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Pricing Risk, Oil and Financial Factors in Saudi Sector Index Returns

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Abstract: Among all the global and domestic factors including systematic risk considered, oil price has the most positive impact and is priced the most in the returns of all the six Saudi equity sectors. The World Capital Market as represented by MSCI has the least impact on those isolated equity sectors. The beta risk estimates for all these sectors, while controlling for the general market, suggest that that higher risk is compensated by greater returns. In the "up" and "down" markets, the sectors have asymmetric risk exposure, which implies that these sectors (or those who invest in them) inhabit an environment that requires serious hedging during the "down" market.

***JEL classification*:** G15

Keywords: Oil Sensitivity; Sectoral Risk Exposure; Conditional and Unconditional Risk

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1. Introduction

Until recently, The Gulf's Arab stock markets of oil-rich countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE) have been one of the fastest growing equity markets in the world. The total market capitalization of these countries has grown from about US $132 billion at the end of 2000 to US$ 534 billion at the end of 2004. The Saudi stock market is the largest in the region, accounting for 56% of the six Gulf's Arab markets and forming up one third of Arab countries' total stock market[1].

The empirical research on these stock market focuses on the general index of the individual markets and not on the individual sectors. The research has concentrated on three main issues: market efficiency, volatility of index returns and sensitivity to global factors particularly the oil price. Butler and Malaikah (1992), an exception, investigate the efficiency for Kuwaiti and Saudi individual stocks and find them not to be efficient by any measure of efficiency. Hammoudeh & Eleisa (2004) examine the oil sensitivity at the aggregate level for five Gulf markets including Saudi Arabia. They find that on a only the Saudi market has a bi-directional causal or mutual predictive relationship with daily oil price changes. However, they find that the stock returns of the smaller oil exporters Kuwait and Oman have no causal relationships with oil price changes. Malik and Hammoudeh (2003) use a multivariate, two-factor GARCH to investigate the conditional

[1] The Saudi market capitalization reached about $306 billion at the end of 2004, giving rise to a gain of 84.9% after yielding 76.3% in 2003 (Al-Shaikh, 2004). At this level, the Saudi capitalization is greater than that of Argentine, Brazil, Denmark, Finland, Greece, Ireland, Korea, Mexico, Norway, Singapore and Turkey, among many others.

volatility of the Gulf's individual markets to both the oil price and the US three-month Treasury bill interest rate. Islam (2004) uses a univariate GARCH to examine the conditional volatility of market returns in the Oman market.

Stock market aggregation may mute equity index sensitivities to risk and global factors and may hide causal relationships, making stock or sector selections more difficult. Therefore, there is a need to revisit the findings reached at the general index level by examining the responsiveness of sectoral index returns. Based on availability of sectoral data, we are only able to examine six equity sectors' sensitivities to three global factors: oil price, the world capital market and US short-term interest rate, and to the domestic interest rate. These sensitivities can then be compared to sectors' own systematic risk sensitivities. In this case, traders and investors in the Saudi market can make more informed decisions in terms of sector section and switching when significant shocks affect sectoral risk and the domestic and global factors involved The finding should shed some light on whether, for example, the industrial sector is more or less sensitive to changes in the oil price, inertest rate or systematic risk than the service or the banking sector. This study also addresses the issue of which sector(s) perform better during the "up" and "down" markets.

The major finding in this paper is that among all the oil and financial factors, whether domestic or global, the oil price has the most positive impact on all the six sectors' returns, particularly on the returns of Electricity, Industry and Cement which all are energy-intensive sectors. The beta risk estimates for all the sectors, suggest that that higher general market risk is compensated by greater returns. In the "up" and "down" markets, all the sectors have asymmetric risk exposure. Accordingly, an increase in risk

exposure during a "down" market has significantly more negative impact on the sectoral returns than a decrease in this exposure during an "up" market. This finding suggests that these sectors inhabit a market that requires serious hedging to deal with the increase in risk during the "down" market. It may also imply that companies in these sectors face a more competitive environment during the down side and have difficulty passing risk on to their customers. The sector that has the least negative risk exposure is Agriculture because the shares of the companies in this sector are "defensible" stock, whereas Banks have the most negative exposure during the "down" market. The World Capital Market has basically no impact on those sectors which have been segmented from the world markets by protective government regulations.

