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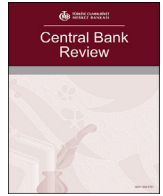
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Investor herds and oil prices evidence in the Gulf Cooperation Council (GCC) equity markets



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ABSTRACT

This paper scrutinizes the effect of crude oil prices on herd behavior among investors in the Gulf Cooperation Council (GCC) stock markets. Using firm level data from Saudi Arabia, Qatar, Oman, Kuwait, Bahrain, Dubai and Abu Dhabi stock exchanges, we examine equity return dispersions within industry portfolios and test whether investor herds exist in these markets. We then assess whether crude oil price movements have any effect on the investment behavior of traders in the aforementioned markets. Our findings reveal significant evidence supporting herd behavior in all GCC equity markets with the exception of Oman and Qatar, more consistently during periods of market losses. Furthermore, we find significant oil price effects on herd behavior in these markets, particularly during periods of extreme positive changes in the price of oil. Our findings suggest that investors' tendency to act as a herd in the said markets is significantly affected by the developments in the oil market.

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1. Introduction

The effect of oil prices on financial markets has been a topic of interest to academics, practitioners as well as policy makers. Throughout the last half century, oil has played a significant role in the economic development of both oil importing and exporting nations, in some cases providing investors clues about the future performance of stock markets in these countries. The bubbles in oil prices and the crash during the second half of 2008 have led researchers as well as market regulators to take a closer look into the behavior of traders in commodity markets. However, the impact of oil market developments on the behavior of traders in stock markets has not yet been fully explored. For this purpose, the stock markets in the Gulf Cooperation Council (GCC) countries provide fertile ground for research as the performance of stock markets in these countries has a strong link with the behavior of oil prices (see Fig. 1).

Studying investor herds in GCC stock markets is particularly interesting for several reasons. First, following the Asian financial

crisis in 1998, the economies of GCC countries experienced extraordinary growth fueled with the boom in oil prices (Fig. 1). Considering the fact that the region possesses about 48% of the world's proved oil reserves, controls one third of world oil production, and 40% of world oil exports,¹ the flow of large sums of petro-dollars into these economies fueled some of the highest GDP growth rates worldwide. In order to move their economies away from their vast oil dependence, the governments in the region have implemented policies to strengthen financial institutions and channeled funds into the real economy through domestic investments that are aimed to modernize the infrastructure in non-oil industries. Moreover, the deregulation of important industries including finance and tourism has attracted a wider spectrum of investors into these countries, creating a great investment opportunity for domestic as well as foreign investors trading in the stock markets of these countries.

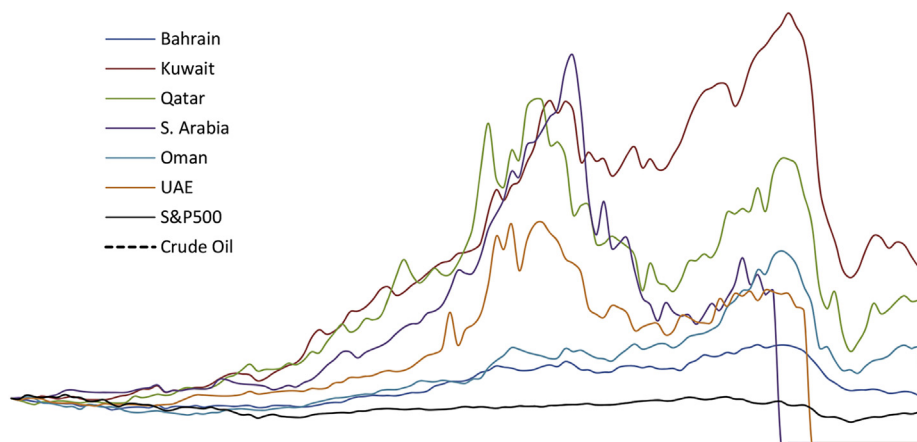
Second, in addition to their domestic investments to build up their infrastructure, the GCC countries, flush with petro dollars, emerged as an important FDI investor towards emerging markets as well as western economies. Recycling large sums of petrodollars by investing in foreign economies, either through sovereign

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¹ Rault and Arouri (2009) the BP Statistical Review of World Energy (June 2015, and the CIA World Factbook, 2014).



Note: Market index values are rebased at one as of January 2000 for comparison purposes. Returns are calculated using local currency based stock market index values. The second axis represents crude oil prices for the front-month futures contract traded at the New York Mercantile Exchange.

Fig. 1. Nominal stock market index returns for GCC countries, S&P 500 Index and Crude Oil Prices (Jan. 2004–Dec. 2013).

Note: Market index values are rebased at one as of January 2000 for comparison purposes. Returns are calculated using local currency based stock market index values. The second axis represents crude oil prices for the front-month futures contract traded at the New York Mercantile Exchange.

investment funds or private investment funds, bolstered the position of GCC countries in international markets. As a result, the GCC markets have not just become more attractive to foreign investors, and thus, been able to draw high levels of foreign direct investment, but also become more important in the global financial arena and attracted an increasing number of key financial players.

Third, unlike the stock markets in other emerging nations such as Poland or Chile, Gulf exchanges are largely dominated by retail traders who tend to be short term investors moving in and out of markets as they react to news. Institutional investors including insurance companies and pension funds generally provide a stabilizing factor in financial markets; however they are largely underdeveloped in the GCC markets. For example, institutional investors have been accounting around 5 percent of the value traded on the Saudi stock exchange. In such markets dominated by retail investors who, compared to institutional investors, tend to have limited access to information, less professional knowledge and financial culture and a short-term investment strategy, investors might have a greater tendency to watch and follow each other's trades, act on the basis of rumors, moving in and out of markets as a group, resulting in herd behavior in these markets.

Fourth, like any other emerging stock market, the stock markets in GCC countries suffer from a combination of regulatory weaknesses, illiquidity, and a great deal of information asymmetry among institutional and individual investors in the market. Recently, a broad range of legal, regulatory and supervisory policy changes has been implemented in order to enhance the transparency of these markets and diminish structural and regulatory weaknesses; however the informational efficiency of these markets and its impact on asset prices are not yet fully examined. The tremendous potential offered by these economies, the growing interest by foreign investors into their equity markets, the emerging nature of financial institutions, the dominance of retail investors in these markets and increasing participation by domestic investors make it especially interesting to examine whether herd behavior exists in these markets. In this study, we contribute to the literature on emerging markets by examining investor behavior in GCC stock exchanges.

This study has several contributions. First, we use firm level data from GCC stock markets with unique characteristics as explained

earlier and study whether investors in different industries in each country exhibit herd behavior. This is especially important for policy makers as herding might lead asset prices to deviate from fundamentals as prices would reflect investors' tendency to flock in and out of stocks as a herd without researching fundamentals. The result might be a bubble and a subsequent crash which regulators, as well as investors, would like to avoid. The infamous dot-com/tech crash in the U.S. market in early 2000 is an example of the potential costs of avoiding fundamentals when pricing assets. The plot of GCC market index returns shown in Fig. 1 suggests that this might just be the case in these markets as well. The pattern of bubble and crashes that can be clearly seen in Fig. 1 might have been due to herd behavior among traders initially overpricing assets and eventually leading to market crashes. The last column of Table 1a reports the annual returns on each country's general market index; the resulting losses from the crashes were as high as 56% for Saudi Arabia and United Arab Emirates (UAE) respectively in 2008. The second contribution of this study is to examine the effect of oil prices on the behavior of investors in these markets. Clearly, the transmission mechanism of oil price shocks to stock returns in GCC markets should be different from that in net oil-importing countries. Since GCC countries have a rich variety in terms of their dependence on oil exports² and are yet connected through a common political and economic union, the study of investor herds in these markets can provide valuable insight to how oil price shocks are transmitted to equity markets and what factors influence herd behavior in stock markets.

Looking ahead, our findings support the existence of investor herds in all of the GCC countries with the exception of Oman and Qatar. Interestingly, we find the strongest evidence across all industries in Saudi Arabia which happens to be the dominant and the most liquid market in the union. The evidence for herding in other countries are found to be more industry specific such as Real Estate for Dubai, Energy and Financials for Abu Dhabi, and Financials and Industrials for Kuwait. We find herding to be more prevalent during

² While UAE, Bahrain, and Oman are less oil-dependent, Saudi Arabia, Kuwait, and Qatar are more oil-dependent as the contributions of oil to GDP is 26% in Bahrain, 34% in UAE, 54% in Saudi Arabia, and 62% in Qatar. (Source: Global Investment House, Global Research, GCC January 2008).

Table 1a
GCC stock exchange statistics.

