01-Mar-1984	30.42	2,400	14,665	36,374	12,482.706	309.089	3,933.175
01-Apr-1984	30.26	2,200	14,741	36,697	12,482.706	309.089	3,933.175
01-May-1984	30.16	1,700	14,543	37,014	12,482.706	309.089	3,933.175
01-Jun-1984	29.25	2,200	15,363	36,971	12,482.706	309.089	3,933.175
01-Jul-1984	27.60	2,400	14,133	37,281	12,482.706	309.089	3,933.175
01-Aug-1984	28.13	1,800	13,453	36,783	12,482.706	309.089	3,933.175
01-Sep-1984	28.88	1,900	13,494	37,101	12,482.706	309.089	3,933.175
01-Oct-1984	27.54	2,100	13,456	37,450	12,482.706	309.089	3,933.175
01-Nov-1984	27.16	2,400	12,928	37,595	12,482.706	309.089	3,933.175
01-Dec-1984	26.33	2,500	12,719	37,664	12,482.706	309.089	3,933.175
01-Jan-1985	25.18	1,942	12,506	37,274	12,888.104	305.259	4,220.250
01-Feb-1985	26.44	2,147	13,469	37,576	12,888.104	305.259	4,220.250
01-Mar-1985	27.20	2,249	13,349	37,863	12,888.104	305.259	4,220.250
01-Apr-1985	27.63	2,351	12,643	37,871	12,888.104	305.259	4,220.250
01-May-1985	27.10	2,045	11,560	37,893	12,888.104	305.259	4,220.250
01-Jun-1985	26.75	2,249	10,590	37,130	12,888.104	305.259	4,220.250
01-Jul-1985	26.68	2,249	11,096	37,573	12,888.104	305.259	4,220.250
01-Aug-1985	27.19	2,453	10,945	37,433	12,888.104	305.259	4,220.250
01-Sep-1985	27.64	2,249	12,106	38,156	12,888.104	305.259	4,220.250
01-Oct-1985	28.66	2,351	13,523	38,271	12,888.104	305.259	4,220.250
01-Nov-1985	29.75	2,249	13,939	38,385	12,888.104	305.259	4,220.250
01-Dec-1985	25.23	2,453	14,321	38,164	12,888.104	305.259	4,220.250
01-Jan-1986	18.83	2,275	13,445	38,183	15,214.945	295.477	4,462.825
01-Feb-1986	13.26	2,166	13,764	37,983	15,214.945	295.477	4,462.825
01-Mar-1986	10.42	1,950	13,639	37,827	15,214.945	295.477	4,462.825
01-Apr-1986	11.27	2,166	14,165	37,339	15,214.945	295.477	4,462.825
01-May-1986	13.81	2,275	14,302	38,062	15,214.945	295.477	4,462.825
01-Jun-1986	12.56	2,275	15,449	37,596	15,214.945	295.477	4,462.825
01-Jul-1986	10.77	2,220	16,185	38,052	15,214.945	295.477	4,462.825
01-Aug-1986	11.55	1,841	17,284	37,985	15,214.945	295.477	4,462.825
01-Sep-1986	13.97	1,625	13,638	37,819	15,214.945	295.477	4,462.825
01-Oct-1986	13.73	1,625	13,922	37,891	15,214.945	295.477	4,462.825
01-Nov-1986	14.71	1,841	14,376	38,344	15,214.945	295.477	4,462.825
01-Dec-1986	15.00	2,166	14,329	38,331	15,214.945	295.477	4,462.825
01-Jan-1987	17.95	2,463	13,203	38,271	17,450.108	321.391	4,739.475
01-Feb-1987	16.40	2,368	12,784	38,069	17,450.108	321.391	4,739.475
01-Mar-1987	16.39	2,368	12,219	37,863	17,450.108	321.391	4,739.475
01-Apr-1987	17.98	2,179	12,850	37,894	17,450.108	321.391	4,739.475
01-May-1987	18.83	2,463	13,347	37,917	17,450.108	321.391	4,739.475
01-Jun-1987	19.40	2,368	13,856	37,104	17,450.108	321.391	4,739.475

01-Jul-1987	20.48	2,368	15,551	38,021	17,450.108	321.391	4,739.475
01-Aug-1987	18.60	2,558	16,045	37,884	17,450.108	321.391	4,739.475
01-Sep-1987	18.94	1,989	15,417	38,374	17,450.108	321.391	4,739.475
01-Oct-1987	19.44	2,273	15,032	38,470	17,450.108	321.391	4,739.475