2. Data Description

The data set covers the weekly period July 9, 1994–October 14, 2004. The Saudi stock market data includes time-series for the Tadawul all-share general index (SAUD, thereafter) and six of its sectoral indexes: Industry, Banks, Service, Electricity, Agriculture and Cement[2]. The global factor data included series for the spot price of West Texas Intermediate (WTI) crude oil, the Morgan Stanley Capital International index, MSCI-World, and the US short-term T-bill rate. To control for the Saudi domestic liquidity, we include the Saudi short-term interest rate. All the variables are expressed in log form, except the two interest rate variables. The data also includes generated time series for the six sectors' systematic risk relative to the Saudi aggregate market. These risk series are the sectoral betas generated relative to the overall stock market by window-

[2] We chose these six sectors because of availability of adequate sectoral index data. We only excluded the communications sector because its newly created index does not have sufficient data.

rolling regressions on a two-month basis, as is the case in the literature, for each of the sectors while controlling for the global factors

The original daily data span the period July 9, 1994–October 14, 2004. Because the US capital and oil markets have Saturday and Sunday as the weekend while Saudi Arabia has Friday as its weekend, and thus the two groups have only four days a week in common, we opted to use weekly data and chose Tuesday as the week day for all the variables because it is in the middle of the trading weeks for both sets of the markets[3].

The general stock index Tadawul is an all-share index which is compromised of shares of all the companies listed on the Saudi market. There were 73 companies listed in this market in 2004, but its capacity exceeds 200 firms[4]. During the past decade, only 13 new companies were listed on this market. The country's major economic powerhouses, like Saudi Arabian Airlines , Saudi Telecom and the National Commercial Bank, with total assets that are over 70 billion dollars, were not yet fully listed in 2004.

The Morgan Stanley Capital International index, MSCI-World (MSCI, thereafter) is one of the three global factors used in this study. The second global factor is the WTI spot price (WTIS) which is the price for contracts delivered at Cushing, Oklahoma centre (Hammoudeh and Li, 2004). The short-term interest rates include the US 3-month Treasury bill rate (USTB), as the third global factor, and the Saudi 3-month interest rate (STB) as a domestic factor.

The data base also includes two dummy variables to account for structural breaks in the sample period: one for the 1997 East Asian financial crisis (D97), and the other for

[3] By choosing a middle of the week trading day, we aimed at avoiding the weekend effect bias. In the United States, the weekly data is usually selected for Wednesday.
[4] Among the listed companies, the Industrial sector has 26 firms, Banking 9, Agriculture 9, Cement 8, Telecommunications 1, Electricity 1, and Service 19 (See Al-Shaikh, 2004).

the change in the OPEC oil price regime in 2000 (D00) from single price-targeting to price band-targeting[5]. The first structural break is dated to when Thailand abandoned its fixed exchange rate on July 2, 1997 (Hammoudeh and Li, 2004). The South Asian stock markets collapsed as a result of this crisis, affecting stock markets in other developing countries. The crisis also caused a drop in the demand for oil, culminating in the collapse of oil prices in 1998. The second structural break dates back to February 1, 2000 which occurred as a result of lifting the oil price from $19 a barrel to the $25 centre of the band. Only D00 which also includes the collapse of the oil price in the aftermath of the Asian crisis was found to be significant[6].

3. Overview of Market Performance

The general market returned an average of 13% annualized on the basis of 52-weeks over the sample period[7]. The industrial sector averaged an annualized return of 18.7% leading all the sectors, followed by the electricity (16.1%) and banks. Cement yielded the lowest return averaging 8.8% annualized. However, the Saudi market and all its sectors generated returns that are significantly higher than the 5.2% yielded by the world market as represented by MSCI. On the other hand, the Saudi market and some of its sectors fell short of the 11.4% rerun yielded by the WTI spot price.

The (unconditional) return volatility as measured by annualized standard deviation is 1.154 for the Saudi market[8], which is between the MSCI volatility of 1.092

[5] For more information on the oil price target zones see Tang and Hammoudeh (2002).
[6] Other structural dummies were tried but found not significant.
[7] This rate of return averaged 33.5% during the period that followed the introduction of the Tadawul trading system in October 2001, the repatriation of Saudi funds from the United States as a result of 9/11 and the drastic increases in oil prices. The table of the descriptive statistics is available upon request.
[8] The Saudi market volatility increased to 1.378 during the period after October 2001. All the individual sectors also experienced an increase in volatility during this recent period.

and the S&P 500 of 1.222. The oil market has higher return volatility than those stock markets, averaging at 2.698 annualized. Interestingly, the Saudi and US T bill rates are significantly more volatile than the oil market because they move more closely with the business cycles.

