EMPIRICAL ECONOMIC BULLETIN

Determinants of Gasoline Price:

Can Consumer Spending Make a Difference?

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Abstract:

This paper investigates the determinants to gasoline prices in the United States. The regression contains five different independent variables: the price of imported oil per barrel, the number of barrels of oil imported to the United States, the number of barrels of oil produced domestically in United States, the commodity price of oil, the number of automobiles purchased monthly in the United States, and the dependent variable, Gasoline Price. By using these variables in a linear regression model, the results show that the price of gasoline is primarily driven by the price of imported crude oil, followed shortly thereafter by the domestic oil produced.

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1.0 Introduction

Each month, millions of cars are sold nationwide to eager new owners looking for an easier method to get to and from where they need to go. Unfortunately, what most people don't realize is that the price of a vehicle only starts after it has been purchased. Today, gasoline prices are soaring to record highs and becoming one of the major concerns to consider when purchasing a vehicle. But what exactly is the cause for the price increases? In this regression, five different independent variables will be included to see what exactly is the cause of recent gasoline price increases. Gasoline Price will be used as the independent variable while Imported Oil Price, the number of barrels ordered per month, the commodity price of oil, the number of barrels produced domestically per month, and the number of auto sales per month will be dependent variables.   This study hopes to examine these variables to see the effects and importance that each one has on the overall price of gasoline in the United States.

With the current trends continuing and no end seeming to be in sight, the price of gasoline is a very real concern for a country that is highly dependent on foreign oil. This topic is incredibly important to our economy, because if we can discover the main cause behind gasoline price, efforts can be made so that we can stabilize, or even decrease the price of gasoline so money can be spent elsewhere to further boost the economy.

This paper differs from others that have been observed, in that this contains the inclusion of the number of automobiles purchased monthly in the OLS regression with the variables pertaining to oil. It seems common sense that the increase of automobile sales will increase gasoline prices as the demand for more fuel becomes present. However, is this truly the main

cause for the increase in prices? McManus (2007) believes that the increase in gasoline prices may not be correlated with the number of automobiles sold. He states that since September 11th automobile sales have decreased (on average compared to previous trends), while the price of gasoline and oil has steadily increased. This paper will answer not only, which of the five variables run in the OLS regression is the most significant factor, but it will also show which variables have positive or negative impacts upon gasoline price, and to what degree they affect gasoline price.
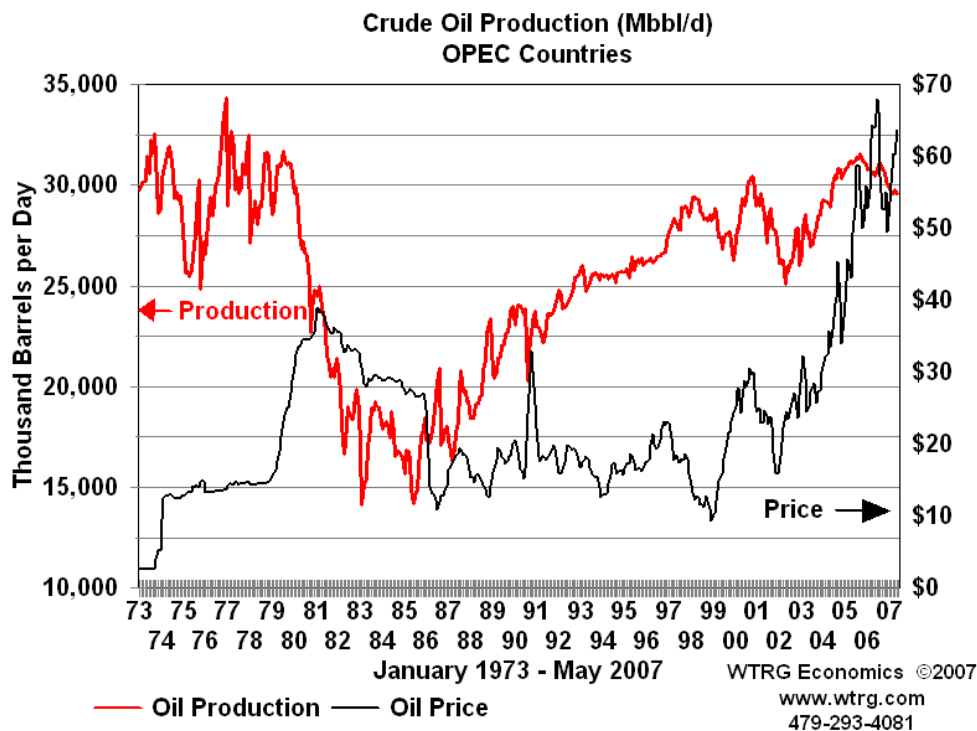
2.0 Trends

