The Impact of the Price of Oil On the Stock and Bond Markets During the Crisis In the Persian Gulf

An Honors Thesis (HONRS 499)

by

Gordon D. Burgin

Thesis Director

Ball State University

Muncie, Indiana

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ABSTRACT

This study addressed the impact of the oil price on several stock and bond indices during the Persian Gulf Crisis. Daily data were used in standard regression techniques to determine the impact of the oil price. It was found that the oil price had a tremendous negative impact on the S&P 500, the Dow Jones Industrial Average, and the Dow Jones Transportation Average, while the price of oil had little explanatory power concerning bond prices.
I. Introduction

At a time when the United States economy appeared headed for a recession, the stock market moved off of its record high of the summer of 1990. Helping the markets in the downward move was Saddam Hussein, who ordered his Iraqi army to invade neighboring Kuwait on August 2, 1990. The day prior to the invasion the Dow Jones Industrial Average closed at 2899.26, almost exactly one hundred points off of the record high recorded in late July. During the next several months the Dow Jones Industrial Average, and many other indices, were taken on a roller-coaster ride. The cause of this volatility was the price of crude oil.

The price of oil has been proven to be a major factor in inflation. Throop (1991) has shown that oil price can affect inflation both directly and indirectly. These effects can lead to a wage-price spiral which could be devastating to the economy. The direct effect is the immediate mark-up on final goods and services due to higher oil prices, while the indirect effect is caused by the expectations of higher inflation in the future by workers. This expectation leads to the demand of higher wages to compensate for the higher prices of goods. Ely and Robinson (1991) have shown that inflation can have an impact on the stock markets through what is known as the "tax effect." The tax effect is caused by the U.S. tax code, and its depreciation allowance. During inflationary times, the depreciation write off becomes inadequate due to the rising replacement costs of goods because the depreciation base is valued at historical cost. The FIFO method of inventory valuation
also is detrimental during periods of inflation. When inventory is valued using FIFO, the replacement cost is understated. Both of the factors cause an increased tax burden on the corporation. Due to the increased taxes, the after-tax profit is obviously lower, which leads to lower dividends and subsequently to lower stock prices. Kling(1985) and Rathinasamy(1990) have both contended that the stock market anticipates changes in oil prices. Rathinasamy concluded that the stock market anticipated future oil prices two periods in advance. However, during the crisis in the Middle East and the actual war in Iraq and Kuwait, the markets appeared to be incorporate the prices of oil on the very day of the price change. The markets were overly driven by the oil price. According to the article "Stock Market Is Dancing to Oil's Tune" in the September 17, 1990 issue of the Wall Street Journal, oil became "the latest obsession of stock investors, who love to seize upon an economic indicator...to point the direction they should run in." This tendency for investors to focus on only one economic variable can lead to high volatility, especially when that variable is given a daily price, such as oil. Clearly, the price of oil can be very detrimental to the markets. The problem is, however, that the markets were overly moved by a panicked market in oil. The price of oil did not accurately reflect supply and demand. Immediately pre-invasion of Kuwait, the United States had an oil glut of 386.7 million barrels(Donnelly, 1990). Saudi Arabia and other OPEC countries had increased their output to make up for the lost production of both Iraq and Kuwait. On top of that, the
United States government stood ready to use the Strategic Petroleum Reserves, which contains 590 million barrels of oil (Tanner and Sullivan, 1991). At the beginning of the crisis, many analysts were predicting a price of around $23.25 per barrel at the end of 1990 (Donnelly, 1990). The actual closing price on the final day of 1990 was $28.35, and had previously closed at a high price of $40.40 on two occasions. Clearly the oil market was in a panic. This panic spilled over into almost all of the other markets. It is no coincidence that the lowest point in the crisis for the Dow Jones Industrial Average, the Dow Jones Transportation Index, and the S&P 500 all occurred on the day of the highest oil prices of the crisis, October 11, 1990.

Most of the above has focused on the stock markets, but the bond markets can also be affected by the price of oil. The higher than expected inflation due to the higher price of oil can effectively eat into the realized yields of bond investors. It could also work in the opposite way. If the price of oil were to go lower, the lower than expected inflation would give the bond investor a better than expected yield.

This report will look at the daily closes of the Dow Jones Industrials, the S&P 500, the Dow Jones Transports and the daily closes of both oil spot and futures prices to determine the effect that the oil prices had on the stock markets. The daily Lehman Brothers Long T-Bond Index, the Merrill Lynch Corporate Bond Index, and the 10+ year Treasury yield will be examined to determine the effects of the oil price on the bond markets.
II. REVIEW OF LITERATURE

1. "The Costs of Anticipated Inflation"

This article looks at the costs of anticipated inflation. People know of the costs of unanticipated inflation, but they feel that if inflation is anticipated, then there is no cost to the economy. However, this article points out that there indeed are costs associated with fully anticipated inflation.

