Basic Report

Investment Strategy for Oil Stocks

1. Introduction

Although profit-oriented oil exploration only began about 100 years ago, what is known as "black gold" has attained great economic importance and now forms the most important primary energy source in many countries. Therefore, countries with oil reserves can as a rule operate a significant oil industry which, in turn, is usually reflected by an important share of this sector in the respective country's stock market index. In the case of the USA, the share of the energy corporations, i.e., oil, gas and oil service corporations totals around 12% of the S+P 500. Since the American stock market is the global number one in capitalization terms and, at the same time, possesses a major oil industry, this market represents an interesting study for investors. Let us envisage a portfolio manager who aims to "outperform" the S+P 500 average. If he utilizes the now widely used "top down approach", then at this stage of the decision-making process he is faced with the question of whether he should underweight or overweight oil stocks, i.e., the sector is to be weighted less or more than its share of the index. In concrete terms, he will overweight (or underweight) a segment if he expects it to outperform (or underperform) the market. By the term "outperform" we mean an above-average price development relative to an index.

In this study, we investigate the most suitable environment for oil stocks to outperform the market. Theoretically, the stocks of a sector should do so when their profits rise more strongly than those of the total stock market. Since the profits of the oil corporations – at least according to current opinion – depend on the oil price, we shall firstly examine this connection. Here it will be shown that the oil price can only be said to form a certain part of the profits, so that we cannot satisfactorily link oil price changes to earnings fluctuations and, in turn, to stock price fluctuations. In order to bypass this problem, we shall then examine the dependence of the oil stocks' performance on both the stock market and the oil price. By means of these results, it will then be possible to define phases of anticipated outperformance or underperformance. We shall simplify the actual selection of stocks by means of a brief investigation of oil stocks in relation to the sensitivity of the oil price. Finally, we will deal with the question of whether oil stocks act as a hedge against inflation.

2. The influence of the oil price on profits

In the investigation of the connection between the oil price and earnings, the first step is to select actual corporations. Since the most important subdivision of energy corporations consists of integrated oil companies, we shall limit ourselves to these. Integrated oil companies are simultaneously active in exploration and production, marketing and refining as well as in petrochemicals. As a result, they are characterized by stronger earnings stability. A further restriction is that we concentrate on integrated American oil corporations because these are subject to the strictest disclosure requirements. Moreover, the inclusion of non-American enterprises would raise comparison problems owing to the differing accounting principles from country to country.

Integrated oil companies not only specialize in the exploration and production business, which is directly dependent on the oil price, but also operate in the refinery and petrochemicals sector, where their margin development often runs counter to the above business segments. In concrete terms, one often observes a decline in margins in the refinery and petrochemicals sector amid rising oil prices, since higher oil prices, for example, cannot always be entirely passed on to consumers over the short term. In other words, the positive effect of rising oil prices on the exploration and production sector is at least partially offset by falling margins in the other two sectors. In order to investigate this connection, we shall examine an universe of 8 integrated American oil corporations[1] and consider their performance in terms of operating profits[2] between 1980 and 1990[3]. Not only the period but also the corporations re-

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viewed were subject to the restricted availability of the adjusted quarterly figures. In Fig. 1, we contrasted the operating results of our universe[4] of 8 American corporations in relation to the oil price trend. This chart shows both curves running parallel from 1985 onwards in contrast to the period 1982–1985, when operating results and the oil price ran contrary to each other, i.e., despite an oil price downtrend, operating results rose strongly. This can mainly be attributed to the projections of analysts at the start of the 1980s, who assumed that the oil price would fluctuate around $ 40, as a result of which the corporations began to lift "expensive" oil. Major oil corporations own countless oilfields with varying finding and production costs or, in other words, both "cheap" and "expensive" oil.

Fig. 2 compares the finding costs[5] with the oil price: until 1982 the finding costs rose gradually to $ 20 while the oil price depreciated. In 1982, the oil price forecasts were therefore revised downwards, bringing the expensive exploration program to a standstill, with the result that profits raced upwards despite the decelerating oil price. Corporations that did not recognize the need for this step were soon threatened by hostile takeovers. Seasoned investors such as T. Boone Pickens saw the possibility of takeover financing by forcing down expenses, e.g., by reducing these unprofitable exploration costs.