01-Nov-1987	18.40	2,084	14,636	38,543	17,450.108	321.391	4,739.475
01-Dec-1987	15.16	2,084	14,603	38,600	17,450.108	321.391	4,739.475
01-Jan-1988	16.59	2,082	13,693	38,741	19,523.342	401.072	5,103.750
01-Feb-1988	15.78	1,983	13,734	38,828	19,523.342	401.072	5,103.750
01-Mar-1988	15.37	2,082	13,856	38,918	19,523.342	401.072	5,103.750
01-Apr-1988	16.79	2,181	14,262	38,724	19,523.342	401.072	5,103.750
01-May-1988	17.14	2,181	14,304	38,449	19,523.342	401.072	5,103.750
01-Jun-1988	15.16	2,082	14,614	37,802	19,523.342	401.072	5,103.750
01-Jul-1988	14.44	2,280	14,607	38,136	19,523.342	401.072	5,103.750
01-Aug-1988	15.03	2,280	15,857	38,042	19,523.342	401.072	5,103.750
01-Sep-1988	13.37	2,380	16,230	37,822	19,523.342	401.072	5,103.750
01-Oct-1988	12.60	2,380	17,483	38,252	19,523.342	401.072	5,103.750
01-Nov-1988	12.98	2,479	17,919	38,176	19,523.342	401.072	5,103.750
01-Dec-1988	15.34	2,479	18,156	38,186	19,523.342	401.072	5,103.750
01-Jan-1989	17.03	2,748	15,115	38,095	20,499.064	449.104	5,484.350
01-Feb-1989	17.11	2,797	14,907	37,775	20,499.064	449.104	5,484.350
01-Mar-1989	18.28	3,141	14,886	37,854	20,499.064	449.104	5,484.350
01-Apr-1989	19.80	2,846	15,709	37,653	20,499.064	449.104	5,484.350
01-May-1989	19.04	2,454	16,201	37,474	20,499.064	449.104	5,484.350
01-Jun-1989	19.26	2,748	16,522	36,947	20,499.064	449.104	5,484.350
01-Jul-1989	17.93	2,748	16,417	37,416	20,499.064	449.104	5,484.350
01-Aug-1989	17.91	2,945	16,554	37,820	20,499.064	449.104	5,484.350
01-Sep-1989	18.85	2,797	16,886	37,822	20,499.064	449.104	5,484.350
01-Oct-1989	19.38	2,896	17,079	37,997	20,499.064	449.104	5,484.350
01-Nov-1989	19.25	2,748	17,981	38,055	20,499.064	449.104	5,484.350
01-Dec-1989	20.25	2,846	18,033	37,496	20,499.064	449.104	5,484.350
01-Jan-1990	21.59	2,700	17,393	37,855	22,679.874	387.772	5,803.075
01-Feb-1990	21.42	3,000	17,781	37,425	22,679.874	387.772	5,803.075
01-Mar-1990	19.28	3,000	18,090	38,019	22,679.874	387.772	5,803.075
01-Apr-1990	16.96	2,900	18,133	37,749	22,679.874	387.772	5,803.075
01-May-1990	17.40	3,200	17,460	37,402	22,679.874	387.772	5,803.075
01-Jun-1990	15.30	3,100	17,209	36,823	22,679.874	387.772	5,803.075
01-Jul-1990	16.47	3,050	17,336	36,647	22,679.874	387.772	5,803.075
01-Aug-1990	21.54	3,300	15,982	36,643	22,679.874	387.772	5,803.075
01-Sep-1990	29.12	3,300	18,702	36,978	22,679.874	387.772	5,803.075
01-Oct-1990	28.38	3,000	19,068	37,303	22,679.874	387.772	5,803.075
01-Nov-1990	28.85	3,200	19,648	37,366	22,679.874	387.772	5,803.075
01-Dec-1990	25.35	3,300	20,021	37,105	22,679.874	387.772	5,803.075
01-Jan-1991	19.25	3,179	19,579	37,600	23,877.067	406.090	5,995.925
01-Feb-1991	17.91	3,278	19,654	37,372	23,877.067	406.090	5,995.925
01-Mar-1991	18.99	3,378	19,430	37,751	23,877.067	406.090	5,995.925
01-Apr-1991	19.29	3,278	18,785	36,893	23,877.067	406.090	5,995.925
01-May-1991	20.74	3,278	18,590	36,758	23,877.067	406.090	5,995.925