The current trends that are emerging in the oil markets have been an increase in production amount and price almost every year. Most of these increases are due in large part to economic shocks such as war, embargos, and governmental regulations. In order to obtain the true determinants of price for gasoline, four years prior and after September 11, 2001 have been chosen so that the impact of the actual event can be spread over a greater period of time when the averages are computed.

The following graph contains data showing the Price of Crude Oil to the United States from the years 1947-2007.

Crude Oil Prices
2006 Dollars
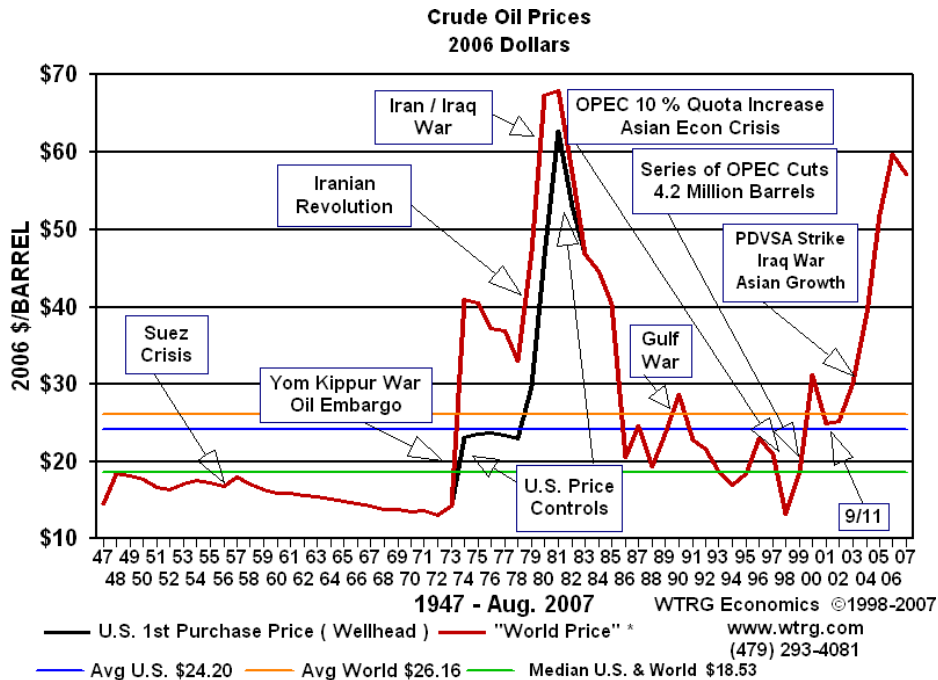
As evidenced by the graph, the most important factor that has been determining the price of Crude Oil has been shocks to the economy caused by war or forms of embargo. The biggest spike was caused by the Iran/Iraq war which placed large strains on all OPEC countries to produce and export oil. Likewise, after September 11th oil prices once again soared and continue to increase today.

The next chart shows the amount of crude oil production by OPEC countries, who together export the largest amount of crude oil.