Investors are interested in the mathematical connection between high oil prices and profits, since – under the assumption of a constant P/E ratio – the stock price should rise to the same extent as earnings. We shall utilize a regression analysis[6] to trace this connection by investigating the statistical changes in earnings in relation to the oil price. Our investigations show that not only the present oil price but also the average oil price of the preceding quarter form a determining factor as far as earnings are concerned. In concrete terms, we obtain the sensitivity factors of 0.18 for the oil price change in the previous quarter and 0.32 for the oil price change in the current quarter. Therefore, if – for instance – the oil price rises by another 15% after an increase of 10% in the preceding quarter, an expected operating profit rise of (0.18 x 0.15) + (0.32 x 0.10) = 0.059 or 5.9% shall result. The explanation content[7] of this equation is unsatisfactory, although the relatively loose connection between the oil price and profits, which has already been graphically established, is confirmed. In fact, using this equation, which studies the oil price change as the sole factor, we can explain "only" 34% of the earnings change. This means that the profits of the oil corporations still depend on other factors. Specifically, these are volumes and costs involved.

We have thus shown that current opinion, whereby the operating profit of the oil corporations depends on the oil price, is fundamentally right, but it must not be forgotten that other factors have an influence on profits too. Consequently, it makes little sense to calculate the change in operating profits based on the expected change in the oil price and then to estimate the expected change in the stock-price[8]. In order to project future performance we must therefore utilize another method.

3. The factors influencing the performance of oil stocks

One possibility is the the so-called market model, which connects the yield of a security in a linear relationship to a stock market index. The market model can be illustrated as follows:

Yield of the stock = alpha + (beta x market return) + e

alpha = share of return independent of stock market performance

beta = average return depending on the stock market performance or systematic risk. Also corresponds to sensitivity in terms of the stock market index.

e = error term or residuum

In other words, using this model the price development of a stock or stock segment is solely determined by the overall stock market performance. We now utilize this model for our oil index which is known to consist of 8 American integrated oil corporations. Since the price data, in contrast to profits, are published more frequently than each quarter, we shall apply the monthly data to the period from January 1976 to May 1991. The market model for our 8 corporations is presented as follows:

Price change of oil stocks = 0.0017 + (0.82 x change of S+P 500)[9].

Fig. 1: Oil Price and Profits

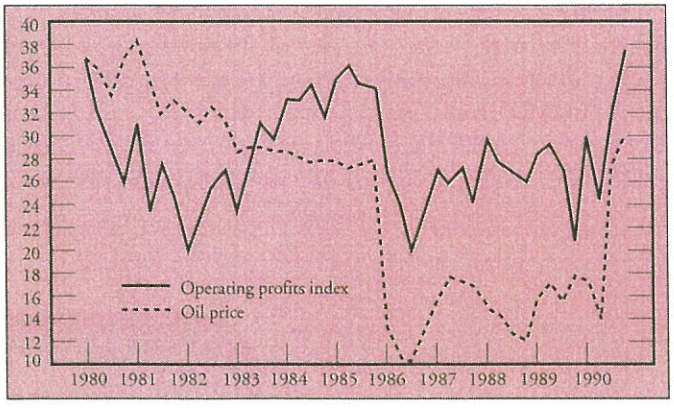
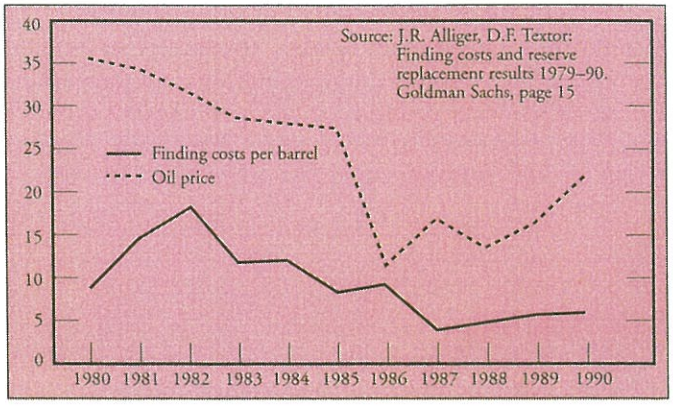


Fig. 2: Finding Costs and the Oil Price



If we look at the individual factors rather more closely, the 0.0017 or alpha means, in principle, that oil stocks – even without the S+P 500 advancing – climb by 0.17% on a monthly average, which is an attractive feature. Unfortunately, however, this value cannot be confirmed as statistically significant. The figure 0.82 corresponds to beta which in our case amounts to less than 1 (= stock market), which is why oil stocks are often described as defensive securities in practice: if the stock market drops by 10%, then only a price decline averaging 8.2% would be expected for oil stocks.