01-Jun-1991	19.67	3,278	19,361	36,179	23,877.067	406.090	5,995.925
01-Jul-1991	20.67	3,378	19,824	36,558	23,877.067	406.090	5,995.925
01-Aug-1991	21.27	3,378	19,844	35,842	23,877.067	406.090	5,995.925
01-Sep-1991	21.33	3,278	19,877	36,947	23,877.067	406.090	5,995.925
01-Oct-1991	22.22	3,278	20,049	36,729	23,877.067	406.090	5,995.925

01-Nov-1991	21.02	3,278	20,349	36,675	23,877.067	406.090	5,995.925
01-Dec-1991	18.50	3,477	20,546	36,688	23,877.067	406.090	5,995.925
01-Jan-1992	17.86	3,500	20,865	36,833	24,050.120	483.047	6,337.750
01-Feb-1992	18.12	3,500	20,670	36,188	24,050.120	483.047	6,337.750
01-Mar-1992	18.34	3,350	20,070	36,273	24,050.120	483.047	6,337.750
01-Apr-1992	19.80	3,250	20,200	36,600	24,050.120	483.047	6,337.750
01-May-1992	20.12	3,250	20,260	35,403	24,050.120	483.047	6,337.750
01-Jun-1992	21.60	3,250	20,415	35,490	24,050.120	483.047	6,337.750
01-Jul-1992	21.28	3,300	20,605	35,713	24,050.120	483.047	6,337.750
01-Aug-1992	20.91	3,450	20,800	35,352	24,050.120	483.047	6,337.750
01-Sep-1992	21.64	3,450	21,045	35,368	24,050.120	483.047	6,337.750
01-Oct-1992	20.62	3,650	21,285	35,726	24,050.120	483.047	6,337.750
01-Nov-1992	19.89	3,650	21,370	35,349	24,050.120	483.047	6,337.750
01-Dec-1992	18.84	3,550	21,645	35,492	24,050.120	483.047	6,337.750
01-Jan-1993	18.33	3,650	21,746	35,113	24,594.117	601.083	6,657.400
01-Feb-1993	19.33	3,750	21,750	35,369	24,594.117	601.083	6,657.400
01-Mar-1993	19.52	3,700	21,133	35,312	24,594.117	601.083	6,657.400
01-Apr-1993	19.84	3,500	20,758	35,175	24,594.117	601.083	6,657.400
01-May-1993	19.15	3,650	20,837	35,138	24,594.117	601.083	6,657.400
01-Jun-1993	18.42	3,650	20,999	34,690	24,594.117	601.083	6,657.400
01-Jul-1993	17.09	3,800	21,256	34,894	24,594.117	601.083	6,657.400
01-Aug-1993	17.27	3,500	21,536	34,731	24,594.117	601.083	6,657.400
01-Sep-1993	16.76	3,650	21,456	34,648	24,594.117	601.083	6,657.400
01-Oct-1993	16.92	3,700	21,326	35,192	24,594.117	601.083	6,657.400
01-Nov-1993	15.31	3,550	21,166	35,552	24,594.117	601.083	6,657.400
01-Dec-1993	13.91	3,700	21,356	35,611	24,594.117	601.083	6,657.400
01-Jan-1994	14.33	3,618	21,356	35,439	26,418.660	542.534	7,072.225
01-Feb-1994	13.93	3,568	21,361	35,304	26,418.660	542.534	7,072.225
01-Mar-1994	14.08	3,668	21,318	35,156	26,418.660	542.534	7,072.225
01-Apr-1994	15.57	3,518	21,262	34,890	26,418.660	542.534	7,072.225
01-May-1994	16.86	3,568	21,331	35,215	26,418.660	542.534	7,072.225
01-Jun-1994	17.75	3,668	21,350	35,412	26,418.660	542.534	7,072.225
01-Jul-1994	19.12	3,568	21,315	35,148	26,418.660	542.534	7,072.225
01-Aug-1994	16.87	3,618	21,006	35,298	26,418.660	542.534	7,072.225
01-Sep-1994	16.70	3,668	21,396	35,467	26,418.660	542.534	7,072.225
01-Oct-1994	16.97	3,618	21,457	35,953	26,418.660	542.534	7,072.225
01-Nov-1994	17.37	3,717	21,428	36,058	26,418.660	542.534	7,072.225
01-Dec-1994	16.73	3,618	21,501	36,405	26,418.660	542.534	7,072.225
01-Jan-1995	17.37	3,585	21,483	36,105	29,302.774	700.219	7,397.650