Crude Oil Production (Mbbl/d)
OPEC Countries

January 1973 - May 2007

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Oil Production —— Oil Price

The price of crude oil has steadily increased over the past 34 years regardless of the fact that production levels are constantly changing. This price has obviously been transferred to the consumers who have seen gas prices steadily and incrementally rise every month for years.

3.0 Literature Review

Each month it seems that the price of gasoline continues to increase no matter what we seem to do (buy hybrids, protest gas sales etc). Lee and Zyren (2007) say that the traditional price theory in economics, which determines an equilibrium price by balancing supply and demand, may not fully explain the current price behavior of crude oil and petroleum products. This is important because if the traditional theory of supply and demand does not hold for crude oil prices, what exactly determines the equilibrium price? Abosedra and Radchenko (2006) find that gasoline prices tend to increase quicker when crude price increases, than they decrease when crude price decreases. If this is

truly the case, then can we blame outside oil companies and countries who sell the oil we so desperately need? As a corollary to this, Lewis (2004) found that there is little or no empirical evidence identifying the market characteristics responsible for changes in gas price. Borenstein, Cameron, and Gilbert (1997) find asymmetric passthrough from crude to retail oil prices in the U.S. and they attribute the asymmetry partly to retailer market power and tacit collusion. It is their opinion that the price of crude oil has more to do with the collusion between oil tycoons rather than the actual marketplace. Borenstein, Cameron, and Gilbert (1997) also hold that wholesale gasoline prices respond about as equally quickly to decreases as to increases in spot prices (the commodity price) for generic gasoline. McManus (2007) holds that the price of gasoline may not impacted by the sale of automobiles. Due to this, the variable of Automobiles sold per month was added to the regression to test this hypothesis. Based upon the opinions of these authors and some of the conflictions in their opinions, the variables of imported oil price, the number of barrels imported, commodity price, domestic oil produced, and the number of automobiles sold were run in an OLS regression, in order to determine which of these variables does in fact have the greatest effects on gasoline price.

4.0 Data and Empirical Methodology

4.1 Definition of Variables

$$PRICE = \beta_0 + \beta_1\, IMPOILPRI_i + \beta_2\, NUMBARIMP_i + \beta_3\, COMPRI_i + \beta_4\, DOMOILPRI_i + \beta_5\, AUTOSALE_i$$

The dependent variable, *PRICE,* represents the price for a single gallon of gasoline based on the United States national average based on monthly data in cents. The independent variables which affect the price include the following: *IMPOILPRI* is the price per barrel of

imported oil. The independent variables, *NUMBARIMP* and *DOMOILPRI*, signify the number of barrels ordered per month for imported and the latter correspond to domestic orders. The next variable, *COMPRI* stands for the Commodity Price of Oil in the Stock Market. To statistically symbolize the number of auto sales the next variable is labeled *AUTOSALE*.   To maintain accurate data for the ordinary least square (OLS) regression model, the data for the five independent variables will be collected by monthly, national averages. All of the variables are expected to have a positive sign, as it is believed that each variable does have a positive impact on the final price of gasoline.

4.2 Data

This study uses data that was collected on month by month nationwide average for the years 1996-2006. The data for the variables of Average monthly Gasoline Price (*PRICE)*, Domestic Oil (*DOMOILPRI*), the Commodity Spot Price of Oil (*COMPRI)*, and the Imported Crude Oil (*NUMBARIMP*) all come from information listed on the Energy Information Administration (EIA) website. The information containing the number of automobiles sold in the years 1996-2006 monthly was taken from the Wards Automotive Group's yearly journals depicting all information regarding auto sales around the world.

Predictions: It is the belief of this author that the most important factors which determine gasoline price are the imported oil price, and the number of barrels imported. Since the United States relies almost entirely on imported oil, the belief that the price of this imported oil would be the largest determinant seems to be well founded.