Unfortunately, however, the explanation content of this model is relatively small with 37%, i.e., we can account for only 37% of the price change of our index with this equation. In the previous chapter we have demonstrated that the oil price plays a certain role in influencing earnings. Therefore, it appears advisable that the oil price, as a further determining factor, be included in the former equation.

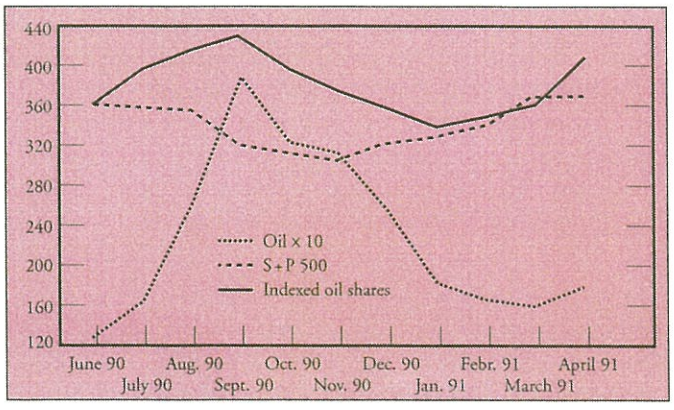
Such a multiple regression analysis[10], which displays the price change in simultaneous dependence on the performance of the total stock market (S+P 500) and the oil price change, leads to the following result:

Price change of oil stocks = 0.00126 + (0.833 × change in S+P 500) + (0.163 × oil price change)[11].

Owing to the inclusion of the oil price change, the explanation content of the model rises from 37% to 47%, which is a major improvement. Since a multiple regression model is utilized here, beta does not have the same importance as in the simpler market model and we shall in future use the term beta* (beta* = beta in the multiple regression model).

This equation indicates the ideal environment for the relative performance of oil stocks: rising oil prices and falling stock market. If, for example, a military conflict results in a 100% appreciation in the oil price and a 20% dip in the stock market, the following expected average performance of oil stocks would result: 0.00126 + (0.833 × [–0.20]) + (0.163 × 1.00) = –0.0024 or –0.24%. In this case, oil stocks could largely detach themselves from the overall market performance. This constellation can appear as follows: the oil price rises unexpectedly and as a result the stock market participants revise their inflation expectations upward and thus require a correspondingly higher yield for fixed-interest securities. The higher level of interest rates presents greater opportunity costs for the stock market, i.e., bonds become more interesting relative to the stock market, resulting in a stock market decline. Therefore, all things being equal, higher oil prices cause an expected stock market decline. The summer of 1990 represents an ideal illustration in this respect. Following the occupation of Kuwait the oil price surged and the U.S. stock market slumped by 20% (although, aside from the oil price increase, there were probably other factors involved). At the same time, oil stocks displayed a good performance by comparison with the total stock market (see Fig. 3).

Fig. 3: Kuwait Crisis



On the basis of this regression, we can make the following conclusions:

1. From 1976 to 1990 oil stocks did not show any significant positive alpha.
2. Oil stocks showed a beta less than 1.
3. Oil stocks react to oil price changes statistically significant positive.

4. Should oil stocks be underweighted or overweighted?

Let us firstly consider the case in which a portfolio is formed and no changes are effected (so-called buy and hold approach). Table 1 shows the annualized monthly return[12] of the S+P 500 and the oil index. It can immediately be seen that oil corporations had better returns than the S+P 500 (10.07% compared with 9.80%) over the whole period from 1976 to 1990, i.e., the portfolio manager was well advised to have overweighted oil stocks. But in practice few investors have a time horizon of more than 4 or 5 years, which is why we divided our comparison into sections. By this it becomes clear that the relative price development was subject to large fluctuations. While the oil stocks displayed a manifestly better performance when compared with the stock market from 1976 to 1981, they could not keep up with it between 1982 and 1988 and only in 1986 did the tide turn in favor of oil stocks. Therefore, it can be seen that timing also plays an important part as far as oil equities are concerned.