01-Feb-1995	18.24	3,685	21,564	36,446	29,302.774	700.219	7,397.650
01-Mar-1995	17.91	3,485	21,376	36,091	29,302.774	700.219	7,397.650
01-Apr-1995	19.03	3,635	21,722	36,393	29,302.774	700.219	7,397.650
01-May-1995	18.69	3,835	22,030	35,888	29,302.774	700.219	7,397.650
01-Jun-1995	17.40	3,585	21,614	35,693	29,302.774	700.219	7,397.650
01-Jul-1995	16.79	3,535	21,983	36,332	29,302.774	700.219	7,397.650
01-Aug-1995	17.47	3,685	22,066	36,218	29,302.774	700.219	7,397.650
01-Sep-1995	17.25	3,635	21,922	36,813	29,302.774	700.219	7,397.650
01-Oct-1995	16.87	3,735	22,070	36,228	29,302.774	700.219	7,397.650
01-Nov-1995	17.65	3,635	21,850	36,748	29,302.774	700.219	7,397.650
01-Dec-1995	18.43	3,685	21,904	37,032	29,302.774	700.219	7,397.650
01-Jan-1996	17.45	3,735	21,910	36,927	30,008.819	816.410	7,816.825
01-Feb-1996	17.54	3,685	22,052	37,234	30,008.819	816.410	7,816.825

01-Mar-1996	19.20	3,715	22,119	36,983	30,008.819	816.410	7,816.825
01-Apr-1996	21.20	3,685	21,922	37,068	30,008.819	816.410	7,816.825
01-May-1996	19.76	3,635	22,034	37,001	30,008.819	816.410	7,816.825
01-Jun-1996	19.72	3,685	22,124	37,186	30,008.819	816.410	7,816.825
01-Jul-1996	20.11	3,685	22,204	37,193	30,008.819	816.410	7,816.825
01-Aug-1996	21.04	3,715	22,191	36,843	30,008.819	816.410	7,816.825
01-Sep-1996	23.19	3,735	22,254	37,226	30,008.819	816.410	7,816.825
01-Oct-1996	23.35	3,635	22,447	37,484	30,008.819	816.410	7,816.825
01-Nov-1996	22.64	3,685	22,414	37,921	30,008.819	816.410	7,816.825
01-Dec-1996	23.38	3,635	22,677	37,944	30,008.819	816.410	7,816.825
01-Jan-1997	23.90	3,685	22,367	37,966	29,875.733	898.240	8,304.325
01-Feb-1997	20.30	3,685	22,586	38,064	29,875.733	898.240	8,304.325
01-Mar-1997	20.11	3,685	22,723	37,857	29,875.733	898.240	8,304.325
01-Apr-1997	19.12	3,685	22,831	38,189	29,875.733	898.240	8,304.325
01-May-1997	19.60	3,635	22,604	37,757	29,875.733	898.240	8,304.325
01-Jun-1997	18.53	3,735	22,819	37,367	29,875.733	898.240	8,304.325
01-Jul-1997	18.99	3,685	22,874	37,812	29,875.733	898.240	8,304.325
01-Aug-1997	19.26	3,685	23,109	37,561	29,875.733	898.240	8,304.325
01-Sep-1997	19.27	3,485	23,073	37,935	29,875.733	898.240	8,304.325
01-Oct-1997	20.46	3,635	23,164	38,327	29,875.733	898.240	8,304.325
01-Nov-1997	19.15	3,685	23,154	38,369	29,875.733	898.240	8,304.325
01-Dec-1997	17.60	3,685	23,367	38,564	29,875.733	898.240	8,304.325
01-Jan-1998	15.74	3,635	24,061	38,656	29,628.951	946.318	8,746.975
01-Feb-1998	15.31	3,635	24,086	38,554	29,628.951	946.318	8,746.975
01-Mar-1998	13.21	3,635	23,948	38,449	29,628.951	946.318	8,746.975
01-Apr-1998	15.09	3,835	23,505	38,396	29,628.951	946.318	8,746.975
01-May-1998	12.96	3,635	23,377	37,921	29,628.951	946.318	8,746.975
01-Jun-1998	11.56	3,835	22,957	38,199	29,628.951	946.318	8,746.975
01-Jul-1998	13.34	3,585	22,637	38,204	29,628.951	946.318	8,746.975
01-Aug-1998	12.71	3,435	22,307	37,469	29,628.951	946.318	8,746.975
01-Sep-1998	13.67	3,685	22,137	37,490	29,628.951	946.318	8,746.975