	Year	Transactions ('000)	Volume (mil. shares)	Value (\$billions)	Market Cap. (\$billions)	No. of Companies	Index Gain
Bahrain	2002	13.0	353.1	0.2	7.6	41	0.30%
	2003	14.6	405.6	0.3	9.7	44	27.40%
	2004	15.8	335.8	0.5	13.5	45	32.10%
	2005	22.5	458.3	0.7	17.4	47	22.70%
	2006	21.7	727.6	1.3	21.1	50	-1.90%
	2007	27.7	851.1	1.1	27	51	26.50%
	2008	43.5	1675.90	2.1	19.9	51	-33.50%
Kuwait	2002	521.3	27,834.00	22.7	35.8	95	24.10%
	2003	1081.70	49,563.00	55.1	61.5	108	63.90%
	2004	1056.90	33,543.70	51.8	75.2	125	11.90%
	2005	1964.20	52,337.60	97.6	142.1	158	66.40%
	2006	1486.20	37,657.90	59.2	143.8	180	-9.20%
	2007	2101.10	70,432.80	135.5	210.5	196	30.00%
	2008	1999.00	80,923.70	129.7	121.1	204	-45.40%
	Oman	2002	92.9	191.8	0.6	5.2	127
2003		179.1	315.2	1.5	6.6	139	42.10%
2004		255	345.4	1.9	7.6	146	23.80%
2005		394	512.2	3.6	12.7	156	44.40%
2006		312.4	925.5	2.3	12.9	155	14.50%
2007		564.2	2989.10	5.2	23	161	61.90%
2008		881.9	4199.00	8.7	15	150	-39.80%
Qatar		2002	29.8	79.6	0.9	10.6	25
	2003	134.7	190	3.2	26.7	28	56.60%
	2004	290.2	316.6	6.4	40.4	30	47.60%
	2005	1130.10	1033.10	28.3	87.1	32	83.50%
	2006	1732.60	1865.40	20.5	60.9	36	-37.50%
	2007	1811.80	3411.30	29.9	95.5	40	40.40%
	2008	2179.90	3893.50	48.2	76.7	43	-24.60%
	Saudi Arabia	2002	1033.70	11,430.00	35.7	74.9	68
2003		3763.40	35,414.00	159.1	157.3	70	76.20%
2004		13,319.50	63,675.00	473	305.9	73	84.90%
2005		46,607.90	70,996.00	1103.70	646	77	103.70%
2006		96,095.90	73,439.00	1402.80	326.3	86	-52.50%
2007		65,665.50	58,862.00	682.1	519	111	40.90%
2008		52,135.90	59,682.60	523.5	246.5	127	-56.50%
UAE		2002	36.3	209.2	1.1	29.9	37
	2003	50.7	561.4	2	39.6	44	32.10%
	2004	299.3	6069.30	18.2	82.3	53	88.40%
	2005	2301.20	34,145.60	140.6	231.4	89	102.90%
	2006	3412.60	51,355.60	120.4	168.7	102	-39.90%
	2007	3354.60	157,318.10	151	257.4	120	33.60%
	2008	3256.20	126,343.60	146.3	132	130	-56.60%

Source: Global Investment House (Global Research, Jan. 2009).

periods of market losses, possibly indicating loss aversion by traders. Furthermore, we find significant oil price effects on herd behavior with herd behavior being more prevalent during periods when oil prices rise. This might indicate that investors follow oil market movements, rather than firm specific fundamentals, in order to make investment decisions in these markets. In short, our findings suggest that investors' tendency to act as a herd in these markets is significantly affected by the developments in the oil market.

An outline of the remainder of the paper is as follows. Section 2 briefly summarizes the literature on tests of investor herds and the link between oil and stock markets, in particular GCC markets. Section 3 provides the description of the testing methodology and the data. Section 4 presents empirical results. Finally, Section 5 concludes the paper and discusses further research avenues.

2. Previous studies

2.1. Herding literature

One of the main axioms of market efficiency is investor

rationality, i.e. greedy, profit maximizing investors making investment choices based on their research on markets. Bikhchandani and Sharma (2001) define herding behavior as an obvious intent to mimic the actions of other investors and base investment decisions on the collective actions of others. Although such behavior can be regarded as a violation of the investor rationality axiom, an extensive list of studies in the literature have proposed rational or irrational explanations to why investors would act in herds [e.g. Scharfstein and Stein (1990), Devenow and Welch (1996), Barberis and Shleifer (2003), and Levy (2004) among others]. Some of the arguments put forth include informational cascades through inference of information from others' actions [Bikhchandani et al. (1992), Welch (1992)]; reputation costs of acting differently than others [Scharfstein and Stein (1990)] and fads [Friedman (1984); Dremann (1979); Barberis and Shleifer (2003)].

A number of studies in the literature have suggested several methodologies to test herd formation in equity markets. A widely employed methodology suggested by Lakonishok et al. (1992) uses trading data (more specifically a ratio derived from buy/sell order activity) and has been applied in a number of studies including Wermers (1999) on herding by mutual funds; Bow and Domuta

(2004) on herd behavior among local and foreigner investors in Jakarta stock market; Carpenter and Wang (2007) on the influence of institutional investors in the Australian foreign exchange market; Uchida and Nakagawa (2007) on herding in the Japanese loan market; and more recently, Lin and Swanson (2008) on herd behavior of foreign investors in the U.S. stock market. Other methodologies proposed by Christie and Huang (1995), Chang et al. (2000) and Hwang and Salmon (2004) utilize return data instead and examine the cross sectional behavior of returns across groups of stocks with similar characteristics such as industry classification, exchange listing or market capitalization. These tests have been applied to a number of studies including Gleason et al. (2003, 2004), Demirer and Kutun (2006), Tan et al. (2008), Chiang and Zheng (2010), Demirer et al. (2010), and more recently Balcalir and Demirer (2015). In general these tests provide mixed evidence on whether or not investor herds exist with some evidence on herding in emerging markets, in particular in Asia.

2.2. Oil prices and stock markets

Quite a number of studies in the literature have focused on the linkages between oil price shocks and macroeconomic variables. Among others, those studies are Basher and Sadorsky (2006), Hammoudeh and Choi (2006), Park and Ratti (2008), and Chiou and Lee (2009). However, as Basher and Sadorsky (2006) point out, there has been little work done on the linkages between oil prices and stock markets. Furthermore, most of these studies have focused on the stock markets in industrialized countries [e.g. Jones and Kaul (1996), and Huang et al. (1996)]. In a related paper, Maghyereh (2004) examined the relationship between oil price shocks and stock market returns for 22 emerging economies. Although the results did not suggest a significant link, he concluded that higher level of energy consumption intensity for a country leads to greater sensitivity of its stock market to oil price shocks.

Regarding the literature on GCC markets, several papers have focused on the issue of informational efficiency of these markets. In an earlier study, Dahel and Laabas (1999) examined the efficiency of four GCC markets including Bahrain, Kuwait, Oman and Saudi Arabia. Their hypothesis of random walk in equity returns were rejected for all GCC countries with the exception of Kuwait. In another study, Sharma (2005) tested the normality of daily returns on four GCC stock markets and found significant deviations from normality. Sarma (2007) extended this study by examining the seasonal regularities in return series in Saudi Arabia, Kuwait, and Oman. He concluded that a strategy of buying on Sundays and selling on Thursdays in Kuwait could yield abnormal profits.

Interestingly, the literature has provided limited evidence on the link between oil prices changes and the performance of stock markets in GCC countries. Hammoudeh and Aleisa (2004) studied stock returns in Bahrain, Kuwait, Oman, Saudi Arabia, and UAE and found that only Saudi Arabia has a bidirectional causal relationship with oil price changes. In a more recent study, Bashar (2006) found that the predictive power of oil prices on the performance of GCC stock markets has increased following the boom in oil prices. He also found that the response of these markets to shocks in oil prices has strengthened over time, with the greatest response to oil price shocks observed in the Saudi market. Hammoudeh and Choi (2006) studied the relationship between GCC stock returns and three global factors including the oil price, S&P 500 index performance, and the U.S. Treasury Bill rate and found that the T-Bill rate has a direct impact on some of the segmented GCC markets, while oil prices and the S&P 500 have no such direct impact, implying the effectiveness of local or regional factors, such as liquidity and profitability, that might have direct

effects on these markets. Furthermore, Aroui and Rault (2012) revealed a positive impact of oil price increases on GCC stock prices with the exception of Saudi Arabia. Akoum et al. (2012) also documented similar findings and report a strong dependency between GCC stock and oil returns particularly after 2007. Awartani and Maghyereh (2013) and Bouri and Demirer (2006) support the existence of significant risk and return transmissions from oil to GCC stock markets, mainly during the post-global financial crisis period.

None of the studies in the literature, however, has examined the link between oil price shocks and the behavior of investors in these markets. If the response of equity returns to oil price shocks has strengthened over time as suggested by Bashar (2006), this might indicate that investors' tendency to act as herds by following the signals from the oil market has also increased. Unexpected changes in oil prices might lead investors to act as a herd and flock to the same stock (or industry) by buying (or selling) at the same time, creating excess volatility that eventually leads to bubbles and crashes in these markets. Therefore, our study contributes to the literature by providing further insight to the effect of oil prices in these markets. Next, we provide a description of the data and methodology used.

3. Data and methodology

3.1. Data

We use daily returns for individual stocks listed on seven GCC stock exchanges including Saudi Arabia, Dubai, Abu Dhabi, Kuwait, Bahrain, Oman (Muscat Securities Market), and Qatar (Doha Securities Market). The data set covers the period between January 2003 and December 2013 for most countries with the exception of Oman which starts in February 1997, Kuwait which starts in July 2002, Bahrain and Abu Dhabi which start in July 2004, and Dubai which starts in December 2002. As it is seen, the data period covers the bull markets in crude oil and real estate during much of the 2000's as well as the real estate and credit market crashes in 2006 and 2008.