In terms of the generated systematic risk *level*, the industrial sector has on average the highest risk of 57.72 annualized, while the service sector has the lowest (annualized 5.72). However, in terms of systematic risk volatility, Agriculture has the greatest risk standard deviation followed by Electricity, while the service sector still has the lowest risk volatility. As of higher moments, all the sectors with the exception of Service and Cement are skewed to the right. This means that there is a higher probability for investors to get positive returns from Industry, Electrify and Banking than from Service and Cement (Harvey and Siddique, 1999).

4. Empirical Results

We use the international arbitrage price theory (APT) to investigate the roles of the oil and financial global factors, domestic interest rate and domestic risk on the Saudi sectoral returns. We also wish to test whether or not asymmetric sensitivity is present in the sector return when the Saudi general market is in an up and down patterns

In the international APT model, we estimate sector systematic risks (betas) with respect to the Saudi market (SAUD) while controlling for the sensitivities of the oil, world capital and money markets. The following basic equations capture the individual sector's sensitivities to own beta risk and to the other factors in a general or *aggregated* market:

$$DLYj_t = \beta_{0j} + \gamma_{1j}\,\beta_{1jt} + \gamma_{2j}DLWTIS_t + \gamma_{3j}DLMSCI + \gamma_{4j}STB_{t\,+}\ e_{jt} \quad (1a)$$

$$DLYj_t = \beta_{0j} + \gamma_{1j}\,\beta_{1jt} + \gamma_{2j}DLWTIS_t + \gamma_{3j}DLMSCI + \gamma_{4j}STB_{t\,+}\ \gamma_{5j}USTB_{t\,+}\ e_{jt} \quad (1b)$$

where DLY_j is the weekly return for the sector j's stock index, $DLWTIS_t$ is the weekly oil price return for the WTI oil spot price, $DLMSCI_t$ is the weekly return on the Morgan Stanley Capital Market Index, STB_t is the Saudi 3-month interest rate and $USTB_t$ is the US 3-month T bill rate,[9] where the data for the risk factor *beta* (β_{1j}) is generated through 8-week rolling regression estimation process[10]. In equations (1), β_{1jt} is the jth sector's unconditional systematic risk which is invariant regardless of the direction of change of the Saudi market.

However, the beta risk may exhibit different behaviour depending on whether the general market is up (down) and the market return is positive (negative). Research has demonstrated that the unconditional systematic risk (betas) and returns may not be related empirically due to the bias created by the combination of positive and negative returns. Pettengil et al (1995) suggest that the general market and risk should be segregated. Thus, we examine the relationship between sectoral returns and risk in the both up and down markets for the all the sector while controlling for oil price changes, the World capital market returns and US and domestic interest rates The relationship conditional on the up and down markets for each sector is estimated for the following equations:

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[9] The correlation between: DLWTIS and DLMSCI is -0.048; DLWTIS and STB is 0.019; and DLMSCI and STB is 0.019. Thus, there is no multicollinearity problem in the STB equations that do not include USTB. The correlation is however high between STB and USTB because the Saudi currency is pegged to the US dollar.

[10] The rolling betas were generated from the rolling regressions:

$$DLYj_t = \beta_{0j} + \beta_{1j}DLSAUD_t + \gamma_{1j}DLWTIS_t + \gamma_{2j}DLMSCI + \gamma_{3j}STB_{t\,+}\ e_{jt}$$

This regression was also run for 13 weeks (three months) and the results are basically the same.

$$DLY_j = \gamma_{0j} + \gamma_{6j}*du*\beta_j + \gamma_{7j}*(1-du)*\beta_j + \gamma_{8j}*DLWTIS + \gamma_{9j}*DLMSCI + \gamma_{10j}*STB + e_j \quad (2a)$$

$$DLY_j = \gamma_{0j} + \gamma_{6j}*du*\beta_j + \gamma_{7j}*(1-du)*\beta_j + \gamma_{8j}*DLWTIS + \gamma_{9j}*DLMSCI + \gamma_{10j}*STB + \gamma_{11j}*USTB + e_j \quad (2b)$$