01-Oct-1998	13.35	3,485	22,207	37,741	29,628.951	946.318	8,746.975
01-Nov-1998	11.22	3,635	22,377	38,316	29,628.951	946.318	8,746.975
01-Dec-1998	10.72	3,585	22,362	38,407	29,628.951	946.318	8,746.975
01-Jan-1999	11.81	3,665	22,162	38,521	30,726.944	991.362	9,268.425
01-Feb-1999	11.37	3,925	22,262	38,342	30,726.944	991.362	9,268.425
01-Mar-1999	12.24	3,795	22,444	38,192	30,726.944	991.362	9,268.425
01-Apr-1999	15.83	3,485	21,293	37,986	30,726.944	991.362	9,268.425
01-May-1999	16.84	3,435	21,224	37,863	30,726.944	991.362	9,268.425
01-Jun-1999	16.34	3,415	21,035	37,371	30,726.944	991.362	9,268.425
01-Jul-1999	19.37	3,515	21,044	38,339	30,726.944	991.362	9,268.425
01-Aug-1999	20.30	3,535	21,194	38,001	30,726.944	991.362	9,268.425
01-Sep-1999	21.49	3,485	21,269	38,018	30,726.944	991.362	9,268.425
01-Oct-1999	20.90	3,535	21,449	38,487	30,726.944	991.362	9,268.425
01-Nov-1999	22.39	3,485	21,429	39,009	30,726.944	991.362	9,268.425
01-Dec-1999	25.00	3,435	21,403	39,079	30,726.944	991.362	9,268.425
01-Jan-2000	24.22	3,444	21,713	38,890	31,546.106	1,080.744	9,816.975
01-Feb-2000	27.55	3,504	21,916	38,877	31,546.106	1,080.744	9,816.975
01-Mar-2000	26.45	3,712	22,021	38,974	31,546.106	1,080.744	9,816.975
01-Apr-2000	23.85	3,653	22,599	38,682	31,546.106	1,080.744	9,816.975
01-May-2000	25.87	3,663	22,760	38,617	31,546.106	1,080.744	9,816.975
01-Jun-2000	29.70	3,683	22,841	38,796	31,546.106	1,080.744	9,816.975

01-Jul-2000	27.43	3,727	23,127	39,137	31,546.106	1,080.744	9,816.975
01-Aug-2000	27.79	3,727	23,618	38,984	31,546.106	1,080.744	9,816.975
01-Sep-2000	30.34	3,732	23,727	39,027	31,546.106	1,080.744	9,816.975
01-Oct-2000	30.53	3,812	23,792	39,196	31,546.106	1,080.744	9,816.975
01-Nov-2000	32.54	3,807	23,942	39,787	31,546.106	1,080.744	9,816.975
01-Dec-2000	25.77	3,881	23,905	39,949	31,546.106	1,080.744	9,816.975
01-Jan-2001	27.21	3,935	23,739	39,497	31,309.580	1,175.722	10,127.950
01-Feb-2001	27.39	3,785	23,013	39,443	31,309.580	1,175.722	10,127.950
01-Mar-2001	25.96	3,835	22,949	39,490	31,309.580	1,175.722	10,127.950
01-Apr-2001	25.59	3,785	22,178	39,344	31,309.580	1,175.722	10,127.950
01-May-2001	27.39	3,685	22,075	38,872	31,309.580	1,175.722	10,127.950
01-Jun-2001	25.56	3,785	22,281	38,796	31,309.580	1,175.722	10,127.950
01-Jul-2001	24.70	3,875	22,384	39,535	31,309.580	1,175.722	10,127.950
01-Aug-2001	26.37	3,785	22,242	39,229	31,309.580	1,175.722	10,127.950
01-Sep-2001	21.81	3,655	21,708	39,716	31,309.580	1,175.722	10,127.950
01-Oct-2001	21.18	3,535	21,490	39,705	31,309.580	1,175.722	10,127.950
01-Nov-2001	17.45	3,535	21,450	40,095	31,309.580	1,175.722	10,127.950
01-Dec-2001	18.08	3,491	21,291	40,630	31,309.580	1,175.722	10,127.950
01-Jan-2002	17.97	3,385	20,388	40,357	32,517.308	1,270.669	10,469.600
01-Feb-2002	19.64	3,365	20,145	40,461	32,517.308	1,270.669	10,469.600
01-Mar-2002	22.40	3,385	20,377	40,053	32,517.308	1,270.669	10,469.600
01-Apr-2002	23.47	3,375	20,497	40,672	32,517.308	1,270.669	10,469.600