Stock exchange statistics provided in Table 1a and Table 1b suggest a diverse set of exchange characteristics (pre and post 2007–2008 crisis period) such as market liquidity, number of firms listed, trading volume and value, market capitalization, which might lead to differences in investor behavior in the aforementioned markets. Clearly, Saudi Arabia is the dominant exchange in the union in terms of market capitalization as well as the number of transactions. Examining market liquidity values in the table, we observe that Saudi Arabia, Dubai, Abu Dhabi and Kuwait are among the most liquid exchanges with the highest trading volume and transaction values. Interestingly, despite the relatively high number of firms listed on its exchange, Oman is not as liquid as these countries. Compared to Qatar with less than fifty firms listed on its exchange, Oman with around 150 firms listed has a trading volume which is slightly higher. This diversity in exchange characteristics in our data set provides a valuable opportunity for comparative analysis. Next, we describe the testing methodology.

3.2. Testing methodology

We employ a methodology based on return dispersions across individual firms suggested by Chang et al. (2000). In this methodology, return dispersions are measured by the cross-sectional absolute deviation of returns (CSAD) expressed as

Table 1b
GCC stock exchange statistics.

Value of Share Trading						
Abu Dhabi Sec. Exchange (Million AED)	Dubai Financial Market (Million AED)	Qatar Stock Exchange ('000 QR)	Saudi Stock Exchange (Million SAR)	Kuwait Boursa (Million USD)	Bahrain Bourse ('000 BD)	
2009	69,982	173,508	92,165	1,264,011	77,298	178,357
2010	34,140	69,665	67,185	759,184	44,357	108,411
2011	24,630	32,088	83,419	1,098,836	21,400	104,966
2012	22,065	48,588	70,673	1,929,318	21,764	110,244
2013	84,632	159,882	74,886	1,369,665	40,331	225,868
2014	144,258	381,507	199,292	2,146,511	21,868	269,333
2015	56,622	151,393	93,720	1,660,622	29,772	109,975
Number of trades in equity shares.						
Abu Dhabi Securities Exchange	Dubai Financial Market	Qatar Stock Exchange	Saudi Stock Exchange	Kuwait Boursa	Bahrain Bourse	
2009	744.691	1.984.272	1.690.085	36,458,326	1.939.100	30,317
2010	363.850	794.661	1052.392	19,536,143	1.254.100	19,647
2011	283.289	444.814	1,119,099	25,546,933	618.400	11,818
2012	258.618	621.421	881,638	42,105,048	1.204.900	10,168
2013	556.233	1.337.857	961,811	28,967,694	2.252.700	14,197
2014	858.283	2.412.839	2,058,604	35,761,091	1.226.739	16,217
2015	436.363	1570.369	1,190,807	30,444,203	984,405	11,248
Number of stocks listed.						
Abu Dhabi Securities Exchange	Dubai Financial Market	Qatar Stock Exchange	Saudi Stock Exchange	Kuwait Boursa	Bahrain Bourse	
2009	65	39	44	135	208	49
2010	67	37	43	146	212	49
2011	68	40	42	150	215	49
2012	71	36	42	158	214	47
2013	71	46	42	163	196	47
2014	67	53	43	169	212	47
2015	69	56	43	171	203	46
Market Capitalization						
UAE (Million USD)	Qatar Stock Exchange (Million QR)	Saudi Stock Exchange (Million USD)	Kuwait Boursa (Million USD)	Bahrain Bourse (Million BD)		
2009	138,244	320,081	318,734	51,45	6131	
2010	131,491	450,203	353,410	53,77	7562	
2011	93,727	457,352	338,873	45,86	6254	
2012	101,328	459,884	373,375	43,54	5855	
2013	180,325	555,606	467,366	46,28	6962	
2014	201,599	676,792	483,116	42,23	8327	
2015	195,874	553,176	421,060	96,27	7199	
Volume of Traded Shares						
Abu Dhabi Securities Exch.	Dubai Financial Market (billion)	Qatar Stock Exchange	Saudi Stock Exchange	Kuwait Boursa (million)	Bahrain Stock Exchange	
2009	37,613,744,866	110.7	3,450,086,784	60,057,191,378	121,746	852,249,480
2010	17,611,127,956	38.4	2,094,391,542	34,772,998,647	55,936	612,188,517
2011	15,820,712,665	25.2	2,302,769,616	50,920,541,308	31,875	520,223,918
2012	16,353,023,973	40.5	2,428,190,041	84,435,251,770	82,806	627,707,657
2013	51,505,844,641	127.2	1,937,534,283	53,469,832,829	129,921	1,867,760,642
2014	56,938,039,670	160.5	4,439,856,747	70,569,600,558	54,660	1,127,448,492
2015	25,263,241,806	98.2	2,302,409,707	65,995,948,684	42,997	515,560,631

Note: Data obtained from individual stock exchanges and the World Bank database.

$$CSAD_t = \frac{1}{N} \sum_{i=1}^N |r_{it} - r_{mt}| \quad (1)$$

where r_{it} is the return for firm i on day t , r_{mt} is the market return, and N is the number of firms in a given portfolio. Consider the standard CAPM specification where the expected return on an asset is linked to the expected return on the market portfolio through a risk factor that measures the sensitivity of the asset's returns to the market portfolio, i.e. its beta. In this specification, one would expect dispersion of returns to be an increasing function of market volatility as each asset would differ in terms of their sensitivities to the

market portfolio. Chang et al. (2000) suggest that during periods of high market volatility, which is when the tendency to act as a herd would be more likely, the standard linear relation between firm level volatility and market volatility would break down. Furthermore, observing lower dispersions during periods of high market volatility might be associated with the formation of investor herds leading asset returns to behave similarly during such periods. For this purpose, they propose a model of cross sectional absolute deviations in a non-linear regression specification of the form:

$$CSAD_t = \alpha_0 + \alpha_1 |r_{mt}| + \alpha_2 r_{mt}^2 + \varepsilon_t \quad (2)$$

In this methodology, herding would be evidenced by a lower or

less than proportional increase in the cross-sectional absolute deviations during periods of high market volatility. As a result, observing a negative and statistically significant coefficient (α_2) for the non-linear term in the model will be consistent with the existence of investor herds.

3.3. The impact of oil prices

In order to examine whether crude oil price changes have any effect on herd formation among investors, we modify the non-linear model in Equation (2) by including several interaction terms that represent movements in oil prices. In the quadratic specification suggested by Chang et al. (2000), observing a significant and negative non-linear term would support the existence of herds. However, in a market where oil prices are also significant in determining herd behavior, as can be the case in most GCC exchanges, one would expect the negative and non-linear relation between market volatility and firm level return dispersions to be even stronger when oil price movements are taken into account. Furthermore, since herding behavior is more likely to be observed during periods of market stress, we would expect herding to be more prevalent during periods of extreme movements in oil prices. For this purpose, we modify Equation (2) and estimate the following model:

$$CSAD_t = \beta_0 + \beta_1|r_{mt}| + \beta_2r_{mt}^2 + \beta_3r_{mt}^2D_t^U + \beta_4r_{mt}^2D_t^L + \varepsilon_t \quad (3)$$

where the dummy variables D_t^U (D_t^L) take on the value of unity if the percent change on the price of crude oil on day t lies in the upper (lower) tail of the return distribution; 0 otherwise. Consistent with the literature, we define an extreme change in the price of oil as one that lies in the five percent upper or lower tail of the return distribution. Note that the model in Equation (3) distinguishes between up and down moves in oil prices allowing us to examine the asymmetric effect of oil price changes on herd behavior.

4. Empirical results

4.1. Descriptive statistics

Most studies in the literature suggest that herd formation would be more prevalent among traders within sufficiently homogeneous groups where they face similar decision challenges and it is easier to observe each other's trades [e.g. Christie and Huang (1995), Chang et al. (2000), Bikhchandani and Sharma (2001), Gleason et al. (2003, 2004)]. For this purpose, we classified firms into different industry groups within each exchange based on the industry classification by each exchange. We then calculated portfolio returns based on an equally weighted portfolio of all firms in each industry classification. Table 2 provides summary statistics for average daily returns, cross-sectional return dispersions, and the average number of firms used to compute these statistics for each industry. Note that the number of firms within a given industry classification changes over time, therefore we present in the second column the average number of firms within each industry during the sample period. The table also reports the data period and the number of observations for each country.

The summary statistics in Table 2 reveal several interesting observations. In general, we observe that the Finance industry dominates all other industries within each exchange in terms of the number of firms listed. At the same time, Financials happen to be the least volatile industry consistently in all exchanges, most likely due to greater liquidity for these stocks. Another reason for lower volatility in this industry might be due to greater regulatory oversight on these firms as Financials constitute the backbone of the

economy as a provider of capital for other industries.

Examining average returns across countries, we observe that Saudi stocks in general are among the least volatile ones, with the highest volatility observed around 1% for Tourism and Media & Publishing in this market. Petrochemicals have the highest average daily return most likely due to the boom in oil prices during much of the 2000's. Examining the summary statistics for other exchanges, we see that Qatar, Dubai and Abu Dhabi industries are the most volatile ones although a majority of industries in Abu Dhabi has negative average returns.