If nominal rates adjust for inflation so that real rates stay the same, there should be no cost to the economy. However, there are some factors that cause anticipated inflation to affect the economy. The first of these is the effect of taxes. The problem with the tax code is the base for depreciation. Depreciation is based on the historical cost of the capital rather than the current replacement cost. During times of rising prices, the depreciation base is not raised. This causes the effective tax rate for the businesses to be higher.

The tax code also causes firms to shy away from investing in inventory during inflationary periods. The FIFO method of inventory valuation causes firms to have to pay a capital gains tax due to the fact that the goods are sold at the inflation boosted prices, rather than the old, low price. LIFO accounting takes care of the tax problem, but is more complex and reduces pre-tax profits.
Inflation causes a liquidity constraint among households. The nominal interest rate rises much higher than the household income during inflationary periods. Households can't borrow against future income increases, so it is harder for them to get loans. When it is tougher to get loans, less is spent on housing and consumer durables. Therefore, the relationship between nominal interest rates and residential investment is an inverse one. Businesses are more affected by the real rate of interest than the nominal rate.

According to the Fisher Effect, the nominal inflation rate should rise by more than the anticipated rate of inflation. However, in a simulation of the U.S. economy, the rate doesn't rise enough to offset the above mentioned costs of higher effective tax rates and the liquidity constraint placed on households. For every percentage point that inflation is raised, nominal interest rates rose by only $\frac{7}{10}$ths of a percent. The simulation suggests that a rise in expected inflation reduces real after tax interest rates. Businesses will gain relative to households, because they are more responsive to real interest rates than to nominal rates.

A large drop occurs in household investments in consumer durables and houses. Even though real rates dropped in the simulation, the higher nominal rates caused a 10% decrease in durables and a 7.5% drop in residential investment.

Business investments fell, even though real interest rates fell. This is because of the higher effective rate of taxation brought about by the fixed depreciation base of historical cost.
There is also more foreign investment due to the decreased U.S. interest rate. However, this isn't enough to offset the decline in domestic investment. The rate of savings in the economy falls. More money is spent on consumption, such as non-durables and services.

2. "Oil Prices and Inflation"

According to Throop(1991), the change in the price of oil has 2 effects on overall prices: the direct effect and the indirect effect. The direct effect is when the rise in prices forces manufacturers to pass the higher price to consumers in a mark-up of final goods and services. The effect will not be permanent unless the Federal Reserve issues more money. The higher oil price will slow down the economy, but if the Fed issues more money stock, the effect can permanently raise the price level.

The indirect effect involves the expectations of future inflation. Workers will demand higher wages to compensate for higher future prices. Because of this, wages tend to increase at the rate of inflation plus the expected rate of growth in labor productivity. The higher expected inflation rate will, through this manner, be passed on the consumers in the form of higher prices. When there is a competitive pressure for workers, wages will go up faster. Real inflation will then be higher. Workers will then raise their demands because of higher expected inflation, which will lead to even higher wages. This can lead to a wage-price spiral.
The indirect effect that a rise in the price of oil will have is based on how it is viewed by labor market participants. If they view it as a one-time shock, then it will have no effect on wages. However, if they view it as a permanent increase, then they will revise their wage demands, which will lead to wage inflation and price inflation. If they feel that the Fed will accommodate the higher prices by issuing more money than a wage-price spiral could occur.

The market has been able to distinguish well between shocks and permanent increases. Less of the effect is passed on to future expectations because the markets are increasingly aware that the effects don't have to be permanent. Also, the Fed has been committed to keeping prices stable.

The response of wage inflation to shocks such as the current one tend to be small and die out quickly. And the wage response is less of an influence now than it used to be. Therefore, the current oil price shock is not likely to set off a significant wage-price spiral.

3. "Oil Price Shocks and Stock Market Behavior"

Although crude oil prices are informative to the future course of real economic activity, the stock market may not have known this prior to 1973.

The objective of this article is to conduct a thorough empirical analysis of the relationships between crude oil prices and the stock market for the period 1973-1982 using an aggregate
measure of the stock market and measures of stock price behavior for several industries.