01-May-2002	24.67	3,395	20,702	40,411	32,517.308	1,270.669	10,469.600
01-Jun-2002	24.12	3,415	20,767	40,518	32,517.308	1,270.669	10,469.600
01-Jul-2002	26.07	3,425	21,032	40,405	32,517.308	1,270.669	10,469.600
01-Aug-2002	26.47	3,440	21,167	40,318	32,517.308	1,270.669	10,469.600
01-Sep-2002	27.79	3,485	21,643	40,063	32,517.308	1,270.669	10,469.600
01-Oct-2002	26.81	3,535	21,775	40,607	32,517.308	1,270.669	10,469.600
01-Nov-2002	25.19	3,535	21,957	40,579	32,517.308	1,270.669	10,469.600
01-Dec-2002	26.71	3,585	20,141	40,746	32,517.308	1,270.669	10,469.600
01-Jan-2003	30.56	3,625	20,569	40,691	36,481.109	1,418.267	10,971.250
01-Feb-2003	32.76	3,699	21,901	40,927	36,481.109	1,418.267	10,971.250
01-Mar-2003	26.91	3,724	23,591	40,867	36,481.109	1,418.267	10,971.250
01-Apr-2003	25.24	3,719	24,026	40,692	36,481.109	1,418.267	10,971.250
01-May-2003	25.67	3,719	23,851	40,633	36,481.109	1,418.267	10,971.250
01-Jun-2003	28.78	3,719	22,909	40,609	36,481.109	1,418.267	10,971.250
01-Jul-2003	29.67	3,749	22,874	41,103	36,481.109	1,418.267	10,971.250
01-Aug-2003	30.70	3,749	22,919	41,036	36,481.109	1,418.267	10,971.250
01-Sep-2003	26.96	3,749	22,919	41,386	36,481.109	1,418.267	10,971.250
01-Oct-2003	28.47	3,749	23,139	41,681	36,481.109	1,418.267	10,971.250
01-Nov-2003	28.75	3,798	23,006	41,876	36,481.109	1,418.267	10,971.250
01-Dec-2003	29.95	3,912	23,396	42,543	36,481.109	1,418.267	10,971.250
01-Jan-2004	32.81	3,950	23,458	42,290	40,894.780	1,653.686	11,734.300
01-Feb-2004	32.48	3,950	23,488	42,323	40,894.780	1,653.686	11,734.300
01-Mar-2004	35.45	3,960	23,183	42,394	40,894.780	1,653.686	11,734.300
01-Apr-2004	34.27	3,970	23,028	42,345	40,894.780	1,653.686	11,734.300
01-May-2004	38.21	3,980	23,233	42,234	40,894.780	1,653.686	11,734.300
01-Jun-2004	35.66	3,990	24,618	42,688	40,894.780	1,653.686	11,734.300
01-Jul-2004	38.39	4,010	24,718	42,633	40,894.780	1,653.686	11,734.300
01-Aug-2004	42.12	4,030	24,698	41,900	40,894.780	1,653.686	11,734.300
01-Sep-2004	42.77	4,030	24,698	42,043	40,894.780	1,653.686	11,734.300
01-Oct-2004	49.91	4,035	24,800	42,549	40,894.780	1,653.686	11,734.300

01-Nov-2004	46.11	4,050	24,770	42,715	40,894.780	1,653.686	11,734.300
01-Dec-2004	40.71	4,060	24,785	42,095	40,894.780	1,653.686	11,734.300
01-Jan-2005	42.12	4,060	24,800	42,197	43,886.037	1,909.659	12,452.417
01-Feb-2005	45.28	4,080	24,895	42,510	43,886.037	1,909.659	12,452.417
01-Mar-2005	51.68	4,080	25,078	42,773	43,886.037	1,909.659	12,452.417
01-Apr-2005	49.72	4,090	25,177	42,785	43,886.037	1,909.659	12,452.417
01-May-2005	46.80	4,100	25,044	42,864	43,886.037	1,909.659	12,452.417
01-Jun-2005	52.54	4,210	25,076	42,474	43,886.037	1,909.659	12,452.417
01-Jul-2005	56.72	4,220	25,180	42,216	43,886.037	1,909.659	12,452.417
01-Aug-2005	60.86	4,230	25,160	42,452	43,886.037	1,909.659	12,452.417
01-Sep-2005	63.00	4,190	25,343	41,684	43,886.037	1,909.659	12,452.417