A comparison of cross sectional return dispersions across countries indicates that Dubai, Abu Dhabi and Kuwait have the highest dispersions among firm returns within each industry. Once again, Saudi industries have the lowest return dispersions consistently across all industries.

4.2. Evidence on herding

Table 3 presents estimation results for the quadratic return dispersion model in Equation (2). In the regressions, we use the stock exchange composite index for each country to represent the market portfolio term, r_{mt} . Note that the table presents regression estimates using the whole data set as well as for up and down market periods separately.³ Distinguishing between up and down market periods allows us to see the asymmetric effects of market movements on herd behavior.

Table 3 reveals several interesting findings. In general, we find significant evidence that would be consistent with herd formation in all GCC markets except for Qatar and Oman. Examining the findings for these countries, we observe negative and statistically significant coefficients for the non-linear term (α_2) indicating that return dispersions are significantly lower during periods of high market volatility and that the standard linear relation of CAPM does not hold. These findings also justify the use of the non-linear specification suggested by Chang et al. (2000). Interestingly, with the exception of Dubai, herding is found to be more prevalent during periods of market losses in Saudi Arabia, Abu Dhabi, Kuwait, and Bahrain. In the case of Dubai, the findings provide support for herding in Real Estate during both up and down markets. This is not unexpected as Dubai's open business policy has led this market to become a hot spot for real estate development during much of the sample period. Strong evidence of herding in this industry is most likely due to investors' tendency to get on the real estate bandwagon in order to reap profits in this booming industry without looking into the fundamentals – much like the dot-com/tech bubble in the U.S. in the late '90s. With open doors to global creditors, it should not come as a surprise how strongly the recent credit crisis in Dubai shook global markets. Interestingly, even though the Saudi market dominates the GCC markets in terms of liquidity and market capitalization, we find the strongest support for the existence of investor herds consistently in all industries.

In the case of more oil dependent economies of Abu Dhabi and Kuwait, our findings support herding in Financials, Energy, Industrials and Telecom, once again more consistently during periods of market losses only. Our results for Bahrain provide limited support with herding observed in Services only, again during periods of market losses. Our findings for Qatar and Oman provide no support for herding in these markets. In short, our findings provide the strongest evidence of herding in the Saudi market across all industries along with industry specific evidence for other GCC markets with the exception of Qatar and Oman.

³ All estimations are done using the Newey-West heteroskedasticity and autocorrelation consistent standard errors.

Table 2
Summary statistics: Average daily returns and cross-sectional absolute deviations.

Industry	Avg. no. of firms	Average Daily Returns				Cross-Sectional Absolute Deviations (CSAD)			
		Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
Saudi Arabia (Jan. 2003–Dec. 2013)									
All Stocks	78.69	0.02%	0.68%	−3.14%	3.25%	0.68%	0.49%	0.16%	3.51%
Banks & Fin. Services	9.57	0.02%	0.44%	−2.79%	2.54%	0.42%	0.36%	0.06%	3.24%
Petro-chemicals	7.22	0.05%	0.89%	−4.15%	5.52%	0.76%	0.65%	0.05%	5.81%
Cement	7.96	0.00%	0.46%	−2.53%	2.29%	0.37%	0.39%	0.03%	3.15%
Retail	4.40	0.04%	0.89%	−4.51%	5.12%	0.78%	0.67%	0.00%	5.09%
Utilities	2.00	0.00%	0.83%	−3.85%	3.32%	0.64%	0.63%	0.00%	3.90%
Agriculture & Food	10.82	0.04%	0.99%	−4.26%	4.33%	0.88%	0.70%	0.09%	4.62%
Telecommunication & IT	1.75	0.01%	0.56%	−2.98%	2.91%	0.43%	0.46%	0.00%	3.35%
Insurance	6.38	−0.02%	0.73%	−3.23%	3.25%	0.61%	0.57%	0.00%	3.91%
Holding	6.04	0.03%	0.98%	−4.88%	4.75%	0.90%	0.69%	0.01%	5.08%
Industrials	6.39	0.03%	0.78%	−3.64%	3.21%	0.70%	0.58%	0.01%	3.84%
Construction	7.26	0.03%	0.75%	−3.04%	3.09%	0.69%	0.55%	0.03%	3.49%
Real Estate	4.60	0.02%	0.84%	−3.59%	3.46%	0.69%	0.63%	0.02%	3.85%
Transportation	3.18	0.01%	0.92%	−3.74%	3.57%	0.76%	0.68%	0.01%	4.39%
Media & Publishing	1.60	0.02%	1.07%	−4.08%	4.13%	0.79%	0.77%	0.00%	4.29%
Tourism	1.98	0.02%	1.02%	−3.99%	3.93%	0.84%	0.74%	0.00%	4.19%
Qatar (Jan. 2003–Dec. 2013)									
All Stocks	26.31	0.04%	1.70%	−9.16%	8.66%	2.00%	1.35%	0.41%	16.76%
Banking	6.31	0.07%	1.89%	−9.06%	11.63%	1.91%	1.52%	0.10%	16.47%
Industrials	3.69	0.03%	2.03%	−14.90%	8.98%	1.91%	1.62%	0.05%	16.53%
Real Estate	1.58	0.06%	2.71%	−10.24%	12.71%	2.22%	1.95%	0.05%	18.31%
Services	9.41	−0.02%	1.95%	−9.31%	9.39%	2.10%	1.47%	0.05%	16.64%
Insurance	3.36	0.10%	2.07%	−9.97%	9.52%	2.16%	1.63%	0.04%	17.71%
Oman (Feb. 1997–Dec. 2013)									
All Stocks	27.57	0.03%	1.16%	−13.56%	15.22%	1.85%	1.19%	0.04%	16.80%
Banks & Financials	13.34	−0.03%	1.60%	−12.40%	7.88%	1.90%	1.41%	0.00%	17.21%
Industrials	7.66	−0.02%	1.93%	−29.30%	18.88%	1.93%	1.73%	0.00%	28.80%
Services & Insurance	6.57	0.00%	1.70%	−17.20%	20.27%	1.65%	1.60%	0.00%	20.27%
Kuwait (July 2002–Dec. 2013)									
All Stocks	41.02	0.05%	1.03%	−5.53%	5.20%	2.16%	0.79%	0.18%	7.61%
Banks & Financials	14.74	0.06%	1.08%	−5.89%	6.01%	1.95%	0.86%	0.11%	8.32%
Insurance	1.39	0.07%	1.55%	−8.70%	8.71%	2.31%	1.57%	0.01%	11.42%
Real Estate	6.71	0.05%	1.30%	−8.35%	8.97%	2.30%	1.15%	0.00%	9.71%
Services	8.04	0.05%	1.11%	−6.15%	5.05%	2.35%	0.87%	0.05%	8.27%
Industrials	6.09	0.05%	1.17%	−7.47%	5.68%	2.20%	0.92%	0.05%	8.47%
Non-national	3.99	0.09%	1.52%	−10.56%	34.06%	0.16%	0.92%	0.00%	34.39%
Telecommunication & IT	1.96	0.09%	1.60%	−9.22%	9.60%	2.28%	2.19%	0.01%	10.94%
Bahrain (July 2004–Dec. 2013)									
All Stocks	13.91	0.06%	1.18%	−5.77%	20.51%	1.66%	1.04%	0.05%	20.74%
Banks & Financials	8.71	0.07%	1.56%	−7.21%	32.35%	0.12%	1.38%	0.00%	45.59%
Services	3.05	−0.02%	1.55%	−10.01%	6.56%	1.49%	1.28%	0.00%	9.75%
Tourism	1.12	0.17%	3.01%	−22.31%	22.31%	1.68%	2.21%	0.00%	14.42%
Dubai (Dec. 2002–Dec. 2013)									
All Stocks	13.43	0.08%	2.00%	−11.34%	12.82%	1.68%	0.94%	0.00%	8.03%
Banks & Financials	6.13	0.07%	1.93%	−11.08%	13.67%	1.63%	0.99%	0.00%	6.78%
Insurance	2.28	0.16%	3.51%	−27.20%	13.99%	2.60%	1.84%	0.13%	16.71%
Real Estate	2.52	0.05%	2.41%	−13.25%	13.88%	1.40%	1.06%	0.00%	7.48%
Transportation	0.92	−0.12%	3.03%	−13.21%	13.71%	1.71%	1.45%	0.00%	7.89%
Abu Dhabi (July 2004–Dec. 2013)									
All Stocks	30.58	−0.04%	1.44%	−7.42%	6.71%	2.60%	1.15%	0.57%	12.30%
Banks & Financials	10.32	−0.04%	1.70%	−7.76%	7.52%	2.35%	1.33%	0.31%	12.65%
Energy	2.1	−0.17%	2.57%	−9.89%	8.76%	2.12%	1.79%	0.07%	14.53%
Construction	5.33	−0.10%	2.01%	−9.19%	7.67%	2.60%	1.56%	0.13%	12.87%
Consumer	1.46	−0.07%	3.75%	−10.68%	9.56%	3.71%	2.23%	0.14%	15.25%
Telecom	2.54	−0.04%	1.70%	−8.84%	8.41%	1.74%	1.46%	0.03%	13.09%
Industrial	3.45	0.01%	2.33%	−10.42%	9.73%	2.86%	1.74%	0.00%	15.40%
Insurance	4.44	0.01%	2.07%	−6.63%	6.14%	3.07%	1.63%	0.13%	11.89%

Note: Average number of firms in the second column refers to the daily average number of firms used to calculate the cross-sectional statistics.