There are 2 possible relationships between crude oil prices and stock prices. The stock market could anticipate future changes in crude oil prices and thus are informative with respect to future crude oil prices, or stock prices reflect all information in past crude prices and adjust contemporaneously to the innovation in crude oil prices. If current stock prices do not reflect the informativeness of crude oil prices, then you could say that stock prices do not adjust contemporaneously, but rather with a lagged effect.

There are two hypotheses:

1. Stock prices were not informative with regard to oil prices.

2. Crude prices were not informative of stock prices.

In other words, one variable could not have been used to predict the other.

The author used a vector autoregressive time series analysis and innovation accounting to interpret the data.

Results show that hypothesis one is reflected with respect to the auto industry, capital goods industry and domestic oil industry. Current stock prices anticipated future crude oil prices.

Evidence strongly suggests that current and past crude prices contained no information relevant in predicting future stock prices for the aggregate market. However for certain industries, such as
air transport, automobile and domestic oil stocks, there was information contained in current and past crude prices that would be useful in predicting future values.

The conclusion is that the stock market did anticipate crude oil price changes after 1972. There was a lagged effect on stock prices of air transport, automobile, and domestic oil industries.


According to Ely and Robinson (1991) equities don't hold their value during inflationary periods, which puzzles many in the financial markets. Since stocks are claims on real assets, they should hold up against inflation, but they don't. During the '70's, the movement in stock prices didn't keep up with general price levels. The two main arguments as to why they don't hold their value are the tax effect and the proxy effect.

The tax effect hypothesis says that the adverse effects are caused by inflation's effects on after tax earnings of firm's, and inflation's effects on individual portfolio selection. The first detriment is the fact that the tax code allows depreciation on historic cost rather than replacement value. When prices rise, the depreciation allowance is not large enough, and real tax liabilities increase. Inflation, therefore, leads to a reduction in real after-tax profits, and a consequent reduction in real dividends and stock prices. Also, if inventory is valued using FIFO, then rising prices causes the cost of replacement to be understated. These two factors lead to lower profits, dividends,
and stock prices. There is a benefit, in that nominal interest rates are higher and firms are allowed to deduct interest payments.

Net tax burden is the benefit of interest deduction and the penalty caused by historic depreciation measures. According to a simulation, at a low inflation rate the loss outweighs the gains. It is estimated that beyond the 7-9% inflation rate, inflation reduces corporate tax burden.

Individuals also have an effect during inflationary times. Because of the reduced profitability of holding corporate stocks and bonds, they may decide to move into other investments. This raises the real cost of raising capital for a firm due to the fact that it will be harder to find investors to commit their money. This will also raise the discount rate that investors use to value securities. Therefore, individual portfolio selection during inflationary times will further push down stock prices.

If inflation is unanticipated, there is another benefit from the decline in the firm's outstanding debt. Inflation reduces the real value of the firm's liabilities. The tax effect, however, cannot be empirically supported.

The proxy effect hypothesis states that expected future output growth and inflation are inversely correlated and inflation is merely proxying for expected output or earnings growth in tests of the relationship between stock returns and inflation. The relationship between inflation and stock prices is spurious.

There are 3 proposed linkages between expected future output growth and current inflation. The first of these is linkage
through monetary demand. The expected lower future growth leads to lower money demand and higher inflation. The lowering of stock values results from lower expected future output growth and a lower expected future dividend. Therefore, they are not directly related.

The second proposal is linkage through debt monetization. In this proposal, stock returns actually cause inflation. Lower current stock returns cause an increase in current inflation.

The third is linkage through a counter-cyclical policy rather than debt monetization. This is again a spurious relationship, such as the money demand linkage.

There is no empirical evidence that either the tax effect or the proxy effect is any good.


The objective of this paper was to link the price of oil to the stock market.

An increase in oil price leads to greater profits for oil companies, and oil service industries. However, it also leads to higher inflation.

Stock returns are influenced by inflationary expectations. Oil prices generally increase inflationary pressures and increase bond yields.

The paper used standard regression methodology on several variables. These dependent variables were: the S&P 500 Stock index, S&P 500 stock return, while the independent variables were:
Crude Petroleum Producer Price Index, Money Supply($M_t$), Unemployment, and discount rate. These variables were plugged into three different regression equations, with significant negative relationships hypothesized between the S&P indexes and the independent variables listed.

The results indicate that there is a negative effect between oil prices and the stock market. The adverse change in oil prices is anticipated by the stock markets two periods in advance. There is also a contemporaneous effect. Inflation and discount rate also have a negative affect on the stock market.