01-Oct-2005	59.76	#NULL!	#NULL!	#NULL!	43,886.037	1,909.659	12,452.417
01-Nov-2005	56.14	#NULL!	#NULL!	#NULL!	43,886.037	1,909.659	12,452.417
01-Dec-2005	57.34	#NULL!	#NULL!	#NULL!	43,886.037	1,909.659	12,452.417

APPENDIX C : Software Development Visual Basic Coding

```
Private Sub cmdExit_Click()
' Stop the program
  End
End Sub

Private Sub cmdBack_Click()
' Move to the front form
  frmCrudePrice.Hide
  frmGraph.Show
End Sub

Private Sub cmdReady_Click()

' Declaring input variables
  Dim sngCOPIR As String
  Dim sngCOPOPEC As String
  Dim sngGDPW As String
  Dim sngGDPCN As String
  Dim sngGDPUS As String
  Dim sngYear1 As String
  Dim sngMonth1 As String

' Declaring output variables
  Dim sngSmoothing As String
  Dim sngEquation As String
  Dim sngYear2 As String
  Dim sngMonth2 As String

' Putting year and months into variables

  sngYear1 = txtYear1.Text
  sngMonth1 = txtMonth1.Text

' Declaring array variables
  Dim aryModel() As String
  Dim row As Integer, col As Integer
  ReDim aryModel(1 To 60, 1 To 8) As String

' The inputs must be within range if not error message is shown
  If (txtYear1 <= 2006) Then
  If (intYear1 >= 2010) Then
  If (txtMonth1 <= 1) Then
  If (txtMonth1 >= 12) Then
    Beep
```

```
    intResponse = MsgBox("Year value must be between 2006 and 2010 and Month
value must be between 1 and 12", vbOKOnly + vbDefaultButton1)
      Call Clear
      Exit Sub
    End If
    End If
    End If
    End If

'Place input values into vb variables
    sngYear1 = txtYear1.Text
    sngMonth1 = txtMonth1.Text

' Load array with values

   row = 1
   col = 1
    Open "F:\june05vb.TXT" For Input As #1
    'type here how many rows columns give to variable names
    For row = 1 To 60
      For col = 1 To 8
      Input #1, aryModel(row, col)
    Next col
    Next row
    Close #1

' Take variables from text file if not input by user

   sngCOPIR = txtCOPIR.Text
   If txtCOPIR.Text = "" Then
   For row = 1 To 60
     If UCase(aryModel(row, 1)) = UCase(sngYear1) And UCase(aryModel(row, 2)) =
UCase(sngMonth1) Then
     sngCOPIR = aryModel(row, 3)
     End If
   Next row
   End If

   sngCOPOPEC = txtCOPOPEC.Text
If txtCOPOPEC.Text = "" Then
   For row = 1 To 60
   If UCase(aryModel(row, 1)) = UCase(sngYear1) And UCase(aryModel(row, 2)) =
UCase(sngMonth1) Then
   sngCOPOPEC = aryModel(row, 4)
   End If
   Next row
```

```
  End If

  sngGDPW = txtGDPW.Text
If txtGDPW.Text = "" Then
  For row = 1 To 60
  If UCase(aryModel(row, 1)) = UCase(sngYear1) And UCase(aryModel(row, 2)) =
UCase(sngMonth1) Then
  sngGDPW = aryModel(row, 5)
  End If
  Next row
  End If

sngGDPCN = txtGDPCN.Text
If txtGDPCN.Text = "" Then
  For row = 1 To 60
  If UCase(aryModel(row, 1)) = UCase(sngYear1) And UCase(aryModel(row, 2)) =
UCase(sngMonth1) Then
  sngGDPCN = aryModel(row, 6)
  End If
  Next row
    End If

sngGDPUS = txtGDPUS.Text
If txtGDPUS.Text = "" Then
  For row = 1 To 60
  If UCase(aryModel(row, 1)) = UCase(sngYear1) And UCase(aryModel(row, 2)) =