The statistics created from this information are contained in the tables below:

(Table 1)
Regression Analysis Data

	Coefficient	Std. Error	t-Statistic	Prob.	Expected Sign
COMPRI	0.90404	0.964087	1.006552	0.3173	+
DOMOILPRI	0.000246	0.000119	2.06194*	0.0425	+
IMPOILPRI	1.873107	0.810884	2.309958*	0.0235	+
NUMBARIMP	0.000102	5.910005	1.719535*	0.0895	+
AUTOSALE	1.0005	6.540006	1.535018	0.1288	+
C	2.942649	25.8583	0.113799	0.9097	+

Table 1 shows us the Coefficients, Std. Errors, t-Statistics, Probability, and Expected Signs that were found for each variable tested in the OLS regression. The asterisk's next to each t-Statistic denote variables that were shown to be significant in obtaining the price associated with a single gallon of gasoline. As expected, each variable did in fact have a positive sign associated with it.

(Table 2)
Regression Analysis Advanced Output

R-Squared	0.83008		Mean dependent var	158.8478
Adj R-Squared	0.819188		S.D. dependent var	19.08307
S.E. of Regression	8.114508		Akaike info criterion	7.093933
Sum Squared resid	5135.928		Schwartz criterion	7.267563
Log Likelihood	-291.945		Hannan-Quinn criterion	7.163731
F-Statistic	76.2079		Durbin-Watson Statistic	1.01127

Table 2 contains the information retrieved during the regression such as the R-Squared value, the F-Statistic, and the Durbin-Watson Statistic.

For the complete Output listing from E-Views, please refer to Appendix A.

5.0 Empirical Methodology

As we can see from the data presented in table 1, the greatest determinant to gasoline price in the United States is the price per barrel of oil that is imported. Since we are in fact a country that depends almost entirely on oil produced in other places in the world, other oil producing countries seem to have the biggest amount of control when it comes to determining our gas prices at the pump. Due to the evidence procured in the Trends section, the supply shocks of war and governmental regulations also play a large role in determining the final price of crude oil. Limiting these events, will most likely cause the equilibrium price of oil to stabilize at a moderate rate. Also, since the data proves that the amount of domestically produced oil is only a fraction compared to what is imported, this is not an unbelievable result for the imported oil price to contribute more to the price of gasoline than the domestic price. The second most important variable to gasoline price is the price of domestic oil produced. This result was different than what was perceived earlier in the regression, as the amount of oil produced domestically was not believed to be large enough to have a large effect on the price of gasoline. If we can find a way to increase the use of domestic sources of oil, the price of gasoline will surely decrease in response to the decreased dependence on foreign sources. By opening up United States oil reserves the price of gasoline would greatly decrease as the abundance of US reserves is more than enough to create gasoline for at least the next decade. The third most significant value is the number of

barrels of oil that were imported. This directly correlates with the price of imported oil, as the increase in price will cause the amount imported to fluctuate. The other variables such as the number of automobiles sold was not truly significant and this proves what was said by McManus (2007). This regression found an opposite reaction to what was held true by Borenstein, Cameron, and Gilbert (1997). In this regression the spot price does not truly have a significant effect on the price we see at the pump.

6.0 Conclusion

In this paper, data was collected from 1996-2006 in order to determine which of the five independent variables have the greatest impact on gasoline price. Through these results we can see that the price of imported oil is truly the greatest determinant of gasoline price. Due to the fact that the United States as a nation relies so heavily on imported oil, fluctuations to the price per barrel that we import will have the greatest effect on changing prices at the pump. In order to bring down or stabilize the price of gasoline, the United States must concentrate on either reducing our dependence on foreign oil, or finding a way in which we can lessen the cost to import crude oil. The sale of automobiles were found to be relatively insignificant, therefore current trends may continue without much of an impact, other than the personal cost of how often one must actually fill up their automobile. Similarly, the commodity spot price of crude oil does not have a significant impact on the final price of gasoline at the pump, which means that constant fluctuations in the stock market can be relatively harmless in the short run. Domestic Oil Prices were also found to be significant, which shows that if we can find a way in which to decrease our dependence on foreign oil and increase our use of domestic oil, then the price will surely fluctuate.

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