III. Data and Methodology

Standard linear regression techniques were used to study the impact of the price of oil on the stock and bond markets. Data were collected daily from the Wall Street Journal to be used as variables in the regression models. The data were collected on August 1, 1990, which was one day before the Iraqi invasion of Kuwait, to March 15, 1991, which was approximately two weeks after the war in the gulf ended. This gave a data set of 158 observations. The dependent variables collected include:

1. The S&P 500—a broad based index used to measure stock market levels.

2. The Dow Jones Industrial Average—an index of 30 "blue chip" stocks used as another measure of stock market levels.

3. The Dow Jones Transportation Index—Index of transportation stocks, and industry heavily dependent on oil.
4. The Shearson-Lehman Hutton T-Bond Index—used as a measure of treasury bond price levels.

5. The Merrill Lynch Corporate Bond Index—used as a measure of corporate bond prices.

The independent variables used in the models were:

1. The spot price of oil— the price of oil purchased at the market price of the day.
2. The futures price of oil— the price for May 1991 delivery.
3. 10+ Year Treasury Yield— used to measure yield of long-term Treasury bonds.

Two basic regression models were used. Both had two independent variables. The long-bond yield was used an independent variable in each of the equations. The difference in the two equations was the second independent variable. This was the oil price. The models were run using both the spot and futures prices. One would be as good as the other, since the correlation coefficient between the two is 98.299%. Regressions were done for both, however. The basic regression models are as follows:

\[ Y_1 = a + b_1 \text{SpotOil} + b_2 \text{IntLong}, \text{ and} \]

\[ Y_2 = a + b_1 \text{FutrOil} + b_2 \text{IntLong} \]

Where

- \( Y \)=dependent variable
- \( b_1 \)=regression coefficient for oil price
- \( b_2 \)=regression coefficient for long bond yield
- \( a \)=intercept

Both models were used for each of the 5 dependent variables listed above.
IV. Results and Discussion

The results of the regression models will be given here, in the order of dependent variables as listed above. The results are presented in table 1. This section will be structured in the following manner: the dependent variable for the equation will be given in the major heading after the letter; the subheadings under the major heading will be: (1.) the results for the regression model with the spot price of oil, and (2.) the results for the regression model with the futures price of oil.

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Insert Table One Here

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A. The S&P 500

1. The spot price of oil was the first to be included in the regression model. With the S&P 500 inserted as the dependent variable, and overall F value of 261.83 was achieved, which was significant at one percent (See Appendix). The F value tests to see if at least one of the explanatory variables contributes significant information for the prediction of the dependent variable. The model produces and R-squared of 77.28 percent. This indicates that the model has excellent explanatory power, and a majority of the information needed to predict the S&P 500 value is given in the model. In breaking the model down further, we see that the estimated regression coefficients are 417.206 for the intercept a, -3.1566 for the spot price of oil, and .1486 for long interest. This indicates that for every one percent increase in
the spot price of oil, the S&P 500 will decrease 3.156 percent. The t-test, which tests to see if the variable differs significantly from zero, gives values of 16.53 for the intercept, -15.78 for the spot price of oil, and .04 for the long bond yield. The intercept and the spot price of oil are significant at the one percent level.

2. The next model used the futures price of oil instead of the spot price. The results were very similar to those of the spot price, as one might suspect. The model had an overall F value of 254.76, which was significant at the one percent level. The model had an R-squared of 76.91. These two numbers disclose that the model has excellent explanatory power, also. The regression coefficient estimates for the intercept, futures oil price and long yield were 439.484, -4.857, and 1.085, respectively. This indicates that for every one percent increase in the futures price of oil, the S&P 500 would decrease 4.857 percent. This is a larger decrease than from the spot price of oil, which seems to make sense. The futures price is more stable since it is a contract for delivery at a later date. The t-test for the three variables are 17.66, -15.43, and .31. The intercept and futures price of oil were significant at the one percent level.

B. The Dow Jones Industrial Average

1. The next model will focus on the effect of the spot price of oil on the Dow Jones Industrial Average. This model had an overall F value of 243.58, which was significant at one percent.
The R-squared was 75.98 percent, which indicates that this model, too, had excellent explanatory power. The regression coefficients are 2758.614 for the intercept, -26.040 for the spot oil price, and 70.096 for long interest. The t-test for the variables are 14.33, -17.06, and 2.75 for the respective variables. All three were significant at the one percent level.

2. The futures price of oil was then inserted as the second independent variable. This model produced an overall F value of 221.25, which was significant at one percent. The R-squared was 74.31 percent. Hence, this model also has excellent explanatory power. The intercept, futures price, and long interest had regression coefficient estimates of 2979.406, -39.377, and 71.568, respectively. The t-test produced results of 15.32, -16.01, and 2.64, respectively. Once again, all three are significant at the one percent level.