UCase(sngMonth1) Then
  sngGDPUS = aryModel(row, 7)
  End If
  Next row
    End If

For row = 1 To 60
  If UCase(aryModel(row, 1)) = UCase(sngYear1) And UCase(aryModel(row, 2)) =
UCase(sngMonth1) Then
  sngSmoothing = aryModel(row, 8)
  End If
  Next row


' Compute Final Crude Oil Price

    sngEquation = 39.859 + sngCOPIR * 0.005 - sngCOPOPEC * 0.001 + sngGDPW *
0.001 + sngGDPCN * 0.059 - sngGDPUS * 0.01

 ' Display results in appropriate labels
```

```
  lblEquation.Caption = sngEquation
  lblSmoothing.Caption = sngSmoothing
  lblYear2.Caption = sngYear1
  lblMonth2.Caption = sngMonth1




End Sub

'Private Sub Form_Load()
  ' Clear all the values in the display labels
  ' Call Clear
'End Sub

'Public Sub Calculation(intHours As Integer, sngModuleCurrent As Single,
sngTemperatureModuleVoltage As Single, intEnergyDemand As Integer,
intBatteryVoltage As Integer, sngBatterySeries As Single)

  ' Calculates the required information using global variables as well
  'sngDesignCurrent = intEnergyDemand / (0.03 * 24 * intSunHours)
  'sngArrayParallel = sngDesignCurrent / sngModuleCurrent
  'sngArraySeries = (intBatteryVoltage * sngBatterySeries * 1.2) /
sngTemperatureModuleVoltage
  'sngArrayTotal = sngArrayParallel * sngArraySeries


  ' Display results in appropriate labels
  'lblDesignCurrent.Caption = sngDesignCurrent
  'lblArrayParallel.Caption = sngArrayParallel
  'lblArraySeries.Caption = sngArraySeries
  'lblArrayTotal.Caption = sngArrayTotal



Public Sub Clear()
 ' Clear all the values in the display labels
  lblSmoothing.Caption = ""
  lblEquation.Caption = ""
  lblYear2.Caption = ""
  lblMonth2.Caption = ""
End Sub
```

```
Private Sub Label12_Click()

End Sub

Private Sub cmdCOP_Click()
'Display Crude Oil Production Graph
   imgPrices.Visible = False
   imgGDP.Visible = False
   imgCOP.Visible = True
   imgWPC.Visible = False
   imgReserves.Visible = False
End Sub

Private Sub cmdExit_Click()
' Stop the program
   End
End Sub

Private Sub cmdBack_Click()
' Move to the other form
   frmGraph.Hide
   frmCrudePrice.Show
End Sub


Private Sub cmdGDP_Click()
'Display Gross Domestic Product Graph
   imgPrices.Visible = False
   imgGDP.Visible = True
   imgCOP.Visible = False
   imgWPC.Visible = False
   imgReserves.Visible = False
End Sub

Private Sub cmdPrices_Click()
'Display Crude Oil Prices Graph
   imgPrices.Visible = True
   imgGDP.Visible = False
   imgCOP.Visible = False
   imgWPC.Visible = False
   imgReserves.Visible = False
End Sub

Private Sub cmdReserves_Click()
'Display World Reserves Graph
   imgPrices.Visible = False
```

```
    imgGDP.Visible = False
    imgCOP.Visible = False
    imgWPC.Visible = False
    imgReserves.Visible = True
End Sub

Private Sub cmdWPC_Click()
    imgPrices.Visible = False
    imgGDP.Visible = False
    imgCOP.Visible = False
    imgWPC.Visible = True
    imgReserves.Visible = False
End Sub
```