4.3. Oil prices and herding

Having found significant evidence consistent with herd formation in all GCC markets except for Qatar and Oman, we then provide

in [Table 4](#) our findings on the effect of oil prices on herd behavior in these markets. [Table 4](#) reports the regression estimates for Equation (3). Note that the table once again reports regression estimates for up and down market periods separately. Our findings suggest a

Table 3
Regression Coefficients for $CSAD_t = \alpha_0 + \alpha_1 |r_{m,t}| + \alpha_2 r_{m,t}^2 + \varepsilon_t$ (t-ratios in parentheses).

Industry	Whole Sample			Down Market (Market index)			Up Market (Market index)		
	α_0	α_1	α_2	α_0	α_1	α_2	α_0	α_1	α_2
Saudi Arabia									
All Stocks	0.004*** (32.361)	1.541*** (12.755)	-40.643*** (-6.612)	0.005*** (23.488)	1.338*** (9.170)	-37.801*** (-7.519)	0.004*** (16.862)	1.484*** (3.751)	7.605 (0.108)
Banks & Financials	0.002*** (23.570)	1.169*** (11.975)	-23.576*** (-4.126)	0.002*** (18.956)	1.035*** (9.020)	-22.610*** (-5.631)	0.002*** (11.897)	1.066*** (3.428)	18.847 (0.333)
Petrochemicals	0.005*** (26.764)	1.715*** (11.124)	-54.785*** (-6.132)	0.005*** (18.481)	1.380*** (7.575)	-49.015*** (-7.402)	0.005*** (16.428)	1.719*** (4.119)	11.296 (0.159)
Cement	0.002*** (17.760)	1.291*** (12.551)	-22.010 (-5.102)	0.002*** (12.518)	1.211*** (8.525)	-20.137*** (-4.447)	0.001*** (10.496)	1.319*** (5.395)	-13.459 (-0.334)
Retail	0.005*** (26.573)	1.591*** (10.842)	-35.151*** (-4.869)	0.005*** (18.479)	1.478*** (8.046)	-35.573*** (-5.542)	0.005*** (14.646)	1.400*** (2.859)	18.813 (0.226)
Energy & Utilities	0.004*** (22.030)	1.652*** (10.780)	-39.714*** (-4.919)	0.004*** (15.925)	1.373*** (6.955)	-28.220*** (-3.967)	0.003*** (12.426)	2.113*** (5.667)	-70.355 (-1.239)
Agriculture & Food	0.006*** (29.871)	1.651*** (10.061)	-48.148*** (-6.779)	0.006*** (20.876)	1.416*** (6.812)	-45.415*** (-5.627)	0.006*** (17.543)	1.535*** (3.298)	15.421 (0.196)
Telecom & IT	0.003*** (15.936)	1.222*** (8.243)	-22.019*** (-3.809)	0.003*** (12.465)	0.980*** (5.334)	-16.498*** (-2.751)	0.003*** (9.404)	1.280*** (3.525)	14.279 (0.254)
Insurance	0.0071*** (15.970)	1.024*** (3.214)	-30.925*** (-2.946)	0.006 (13.485)	0.827*** (2.586)	-25.153*** (-2.259)	0.007** (9.886)	1.157 (1.761)	-12.673 (-0.173)
Holding	0.007*** (31.506)	1.478*** (9.119)	-36.843*** (-4.257)	0.007*** (21.906)	1.244*** (6.349)	-33.993*** (-4.857)	0.007*** (16.943)	1.399*** (2.491)	25.175 (0.249)
Industrials	0.005*** (27.881)	1.527*** (11.235)	-39.739*** (-5.625)	0.005*** (19.506)	1.322*** (8.062)	-37.083*** (-6.534)	0.005*** (16.022)	1.448*** (3.599)	12.672 (0.186)
Construction	0.004*** (28.431)	1.618*** (12.219)	-42.798*** (-5.871)	0.005*** (19.870)	1.410*** (8.777)	-39.763*** (-7.278)	0.004*** (15.646)	1.571*** (3.823)	5.271 (0.074)
Real Estate	0.004*** (24.322)	1.766*** (11.978)	-52.722*** (-8.284)	0.005*** (17.548)	1.477*** (7.946)	-46.400*** (-6.790)	0.004*** (13.183)	1.835*** (4.096)	-13.950 (-0.183)
Transportation	0.005*** (25.112)	1.809*** (11.269)	-52.688*** (-8.220)	0.005*** (18.291)	1.511*** (7.384)	-46.373*** (-5.541)	0.005*** (13.919)	1.860*** (3.858)	-7.349 (-0.088)
Media & Publishing	0.006*** (17.794)	1.137*** (5.552)	-31.902*** (-4.057)	0.006*** (13.016)	1.056*** (4.153)	-29.962*** (-3.089)	0.005*** (11.135)	1.160*** (2.600)	-22.999 (-0.443)
Tourism	0.006*** (27.007)	1.523*** (8.943)	-43.082*** (-5.81)	0.006*** (18.842)	1.279*** (5.993)	-39.240*** (-4.898)	0.006*** (15.534)	1.504*** (3.032)	5.817 (0.071)
Dubai									
All Stocks	0.010*** (34.288)	0.569*** (19.176)	-2.927*** (-6.776)	0.010*** (23.496)	0.452*** (10.143)	-1.873*** (-2.615)	0.010*** (25.056)	0.665*** (16.792)	-3.538*** (-6.772)
Banks & Financials	0.010*** (32.147)	0.503*** (15.717)	-1.838*** (-3.578)	0.010*** (21.928)	0.405*** (7.950)	-0.963 (-1.087)	0.009*** (23.950)	0.584*** (14.715)	-2.360*** (-4.099)
Insurance	0.020*** (21.772)	0.428*** (5.190)	-2.265*** (-2.021)	0.018*** (13.063)	0.448*** (3.735)	-2.658* (-1.721)	0.021*** (17.236)	0.430*** (3.638)	-1.979 (-1.152)
Real Estate	0.008*** (20.963)	0.464*** (10.851)	-2.584*** (-4.480)	0.007*** (14.799)	0.364*** (6.130)	-1.404* (-1.735)	0.008*** (15.298)	0.540*** (9.171)	-3.324*** (-4.223)
Transportation	0.012*** (12.052)	0.398*** (4.780)	-2.391*** (-2.785)	0.012*** (8.535)	0.360*** (3.140)	-1.687 (-1.423)	0.011*** (8.830)	0.422*** (3.754)	-2.897*** (-2.684)
Abu Dhabi									
All Stocks	0.020*** (37.825)	0.506*** (4.589)	1.349 (0.435)	0.020*** (34.863)	0.530*** (5.682)	-2.109 (-1.182)	0.020*** (22.413)	0.499** (2.566)	4.182 (0.758)
Banks & Financials	0.017*** (27.743)	0.598*** (4.937)	0.295 (0.087)	0.016*** (23.412)	0.710*** (6.427)	-4.749** (-2.181)	0.017*** (17.013)	0.506*** (2.364)	4.641 (0.770)
Energy	0.015*** (14.903)	0.585*** (3.106)	-2.202 (-0.441)	0.014*** (11.816)	0.668*** (3.568)	-9.009*** (-2.642)	0.016*** (9.283)	0.632** (1.988)	2.504 (-0.297)
Construction	0.021*** (26.215)	0.389*** (2.746)	4.320 (1.195)	0.021*** (21.869)	0.256* (1.882)	4.217* (1.719)	0.020*** (16.228)	0.534** (2.208)	4.016 (0.624)
Consumer	0.032*** (20.304)	0.391 (1.572)	0.674 (0.115)	0.032*** (15.461)	0.435 (1.494)	-1.473 (-0.248)	0.032*** (13.438)	0.361 (0.916)	2.460 (0.251)
Telecom	0.010*** (16.496)	0.692*** (6.055)	-1.771 (-0.585)	0.010*** (12.715)	0.667*** (5.189)	-4.462* (-1.684)	0.010*** (10.430)	0.735*** (3.820)	0.296 (0.055)
Industrial	0.023*** (26.702)	0.403*** (2.749)	3.401 (0.891)	0.023*** (20.729)	0.310** (2.039)	2.991 (0.895)	0.023*** (17.743)	0.504** (2.121)	3.456 (0.543)
Insurance	0.024*** (31.445)	0.529*** (4.424)	2.869 (0.982)	0.024*** (23.257)	0.618*** (4.367)	-1.508 (-0.525)	0.024*** (21.778)	0.480*** (2.702)	5.935 (1.355)
Bahrain									
All Stocks	0.012*** (26.533)	1.056*** (9.210)	-9.635** (-2.236)	0.012*** (17.515)	1.083*** (5.922)	-13.522** (-2.110)	0.011*** (22.048)	1.044*** (7.378)	-6.240 (-1.035)
Banks & Financials	0.001* (1.813)	-0.013 (-0.199)	1.092 (0.762)	0.001 (1.472)	-0.045 (-0.445)	1.243 (0.685)	0.0005*** (9.725)	0.053*** (3.407)	-0.201 (-0.284)
Services	0.010*** (16.264)	1.142*** (6.372)	-16.057** (-1.982)	0.009*** (11.619)	1.423*** (5.178)	-32.96*** (-2.752)	0.011*** (11.096)	0.831*** (3.227)	2.746 (0.219)