One possible way to gauge the right timing is offered by the regression model estimate, as explained in the previous section, although the time span concerned is restricted to the last four years (1987–1990). The reason for the restriction of the period is that we want to consider a time period which, on the one hand, permits enough data and on the other hand diverges as little as possible from the future circumstances. Implicitly we assume that the last four years are relatively similar to the future. In practice the model will be updated monthly and then the last 48 months (= 4 years) are regressed.

The equation is as follows:

Price change of oil stocks = 0.0011 + (0.772 × change in S+P 500) + (0.1738 × change in the oil price)[13]

Table 1: Annualized Monthly Returns

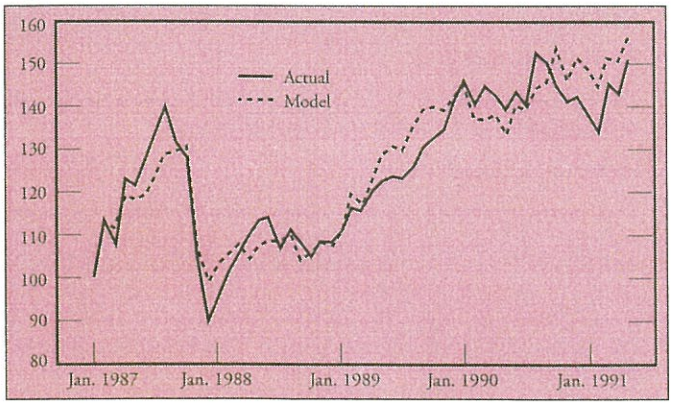
Period	Annualized Return	
	S+P 500	Oil Shares
1976–1991	*9.80*	*10.07*
1976–1979	4.58	16.57
1977–1980	6.11	20.39
1978–1981	6.52	11.91
1979–1982	9.49	8.57
1980–1983	11.12	3.77
1981–1984	5.34	–8.64
1982–1985	14.53	4.59
1983–1986	14.93	9.81
1984–1987	10.59	5.77
1985–1988	13.44	10.07
1986–1989	13.65	14.07
1987–1990	8.04	10.50

This model now explains 65% of the price change of oil stocks.

Fig. 4 shows the actual price trend of oil stocks and the results of our model.

In order to answer the question of underweighting or overweighting, we shall now estimate the input factors: for the S+P 500 we see a capital gains potential of 12% over the next 12 months, while we expect the oil price to decline from US$ 22 to US$ 21 (–4.5%). If these figures are integrated into the above equation, the result will be as follows: 0.0011 + (0.772 × 0.12) + (0.178 × [–0.045]) = 8.6%. If we also take the dividend yield[14] into consideration, the projected stock market gain is calculated at 15.2% compared with 12.7% for oil equities. This corresponds to an expected underperformance of 2.5 percentage points and induces us to underweight the oil sector. Therefore, this model represents a convenient rule for devising an investment strategy with U.S. oil stocks. However, its accuracy mainly depends on the quality of the input factors as well as on the validity of the estimated regression equation in the future.

Fig. 4: Model Precision



5. The statistical sensitivity of individual oil corporations to the oil price

As soon as the question of sectoral weighting is clarified, then stocks have to be selected. Aside from the earnings outlook, the quality of the balance sheet, the management, etc., the sensitivity of the relevant stock related to the oil price represents a possible selection criterion. In order to help investors choose the most suitable corporation or corporations for their requirements, we have examined the oil price sensitivity of our 8 American integrated oil companies in that we regressed the individual stocks to the oil price. Of course, it must not be forgotten that this represents a historical view. Four our period of observation we selected the years 1987 to 1990 and classified the companies in the order of their oil price sensitivity:

Table 2: Oil Price Sensitivity of Integrated U.S. Oil Companies[15]