where du =1 if the broad market is up ($DLSAUD > 0$) and $du = 0$ if this market is down (DLSAUD < 0). The expected sign for γ_{6j} is positive and for γ_{7j} is negative. If this is the case, then it means that high-beta sectors outperform low-beta sectors when the broad market return is positive, and similarly the high-beta sectors incur higher losses when the realized broad market return is negative (Tang and Shum, 2003). The Wald test suggests that estimated conditional betas in equations (2) are not symmetric between up and down markets for all the industry/country returns (test results are available upon request). Thus, in the "up" and "down" markets, all the sectors have asymmetric risk exposure. Accordingly, an increase in risk exposure during a "down" market has significantly more negative impact on the sectoral returns than a decrease in this exposure during an "up" market (see Table 1). This finding suggests that these sectors inhabit a market that requires serious hedging to deal with the increase in risk during the "down" market. It may also imply that companies in these sectors face a more competitive environment during the down side and have difficulty passing risk on to their customers. The sector that has the least negative risk exposure is Agriculture because the shares of the companies in this sector are "defensible" stock, whereas Banks have the most negative exposure during the "down" market.

In terms of sensitivity to the oil price, the sectors can be grouped into three categories. The first category includes the sectors that are directly oil-sensitive in the *general* market with ups or downs, namely Banks, Industry, Services and Electricity.

Banks and Services are directly impacted by the liquidity created by higher oil prices. Industry and Electricity are also directly affected by the oil boom, but they are heavy users of petroleum as an input whether as a raw material or as a fuel.

The second category includes the sectors that are oil-sensitive only when the general stock market is *divided* into up and down markets. This category includes the Service sector which is the least sensitive to total and systematic risks. The third category includes the sectors that are *not directly* oil-sensitive, regardless whether market is aggregated or divided into up and down markets. This category includes Agriculture and Cement. These relatively small sectors are mainly influenced by market risk and government loans.

It is not surprising in this highly segmented stock market which usually flourishes on higher oil price that none of the sectors is sensitive to changes in the world capital market as represented by MSCI, whether in the aggregate level representation or when the market is categorized into the up and down patterns. Moreover, more than 25% of the stocks are traded by few hands such as the government and rich families which control when to buy and when to sell. But this market is highly sensitive to regional factors including security and political uncertainty The banks demonstrate particular sensitivity to political and economic events such as collapse of the oil price in 1999 in the aftermath of the 1997 Asian crisis, and the change in the oil pricing mechanism in 2000 as shown by the effect of the dummy variable *D00*[11].

In contrast to the US Treasury bill rate, changes in domestic interest rates negatively affect most of the sectors. While the interest rate affects the Service sector at

[11] OPEC unofficially adopted the oil price band of $22-28 a barrel in February 2001 (see Tang and Hammoudeh, 2002)

the aggregate and up markets, the impact is greater on Banks and Industry as expected. It should be mentioned that the Cement sector is also sensitive to domestic interest rate regardless whether the market is aggregated or it moves up or down. This could be related to the fact that construction is financed by domestic loans. Only the banking and cement sectors are sensitive to US T- bill rate. While it is obvious why Saudi banks are sensitive to the US bill rate, it is harder to explain why the cement sector is sensitive to this global variable as well.

The most consistent sector sensitivity is to changes in domestic systematic risks. Industry, Electricity and Agriculture are sensitive to changes in the unconditional risk, but all the sectors are compensated in higher returns for the conditional risk in both the up and down markets. This means that investors require extra compensation for investing in the market. Since the sign for the up beta is positive and that for the down beta is negative as expected, then it means that sectors with high-beta sensitivity such as Industry, Electricity and Cement should outperform low-beta sectors such as Agriculture and Banks when the Saudi aggregate market return is positive. Similarly the high-beta sectors incur higher losses when this market return is negative, and thus those sectors should be avoided in the case of lower oil prices which usually determine the direction of the overall economy and the market for Saudi Arabia (Fasano and Iqbal, 2003). But the major result is that the impact of the change in the oil price is much more priced in returns by investors and traders than the impacts of both the conditional and unconditional systematic risk for all sectors.

Analyzing the estimates when the sample period is divided into two subperiods, dated before and after the end of 2001 which corresponds to the change in the pricing

mechanism by OPEC, the sensitivity to systematic risk for the up market has increased considerably for Services and Electricity in the second subsample which comes after September 11th, and has witnessed the 2003 Iraq war and the record increases in oil price after that. On the down side of the market, the systematic risk has increased for all sectors, particularly Electricity. Thus the electricity power sector has increased risk sensitivity in both the up and down markets. Since all the sectors have asymmetric systematic risk exposure,

5. Conclusions

Traders who are interested in investing in oil-sensitive stocks in Saudi Arabia may during high oil prices select stocks of companies operating in high beta sectors such as Industry, Electricity and Cement because the oil price is significantly more priced in these sectors than the others.