Table 3 (continued)

Industry	Whole Sample			Down Market (Market index)			Up Market (Market index)		
	α_0	α_1	α_2	α_0	α_1	α_2	α_0	α_1	α_2
Tourism	0.015*** (6.863)	0.337 (0.581)	5.447 (0.244)	0.016*** (5.039)	-0.033 (-0.035)	16.140 (0.478)	0.012*** (5.146)	0.841 (1.306)	-8.869 (-0.308)
Qatar									
All Stocks	0.014*** (26.207)	0.496*** (4.615)	1.839 (0.671)	0.014*** (24.090)	0.402*** (4.035)	1.338 (0.710)	0.013*** (14.113)	0.540** (2.470)	3.770 (0.608)
Banking	0.013*** (21.548)	0.481*** (4.248)	2.084 (0.739)	0.013*** (19.181)	0.422*** (3.664)	1.417 (0.637)	0.013*** (12.313)	0.500** (2.259)	3.955 (0.637)
Industrials	0.013*** (18.619)	0.498*** (3.963)	2.079 (0.662)	0.013*** (17.468)	0.457*** (3.907)	0.300 (0.140)	0.012*** (10.097)	0.489* (1.954)	5.469 (0.787)
Real Estate	0.016*** (15.507)	0.458*** (2.754)	1.514 (0.411)	0.016*** (12.032)	0.377*** (2.151)	-0.458 (-0.148)	0.015*** (9.811)	0.542* (1.818)	5.281 (0.714)
Services	0.015*** (26.370)	0.473*** (4.373)	1.859 (0.697)	0.015*** (22.604)	0.330*** (3.133)	2.350 (1.292)	0.015*** (14.971)	0.564*** (2.616)	2.739 (0.452)
Insurance	0.015*** (23.033)	0.531*** (4.617)	1.782 (0.630)	0.016*** (20.489)	0.420*** (4.050)	1.492 (0.855)	0.014*** (12.512)	0.593** (2.514)	3.449 (0.523)
Kuwait									
All Stocks	0.016*** (49.119)	0.753*** (8.281)	-1.766 (-0.442)	0.016*** (37.146)	0.808*** (7.342)	-9.402** (-2.295)	0.016*** (43.056)	0.706*** (8.105)	8.682* (2.237)
Banks & Financials	0.014*** (39.535)	0.786*** (9.054)	-1.509 (-0.427)	0.014*** (29.903)	0.769*** (7.391)	-6.897** (-1.992)	0.014*** (31.549)	0.804*** (8.267)	6.534 (1.574)
Insurance	0.019*** (22.511)	0.408** (2.050)	11.698 (1.434)	0.020*** (15.395)	0.478* (1.712)	3.138 (0.319)	0.018*** (17.158)	0.415* (1.752)	18.118* (1.724)
Real Estate	0.017*** (32.952)	0.810*** (6.516)	0.542 (0.110)	0.017*** (22.680)	0.928*** (5.838)	-8.147 (-1.530)	0.017*** (28.017)	0.766*** (5.742)	8.958* (1.725)
Services	0.019*** (51.808)	0.606*** (6.654)	0.815 (0.217)	0.019*** (36.001)	0.692*** (5.756)	-8.372** (-2.108)	0.019*** (40.280)	0.534*** (4.826)	12.247** (2.509)
Industrials	0.018*** (46.268)	0.596** (6.916)	0.842 (0.252)	0.017*** (30.871)	0.693*** (5.292)	-7.166* (-1.676)	0.018*** (31.969)	0.517*** (3.890)	10.518* (1.778)
Non-national	0.001*** (6.798)	0.083** (2.240)	-0.858 (-0.575)	0.001*** (8.183)	0.026 (0.804)	0.561 (0.466)	0.001*** (4.434)	0.114** (2.175)	-1.123 (-0.515)
Telecom & IT	0.016*** (9.420)	0.974** (2.231)	-3.260 (-0.211)	0.014*** (6.650)	1.615*** (3.441)	-32.308** (-2.477)	0.016*** (7.546)	0.798* (1.667)	15.108 (1.232)
Oman									
All Stocks	0.013*** (49.435)	0.738*** (16.934)	0.779 (1.229)	0.013*** (31.304)	0.676*** (7.867)	0.027 (0.014)	0.012*** (31.702)	0.831*** (11.857)	0.742 (0.879)
Banks & Financials	0.013*** (39.732)	0.827*** (15.446)	-0.331 (0.444)	0.014*** (25.717)	0.722*** (7.222)	-0.621 (-0.273)	0.012*** (26.019)	0.953*** (11.444)	-0.629 (-0.781)
Industrial	0.014*** (33.254)	0.611*** (8.868)	1.993*** (2.656)	0.014*** (20.561)	0.647*** (4.602)	0.216 (0.102)	0.014*** (23.476)	0.631*** (7.173)	2.554** (2.197)
Services & Insurance	0.011*** (29.265)	0.735*** (14.608)	1.189 (1.531)	0.011*** (20.149)	0.630*** (6.920)	1.278 (0.670)	0.010*** (19.249)	0.846*** (11.173)	0.823 (0.825)

Note: Up and down market represents positive and negative movements in the stock market index. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

strong link between oil price movements and herd behavior. Once again, we find the strongest results in the Saudi market across all industries, with the greatest impact of oil prices on Real Estate and Petrochemicals. Moreover, we find herding to be more prevalent during extreme downward moves in oil prices indicated by higher negative values for β_4 ($|\beta_4| > |\beta_3|$ across all industries during down markets). This is not unexpected as bad news in the oil market would have a direct effect on Petrochemicals; however the impact on Real Estate is yet to be explored. We observe asymmetric oil effects in Financials, Media & Publishing and Tourism where herding is found to be more prevalent during extreme upward moves in oil prices.

In the case of Dubai, we find a consistent oil effect in Transportation with some effect on Real Estate and Insurance only during extreme upward moves in oil prices. One reason for this might be that a boom in oil prices strengthens investor optimism toward Real Estate and Insurance firms in Dubai, which in turn leads them to flock into investing in these firms without examining fundamentals, but instead by following the market consensus. In the case of more oil dependent economies of Abu Dhabi and Kuwait, we find that extreme upward moves in oil prices support herd formation in Financials, Industrials, Energy, and Construction. Similar findings

are found for Services in Bahrain where we observe herding to be more prevalent during extreme upward moves in oil prices. Once again, in the case of Qatar and Oman, we find no significant oil effect on herd behavior.

4.4. Implications for portfolio diversification

The return dispersion based methodologies proposed by Christie and Huang (1995) and Chang et al. (2000) consider firm-level volatility within industry portfolios during extreme market periods, and during up and down markets separately. Let r_{ijt} be the return on day t for firm j in industry i and suppose that the firm level return is generated by a model of the form

$$r_{ijt} = \beta_j r_{it} + \varepsilon_{ijt} \tag{4}$$

where r_{it} is the return on the industry portfolio for day t and ε_{ijt} is the firm specific error term with $E(\varepsilon_{ijt}) = 0$ and $\text{Var}(E(\varepsilon_{ijt})) = \sigma_{ij}^2$. The return dispersion measure for a given day in fact estimates the variance of the idiosyncratic error term at the firm level. Therefore, the linear and non-linear models based on return dispersions explore the behavior of idiosyncratic risk during different market

Table 4
Regression coefficients for $CSAD_t = \beta_0 + \beta_1|r_{m,t}| + \beta_2r_{m,t}^2 + \beta_3r_{m,t}^2D_t^U + \beta_4r_{m,t}^2D_t^D + \varepsilon_t$ (t-ratios in parentheses).