C. Dow Jones Transportation Average

1. The focus now shifts to the Dow Jones Transportation Average. With the spot price of oil inserted into the model and the Dow Jones Transportation average as the dependent variable, the model had an overall F value of 282.87, which was significant at one percent. The R-squared was very high: 78.60 percent. Therefore, this model had very high explanatory power. 1235.161, -15.986, and 18.383 were the regression coefficients for the intercept, spot oil price, and long bond yield, respectively.
These had a t-test of 10.54, -17.20, and 1.18. The intercept and spot oil price are significant at one percent.

2. The futures price of oil produced excellent results, also. The model had an overall F value of 351.95, which was significant at one percent. The model had a very high R-squared of 82.15 percent. This is due to the fact that airlines are heavily dependent on fuel products. During the fourth quarter of 1990, airlines spent over $4.4 billion dollars on fuel. Clearly, the industry depends a great deal on oil prices, and it is reflected here. The estimates of regression coefficients for the intercept, future oil price, and long bond yield are 1293.199, -25.784 and 32.816, respectively. The t-tests for these variables were 12.35, -19.47, and 2.25. The intercept and future oil prices are significant at one percent and the long interest rate was significant at five percent.

D. Treasury Bond Price Index

1. The model for the T-bond index with the spot oil price included as an independent had very little explanatory power. The overall F value was 1.99 and the R-squared was 2.52 percent. It is clear that the spot price of oil had very little effect on the price of Treasury bonds. The spot price of oil was significant at the ten percent level, although no other variables were significant.

2. The futures oil model also had very little explanatory power. The overall F value was 1.88 and R-squared was 2.40
percent. The t-value of futures oil was 1.86, which was significant at ten percent.

**E. Corporate Bond Price Index**

1. The model with the corporate bond index also had very little explanatory power. The overall F value of 1.10 and R-squared of 1.40 percent show this point. None of the variables had t-values which were significant.

2. The futures model, on the other hand, had an overall F value of 799.25 and an R-squared of 91.27 percent. This model appears to have excellent explanatory power. The F value is significant at the one percent level. The estimates of regression coefficients are 742.358669 for the intercept, -.8088841 for the futures price of oil, and -28.7049245 for the interest on the long bond. All of these variables were significant at one percent.

**IV. Summary and Conclusions**

This study addressed the impact of the price of oil on the stock market during the Gulf Crisis and War. Using daily data collected from August 1, 1990 to March 15, 1991, and applying regression techniques, it was found that the price of oil had a significant negative impact on the S&P 500, Dow Jones Industrial Average, and the Dow Jones Transportation Average. The price of oil had little effect on the bond price indices, except for the
futures price of oil, which had a tremendous amount of explanatory power concerning corporate bond prices.

The price of oil had a tremendous effect on the stock markets during the Gulf crisis. Oil was the dominant factor in moving the markets, as witnessed by the high R-squared values for the regression models high overall F values. By doing this study, there is conclusive evidence that the price of oil had a great impact on the stock markets during the Crisis in the Persian Gulf.
Table 1

1. S&P 500

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Overall F</th>
<th>R²</th>
<th>Regression Coefficient</th>
<th>T-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot Oil Price (157)</td>
<td>261.83*</td>
<td>0.7728</td>
<td>-3.157</td>
<td>-15.78*</td>
</tr>
<tr>
<td>Futures Oil Price (156)</td>
<td>254.76*</td>
<td>0.7691</td>
<td>-4.857</td>
<td>-15.43*</td>
</tr>
</tbody>
</table>

2. Dow Jones Industrial Average

| Spot Oil Price (157)           | 243.58*   | 0.7598 | -26.041                | -17.06* |
| Futures Oil Price (156)        | 221.25*   | 0.7431 | -39.377                | -16.01* |

3. Dow Jones Transportation Average

| Spot Oil Price (157)           | 282.87*   | 0.7860 | -15.986                | -17.20* |
| Futures Oil Price (156)        | 351.95*   | 0.8215 | -25.784                | -19.47* |

4. Treasury Bond Price Index

| Spot Oil Price (157)           | 1.99      | 0.0252 | 37513.032              | 1.92** |
| Futures Oil Price (156)        | 1.88      | 0.0240 | 56786.605              | 1.86** |

5. Corporate Bond Price Index

| Spot Oil Price (157)           | 1.10      | 0.0140 | -1693.783              | -1.22   |
| Futures Oil Price (156)        | 799.25    | 0.9126 | -.8089                 | -6.69   |

*Significant at 1%
**Significant at 10%

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