Stock	Alpha	Beta*	Oil price sensitivity	R^2
Amerada Hess	0.005	0.87	0.28	0.52
Atlantic Richfield	0.008	0.71	0.23	0.51
Chevron	0.002	0.88	0.21	0.52
Mobil	0.000	0.86	0.19	0.66
Amoco	0.004	0.63	0.18	0.58
Texaco	0.005	0.62	0.15	0.25
Exxon	0.002	0.74	0.14	0.61
Occidental Petroleum	–0.014	0.84	0.05	0.43

Table 2 can be interpreted as follows: Amerada Hess rose with an oil price rise of 10% by 28% (oil price sensitivity) the strongest. In second place follows Atlantic Richfield with 23%, etc. The data for Texaco must be treated with caution, for the R^2 (explanation content of the equation) is exceptionally low. This means that other factors had an important influence aside from beta* and the oil price . That this was the case is scarcely surprising, since Texaco was partly undergoing bankruptcy proceedings (Chapter 11) during this period. The low sensitivity of Occidental Petroleum was accounted for by the fact that the corporation has or had important interests in the non-oil sector.

In order to present a larger selection than our 8 integrated U.S. corporations, the oil sensitivies of additional oil and oil service companies[16] may be of interest to investors (see Table 3).

In the case of the above U.S. and foreign integrated corporations, no major surprises materialized bearing in mind, however, that the oil sensitivities of Phillips and Pennzoil are not significant. This can be attributed to the fact that Phillips has strong interest in the chemical business and Pennzoil is heavily active in the refinery business. The oil price sensitivity of the oil service corporations is to our astonishment not higher than that of the "aggressive" in-tegrated corporations. It is also interesting that the ex- planation content of our model is fairly high if it is considered that it deals with individual corporations and not an

Table 3: Oil Price Sensitivity

Stock	Alpha	Beta*	Oil price sensitivity	R^2
U.S. oil corporations (integrated)				
Unocal	0.006	0.97	0.22	0.39
Phillips Petroleum	0.009	1.02	0.14	0.37
Kerr Mc Gee	0.000	0.90	0.13	0.45
Pennzoil	–0.006	0.46	0.08	0.11
Foreign oil corporations (integrated, listed in the USA)				
British Petroleum	0.006	0.76	0.22	0.37
Royal Dutch	0.004	0.64	0.16	0.50
Oil service corporations				
Halliburton	0.001	1.27	0.23	0.60
Schlumberger	0.002	1.09	0.14	0.61
Refineries				
Ashland Oil	–0.004	0.80	0.05	0.38
Sun	–0.006	0.76	0.08	0.34
Exploration companies				
Anadarko Petroleum	0.005	0.60	0.11	0.25
Maxus Energy	–0.02	1.23	0.22	0.41

universe. The oil price sensitivities of the two refinery corporations are not significant, i.e., statistically their prices do not react to oil price changes. From this it follows, moreover, that falling oil prices do not, contrary to often expressed opinions, lead to rising prices for the refinery stocks. Although exploration corporations are most likely to be strongly affected by changing oil prices due to their drilling activities, the oil price sensitivity of the aggressive corporation Maxus Energy amounts to only 22%, while that of Anadarko is not even significant. The main reason for this is probably that American exploration corporations, measured in volume terms, specialize more in gas production and that their stock price performance tends to be influenced by the price of gas as well.

6. Oil stocks: a hedge against inflation?

Many investors are of the opinion that stocks hedge against expected and unexpected inflation because it should be possible for companies to increase selling prices at least in line with the rise in inflation. Thus, profits should increase in nominal terms, with stock prices displaying a parallel rise. But empirical studies[17] prove the contrary, i.e., rising inflation has negative effects on the price performance of stocks. Even if stocks as such do not protect from inflation, it is nevertheless possible that oil stocks as a segment of stocks do, since oil has an influence on inflation and fuels account for about 8% of the American consumer price index (CPI).

This means that rising oil prices have an effect on both the profits of the oil corporations and on accelerating inflation. In order to investigate this question, an attempt to regress[18] the returns of the oil stocks of our integrated corporations to the CPI did not prove any statistically significant connection. This means that oil stocks also do not protect against inflation. In a second stage, we investigated if oil shares act as a hedge against unexpected[19] inflation. Our results show a statistically significant positive connection[20], but the explanation content is low, i.e., oil stocks tend to protect against unexpected inflation, but not strongly.