Industry	Whole Sample					Down Market (Market index)					Up Market (Market index)				
	β_0	β_1	β_2	β_3	β_4	β_0	β_1	β_2	β_3	β_4	β_0	β_1	β_2	β_3	β_4
Saudi Arabia															
All Stocks	0.004*** (23.82)	1.70*** (10.03)	-45.94*** (-6.71)	-59.93*** (-3.73)	-64.82 (-0.93)	0.005*** (18.10)	1.45*** (7.20)	-2.33*** (-5.86)	-45.64*** (-4.64)	-115.15*** (-4.64)	0.005*** (18.58)	0.79** (2.37)	153.21*** (3.07)	214.08 (0.71)	51.43* (1.71)
Banks & Financials	0.002*** (17.23)	1.31*** (9.82)	-30.21*** (-6.03)	-24.76** (-2.50)	54.60 (0.66)	0.003*** (14.28)	1.18*** (7.15)	-29.18*** (-9.499)	-16.65* (-1.68)	0.68 (0.00)	0.003*** (12.87)	0.61** (2.05)	115.38** (2.20)	230.25** (2.12)	174.37*** (6.23)
Petro-chemicals	0.005*** (19.76)	1.91*** (9.30)	-62.52*** (-6.89)	-58.59*** (-3.72)	-120.79 (-1.11)	0.005*** (14.43)	1.56*** (6.75)	-56.26*** (-6.76)	-38.71*** (-2.62)	-202.38*** (-6.87)	0.005*** (16.00)	0.87** (2.08)	183.21*** (3.26)	395.02 (1.11)	71.49* (1.86)
Cement	0.002*** (14.35)	1.38*** (10.56)	-25.88*** (-5.73)	-40.06*** (-5.51)	60.98** (2.32)	0.002*** (9.91)	1.35*** (6.91)	-26.00*** (-3.95)	-39.03*** (-3.88)	48.63 (1.45)	0.002*** (9.96)	1.18*** (4.36)	10.80 (0.28)	-6.84 (-0.03)	84.20*** (3.42)
Retail	0.005*** (19.89)	1.77*** (8.49)	-39.75*** (-4.94)	-75.84*** (-4.87)	-108.80*** (-2.75)	0.006*** (15.17)	1.50*** (6.12)	-37.40*** (-4.19)	-64.04*** (-4.41)	-118.49*** (-4.53)	0.006*** (15.04)	0.45 (1.07)	208.58*** (3.82)	593.12 (0.95)	-82.93** (-2.40)
Utilities	0.004*** (16.97)	1.82*** (9.48)	-42.87*** (-5.97)	-67.39*** (-5.84)	-159.37*** (-2.93)	0.004*** (12.03)	1.59*** (5.87)	-35.61*** (-3.62)	-57.78*** (-4.27)	-192.17*** (-6.06)	0.004*** (11.16)	1.80*** (4.39)	0.26 (0.00)	222.11 (0.29)	-70.87** (-1.97)
Agriculture & Food	0.006*** (21.82)	1.89*** (8.16)	-56.25*** (-6.78)	-95.05*** (-4.96)	-89.64 (-0.86)	0.007*** (16.41)	1.52*** (5.49)	-48.88*** (-4.73)	-75.86*** (-3.89)	-168.18*** (-5.60)	0.006*** (15.45)	0.98** (1.96)	161.17** (2.00)	176.22 (0.53)	94.92* (1.92)
Telecom. & IT	0.003*** (12.81)	1.25*** (6.85)	-25.21*** (-4.04)	-24.67** (-2.01)	-34.35 (-0.29)	0.003*** (10.86)	1.04*** (4.87)	-20.13** (-2.55)	-13.73 (-1.07)	-162.64*** (-7.23)	0.003*** (8.91)	0.63 (1.60)	119.40** (2.29)	57.40 (0.51)	83.18** (2.78)
Insurance	0.006*** (9.76)	1.28** (2.14)	-36.90* (-1.95)	-46.02 (-1.38)	47.95 (0.53)	0.006*** (10.04)	0.68 (1.34)	-20.40 (-1.14)	-13.97 (-0.47)	33.49 (0.59)	0.008** (9.06)	-1.06 (-1.26)	403.26*** (4.89)	273.18** (2.03)	36.33 (0.70)
Holding	0.007*** (22.68)	1.74*** (7.18)	-43.14*** (-4.01)	-60.14** (-1.80)	-172.14 (-2.34)	0.007*** (17.23)	1.40*** (5.20)	-39.95*** (-4.11)	-36.20 (-1.05)	-208.12*** (-5.04)	0.007*** (18.03)	0.28 (0.60)	263.44*** (3.84)	-232.83* (-1.81)	-89.70** (-2.29)
Industrials	0.005*** (20.41)	1.63*** (8.42)	-43.69*** (-5.37)	-51.12*** (-3.42)	-58.91 (-1.16)	0.005*** (14.71)	1.43*** (6.16)	-41.38*** (-5.12)	-39.43*** (-2.80)	-91.06*** (-3.08)	0.005*** (15.43)	0.62 (1.49)	167.64*** (2.62)	513.44 (0.93)	16.40 (0.42)
Construction	0.004*** (20.980)	1.77*** (9.44)	-45.80*** (-5.36)	-71.21*** (-3.23)	-96.55*** (-1.20)	0.005*** (15.30)	1.46*** (6.89)	-42.02*** (-5.64)	-55.24** (-2.54)	-157.34*** (-6.50)	0.005*** (16.82)	0.74** (2.05)	168.99*** (3.35)	166.91 (0.39)	44.62 (1.47)
Real Estate	0.004*** (17.89)	1.94*** (9.39)	-56.31*** (-6.53)	-64.05*** (-2.87)	-138.26 (-1.30)	0.005*** (13.57)	1.66*** (6.79)	-51.93*** (-5.85)	-45.67* (-1.89)	-236.52*** (-8.81)	0.005*** (13.85)	0.96** (2.30)	163.50*** (2.90)	-139.47 (-0.43)	84.01** (2.42)
Transport.	0.005*** (18.30)	1.98*** (8.56)	-55.46*** (-6.88)	-76.47*** (-4.64)	-112.21 (-1.20)	0.006*** (13.95)	1.63*** (5.65)	-49.49*** (-4.67)	-57.64*** (-3.36)	-177.50*** (-5.40)	0.005*** (14.11)	0.94** (2.06)	175.06*** (2.61)	206.13 (0.29)	43.22 (0.96)
Media & Publishing	0.005*** (12.58)	1.27*** (4.45)	-33.64*** (-3.34)	-57.07*** (-3.98)	90.93 (1.16)	0.006*** (9.89)	1.13*** (3.05)	-30.27** (-2.30)	-45.38** (-2.54)	8.45 (0.22)	0.006*** (7.97)	0.50 (0.74)	125.13 (1.57)	-803.18*** (-8.18)	154.94*** (4.16)
Tourism	0.006*** (20.32)	1.63*** (6.78)	-46.38*** (-5.30)	-70.82** (-2.49)	-103.45 (-1.22)	0.007*** (14.88)	1.28*** (4.57)	-39.49*** (-3.76)	-50.32* (-1.73)	-125.11 (-1.24)	0.007*** (14.64)	0.74 (1.42)	171.40** (2.11)	155.05 (0.12)	-43.73 (-0.92)
Dubai															
All Stocks	0.010*** (28.673)	0.561*** (16.327)	-2.858*** (-5.918)	1.440** (2.058)	-3.719** (-2.310)	0.011*** (19.455)	0.464*** (8.546)	-1.994** (-2.342)	-2.672*** (-3.386)	-2.759 (-1.595)	0.010*** (21.255)	0.647*** (14.618)	-3.463*** (-6.266)	1.126* (1.670)	0.215 (0.070)
Banks & Financials	0.010*** (27.133)	0.521*** (14.394)	-1.956*** (-3.555)	0.877 (1.151)	-2.270 (-1.115)	0.010*** (18.446)	0.456*** (7.513)	-1.479 (-1.409)	3.300*** (3.925)	-1.855 (-0.907)	0.010*** (20.264)	0.582*** (13.108)	-2.280*** (-4.259)	0.350 (0.460)	9.916** (2.452)
Insurance	0.021*** (18.321)	0.398*** (4.125)	-2.222* (-1.798)	3.690** (2.058)	1.648 (0.296)	0.020*** (11.131)	0.359** (2.4710)	-1.799 (-0.974)	-17.57*** (-10.284)	1.736 (0.3120)	0.021*** (14.728)	0.455*** (3.492)	-2.696 (-1.631)	4.166*** (3.244)	25.993 (0.591)
Real Estate	0.008*** (18.2770)	0.445*** (9.500)	-2.614*** (-4.387)	2.411*** (4.303)	-2.508 (-1.171)	0.008*** (13.227)	0.363*** (5.604)	-1.699** (-2.065)	-4.326*** (-4.419)	-1.699 (-0.765)	0.008*** (12.918)	0.514*** (7.870)	-3.240*** (-3.963)	2.326*** (3.672)	5.425 (0.503)
Transportation	0.012*** (10.438)	0.447*** (4.425)	-2.913*** (-3.005)	-11.48*** (-5.771)	-5.337*** (-3.321)	0.012*** (7.517)	0.458*** (3.154)	-2.940** (-2.075)	-10.17*** (-4.892)	-5.315*** (-2.955)	0.012*** (7.187)	0.448*** (3.227)	-3.022** (-2.389)	-12.82*** (-6.370)	-19.24** (-1.979)
Abu Dhabi															
All Stocks	0.020*** (30.211)	0.481*** (3.385)	3.732 (0.940)	-8.295*** (-3.061)	-1.929 (-0.540)	0.019*** (28.157)	0.537*** (4.246)	-2.447 (-1.027)	15.56*** (2.858)	1.558 (0.516)	0.022*** (24.439)	0.210 (1.256)	10.810** (2.206)	-13.31*** (-4.684)	19.333 (1.209)
Banks & Financials	0.017*** (23.067)	0.595*** (4.063)	2.435 (0.585)	-9.017*** (-3.522)	-2.687 (-0.681)	0.016*** (19.450)	0.769*** (5.685)	-5.158* (-2.046)	5.644 (1.143)	-0.220 (-0.071)	0.018*** (18.480)	0.244 (1.289)	10.795** (1.969)	-13.69*** (-4.340)	24.708 (1.093)
Energy	0.016*** (11.797)	0.351 (1.304)	4.236 (0.498)	-8.301* (-2.223)	-2.090 (-0.403)	0.015*** (10.024)	0.561** (2.446)	-9.741** (-2.407)	23.498** (2.272)	6.258** (1.968)	0.018*** (9.463)	0.029 (0.087)	16.030* (1.987)	-17.29*** (-3.064)	32.878** (2.236)