Since all the sectors have asymmetric systematic risk exposure in the "up" and "down" markets, this finding suggests that these sectors inhabit a stock market that requires serious hedging in order to deal with the increase in risk during the "down" market. It may also imply that companies in these sectors face a more competitive environment during the "down" side and have difficulty passing on risk to their customers. Traders may select stocks in the Agricultural sector during the down markets, because this sector has the least negative risk exposure as the shares of its companies are "defensible" stock. On the other hand, they should avoid shares of the Banking sector which has the most negative exposure during the "down" market.

Trader should also be aware that systematic risk in the Saudi market has increased since the end of 2001 which comes on the back of 9/11 and has witnessed the impact of the continuing 2003 Iraq war. Risk exposure has increased for Service in the “down” market and for Electricity in both “up” and “down” markets.

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Table 1:

Oil and beta Risk Exposures in the Sectoral Risk-Return Relationships

Equation	Beta	Up Beta	Down Beta	Oil price	MSCI	Saudi interest rate	US interest rate	D00	R^2	DW
Banks ¶ (1a)	0.0003			0.0348[c]	0.0173	-0.0008		n.s.	0.03	2.01
¶ (1b)	8.5E-05			0.0352[c]	0.0224	-0.0054[b]	0.0052[c]	n.s.	0.03	2.01
(2a)		0.0077[a]	-0.0184[a]	0.0139	-0.0139	-0.307		-0.0057[b]	0.04	1.90
(2b)		0.0075[a]	-0.0184[a]	0.0143	-0.0108	-0.0031[c]	0.0027	-0.0059[a]	0.04	1.91
Industry	0.044[b]			0.0409[c]	0.0273	-0.0016[a]		n.s.	0.03	1.88
	0.0046[a]			0.0415	0.0346	-0.0067[a]	0.0058	n.s.	0.04	1.89
		0.0108[a]	-0.0153[a]	0.02951	0.0091	0.0004		n.s.	0.34	2.03
		0.0109[a]	-0.0151[a]	0.0299	0.0129	-0.0023	0.0030	n.s.	0.34	2.03
Service	8.14E-			0.0084[b]	-0.0036	-0.0003[a]		n.s.	0.04	2.10
	0.00057			0.0085[b]	-0.0032	-0.0008[c]	0.0005	n.s.	0.04	2.10
		0.0082[a]	-0.0121[a]	0.0074[b]	-0.0063	-0.0002[b]		n.s.	0.19	2.18
		0.0082[a]	-0.0121[a]	0.0074[b]	-0.0064	-0.0002	-1.26e-5	n.s.	0.19	2.18
Electricity	0.0027[a]			0.0697[b]	0.0172	-0.0017[c]		n.s.	0.02	1.89
	0.0026[a]			0.0700[b]	0.0213	-0.0046	0.0032	n.s.	0.02	1.89
		0.0102[a]	-0.0142[a]	0.0242	-0.0249	-0.0011		n.s.	0.02	1.89
		0.0102[a]	-0.0142[a]	0.0244	-0.0219	-0.0031	0.0023	n.s.	0.02	1.89
Agriculture	0.0029[a]			0.0490	-0.0557	-0.0024[a]		n.s.	0.04	2.05
	0.0029[a]			0.0492	-0.0531	-0.0042	0.0021	n.s.	0.04	2.05
		0.0045[a]	-0.0052[a]	0.0414	-0.0628	-0.0020[b]		n.s	0.07	2.05
		0.0045[a]	-0.0053[a]	0.0416	-0.0612	-0.0032	0.0013	n.s.	0.07	2.05
Cement	0.0004			0.0271	0.0554	-0.0011[b]		n.s.	0.02	1.70
	0.0008			0.0275	0.0625	-0.0062[a]	0.0058[b]	n.s	0.03	1.71
		0.0112[a]	-0.0117[a]	0.0086	0.0403	-0.0007[c]		n.s	0.26	1.72
		0.0114	-0.0112[a]	0.0090	0.0446	-0.0036[c]	0.0033	n.s.	0.26	1.73

Notes: Equations (1a) to (2b) are defined in the text. Superscripts a, b and c represent levels of significance at 1%, 5% and 10%, respectively. n.s. means not significant.