In summarizing, it can be concluded that oil stocks, just like any other equities, do not hedge against expected inflation but offer – in contrast to equities as a whole – some, albeit poor, protection from unexpected inflation.

7. Conclusions for the investor

Integrated oil corporations and their stocks can be described as defensive investment instruments (beta less than 1), with the price trend depending on the performance of the overall stock market and also on the oil price. The defensive characteristics and the positive link with the oil price or oil price fluctuations would indicate a good performance or even outperformance during market downswings and a parallel upswing in the oil price.

Similar to the stock market as a whole, it is safe to say that oil stocks do not act as a hedge against expected inflation, but – in contrast to the overall market – offer a certain degree of protection against unexpected inflation.

Footnotes

1 The universe consists of the following companies: Amerada Hess, Amoco, Atlantic Richfield, Chevron, Exxon, Mobil, Occidental Petroleum and Texaco.

2 Operating profits can be defined as follows: net sales less costs of goods sold less selling, general and administrative costs. This means that operating profits include exploration costs but exclude depreciation, interest paid or taxes. Consequently, this figure is most suited for the calculation of the oil-price impact, since such specific corporate factors as forms of financing or the tax rate are eliminated.

3 Based on quarterly data.

4 The operating profits in absolute terms of the 8 companies are added together to give a compound earnings index.

5 Implied finding costs.

6 This means regressing the logarithmic rates of change compared with the previous quarter. Quarterly data are employed. "Saudi Arabia Light" is used for the oil price as well as the quarterly average calculated on the basis of month-end prices. As an experiment, we also employed oil futures. But there was no improvement in results and the availability is of shorter duration. This induced us to subsequently use spot prices.

7 Equation: Change in operating profit = 0.00863 + 0.1805 x change in oil price in the current quarter + 0.3206 x change in oil price in the preceding quarter, intercept not significant, while the two sensitivity factors are significant, R^2= 0.34, DW 2.6

8 Implied assumptions: Constant P/E and constant number of outstanding shares (no dilution).

[9] R^2 = 0.37, intercept not significant, S+P 500 significant, DW 1.79.

[10] The overall market is incorporated by the S+P 500, while the oil price is again represented by "Saudi Arabia Light". For the monthly returns we have used the logarithmic rates of change compared with the previous month. As a "surrogate" for the oil stocks, we have calculated the average, equally weighted capital gains return on our "family" consisting of 8 equities, i.e., 0.125 x return on share 1 + 0.125 x return on share 2, etc. Owing to this procedure, all companies – regardless of their absolute price – are weighted equally.

[11] R^2 = 0.47, DW 1.91, intercept section not significant, S+P 500 and oil price change significant, F = 81.83.

[12] Equally weighted index of returns.

[13] R^2 = 0.65, DW 2.12, F = 41.98, except intercept all factors significant.

[14] Estimated 1991 dividend yields on November 6, 1991:
S+P 500 = 3.2%
Oil index = 4.1%.

[15] Alpha not significant for all shares at 5% level. Beta* significant for all shares. Oil-price sensitivity significant for all shares except Occidental Petroleum.

[16] Alpha nowhere significant at 5% level. Beta* significant everywhere. Oil-price sensitivity significant except at Anadarko, Ashland Oil, Phillips, Pennzoil and Sun.

[17] Cp. for instance Fama and Schwert, "Asset Returns and Inflation", Journal of Financial Economics, November 1977.

[18] The equation reads: 0.0038 + (1.3358 x CPI), with both factors not significant. R^2 = 0.013. Time horizon: 1st quarter 1976 until 1st quarter 1991.

[19] Change in unexpected inflation = – change in real interest rate.

[20] Equation: Capital gain on oil shares = 0.041 + (–3.3038 x real interest), all factors significant at 5% level. R^2 = 0.067. Time horizon: 1st quarter 1976 until 1st quarter 1991.

Investment Counselling and Investment Research – A. Scherer, CFA – Tel. 01/235 38 48
Further information will be provided upon request

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