Construction	0.021*** (23.117)	0.337** (2.575)	6.009* (1.879)	-12.35*** (-5.358)	-0.582 (-0.191)	0.021*** (17.079)	0.204 (1.205)	4.426 (1.586)	22.535 (2.665)	2.998 (1.057)	0.021*** (19.626)	0.303* (1.897)	9.126** (2.306)	-16.64*** (-7.700)	12.503 (0.640)
Consumer	0.031*** (16.528)	0.409 (1.462)	1.043 (0.143)	-10.69*** (-2.635)	-1.227 (-0.242)	0.031*** (12.412)	0.598* (1.814)	-5.745 (-0.888)	-17.683 (-1.190)	-0.028 (-0.006)	0.033*** (12.628)	-0.055 (-0.124)	13.448 (1.156)	-16.37*** (-2.619)	114.72*** (3.741)
Telecom	0.011*** (13.752)	0.499*** (3.285)	3.941 (0.850)	-4.559 (-1.456)	-7.829** (-2.360)	0.010*** (11.845)	0.604*** (4.426)	-2.849 (-1.205)	21.787*** (3.275)	-4.068 (-1.560)	0.012*** (10.668)	0.245 (1.138)	11.728* (1.935)	-10.08*** (-2.882)	15.919 (1.495)
Industrial	0.024*** (23.961)	0.395** (2.443)	3.104 (0.740)	-4.211* (-1.715)	1.427 (0.258)	0.023*** (16.754)	0.446** (2.202)	-0.267 (-0.054)	-5.943 (-1.054)	3.667 (0.624)	0.024*** (17.404)	0.322 (1.387)	5.762 (0.988)	-5.798* (-1.758)	-8.786 (0.736)
Insurance	0.025*** (27.242)	0.499*** (3.780)	4.663 (1.227)	-3.686 (-1.088)	2.136 (0.474)	0.024*** (18.793)	0.615*** (3.587)	-1.367 (-0.308)	36.074*** (3.405)	4.949 (1.027)	0.026*** (20.664)	0.232 (1.285)	11.117*** (2.591)	-8.646*** (-3.541)	22.92** (2.095)
Bahrain															
All Stocks	0.012*** (29.089)	1.166*** (9.706)	-12.93*** (-3.106)	5.483 (0.355)	64.138* (1.867)	0.011*** (20.115)	1.321*** (6.473)	-18.99*** (-2.875)	-25.67*** (-3.799)	59.517* (1.670)	0.012*** (20.116)	1.067*** (7.292)	-8.864* (-1.665)	26.474*** (10.394)	86.338*** (8.007)
Banks & Financials	0.0005*** (11.898)	0.066*** (4.855)	-0.653 (-1.157)	-0.041 (-0.064)	0.422 (0.140)	0.000*** (7.796)	0.084*** (3.634)	-1.147 (-1.282)	-1.537 (-1.602)	0.333 (0.095)	0.000*** (8.662)	0.057*** (3.461)	-0.406 (-0.577)	0.922*** (2.618)	-4.926*** (-3.615)
Services	0.010*** (14.620)	1.160*** (6.143)	-15.521** (-1.988)	26.503 (1.005)	82.478*** (3.546)	0.009*** (10.7130)	1.567*** (5.170)	-33.93*** (-2.696)	-22.62** (-2.838)	59.672*** (3.260)	0.011*** (9.720)	0.814*** (3.138)	1.372 (0.124)	57.470*** (9.204)	300.459*** (14.441)
Tourism	0.014*** (5.949)	0.607 (0.908)	-4.200 (-0.166)	-50.396 (-0.579)	16.644 (0.190)	0.015*** (3.963)	0.521 (0.391)	-4.658 (-0.098)	22.892 (0.144)	16.928 (0.178)	0.013*** (4.894)	0.803 (1.378)	-7.231 (-0.267)	-141.73*** (-3.565)	-1320.1*** (-6.308)
Qatar															
All Stocks	0.013*** (25.380)	0.650*** (6.927)	-2.117 (-1.021)	7.905** (2.532)	8.134*** (5.304)	0.014*** (20.4540)	0.390*** (3.351)	1.619 (0.830)	17.907* (1.879)	7.866*** (4.857)	0.012*** (17.835)	0.874*** (7.086)	-6.071** (-2.008)	9.097*** (2.689)	-7.253 (-1.360)
Banking	0.012*** (19.785)	0.653*** (6.302)	-2.174 (-0.957)	8.102** (2.108)	10.648*** (5.591)	0.013*** (16.433)	0.427*** (3.242)	1.320 (0.567)	33.468*** (2.620)	10.249*** (4.956)	0.012*** (13.778)	0.851*** (6.719)	-6.165** (-2.153)	9.575** (2.412)	-5.565 (-0.833)
Industrials	0.012*** (17.955)	0.681*** (6.660)	-3.091 (-1.443)	12.545*** (5.345)	8.509*** (3.854)	0.014*** (15.453)	0.445*** (3.193)	0.093 (0.038)	53.381*** (2.822)	8.289*** (3.457)	0.010*** (11.081)	0.884*** (6.414)	-6.370** (-1.975)	13.404*** (4.777)	0.334 (0.021)
Real Estate	0.015*** (14.381)	0.605*** (4.325)	-3.517 (-1.384)	12.410*** (4.230)	5.087*** (3.166)	0.016*** (10.388)	0.308 (1.573)	0.280 (0.075)	-7.450 (-0.014)	4.917** (2.321)	0.014*** (9.751)	0.883*** (4.561)	-7.128*** (-2.990)	12.577*** (4.457)	54.531*** (7.681)
Services	0.014*** (24.186)	0.616*** (6.073)	-1.616 (-0.731)	6.492** (2.009)	7.405*** (5.324)	0.015*** (19.162)	0.337*** (2.810)	2.583 (1.509)	13.055* (2.527)	7.177*** (5.419)	0.014*** (17.757)	0.868*** (6.929)	-6.407** (-2.185)	8.115** (2.393)	-44.711*** (-11.287)
Insurance	0.014*** (21.048)	0.691*** (6.541)	-1.828 (-0.836)	4.574 (1.047)	6.752*** (4.553)	0.016*** (17.656)	0.382*** (3.216)	2.230 (1.314)	-4.902 (-0.308)	6.363*** (5.819)	0.013*** (12.992)	0.933*** (5.354)	-5.267 (-1.143)	5.100 (1.010)	65.655*** (16.262)
Kuwait															
All Stocks	0.016*** (37.367)	0.861*** (7.243)	-3.860 (-0.744)	7.832 (0.516)	-0.254 (-0.066)	0.016*** (27.718)	1.088*** (7.572)	-18.62*** (-3.606)	-1.092 (-0.504)	8.117** (1.985)	0.016*** (35.492)	0.760*** (7.587)	6.544* (1.713)	43.252 (0.868)	-11.503 (-1.468)
Banks & Financials	0.014*** (31.075)	0.886*** (8.137)	-2.970 (-0.680)	-0.917 (-0.075)	-2.478 (-0.623)	0.013*** (23.481)	0.990*** (7.477)	-13.64*** (-3.448)	-6.035*** (-2.592)	5.296 (1.366)	0.014*** (24.932)	0.872*** (7.656)	3.786 (0.932)	25.571 (0.586)	-11.603 (-0.712)
Insurance	0.020*** (18.243)	0.368* (1.648)	16.685* (1.908)	-15.938 (-0.428)	-0.854 (-0.064)	0.020*** (11.310)	0.677* (1.876)	4.717 (0.423)	-51.17*** (-9.400)	2.993 (0.212)	0.020*** (14.252)	0.271 (1.001)	20.588* (1.924)	251.578*** (8.912)	-38.824** (-1.766)
Real Estate	0.016*** (24.712)	1.004*** (6.211)	-3.765 (-0.578)	32.280 (1.358)	-3.259 (-0.6410)	0.015*** (15.874)	1.310*** (6.664)	-20.46*** (-3.502)	21.082*** (6.353)	4.997 (1.017)	0.016*** (22.505)	0.879*** (5.505)	5.450 (0.950)	73.375 (0.865)	-6.438 (-0.413)
Services	0.019*** (40.307)	0.669*** (5.840)	0.394 (0.085)	10.860** (2.560)	0.449 (0.083)	0.018*** (27.587)	0.999*** (6.448)	-18.99*** (-3.959)	11.290*** (4.664)	10.671* (1.852)	0.019*** (32.069)	0.559*** (4.317)	11.238** (2.287)	20.596* (1.869)	-23.855 (-0.958)
Industrials	0.017*** (37.411)	0.661*** (6.531)	0.447 (0.116)	16.825 (0.492)	-1.003 (-0.349)	0.016*** (23.351)	0.868*** (5.177)	-11.521** (-2.102)	-11.45*** (-4.107)	5.489* (1.712)	0.017*** (26.433)	0.621*** (4.113)	7.641 (1.209)	-1.881 (-0.417)	-16.89*** (-4.489)
Non-national	0.001*** (4.426)	0.098** (1.966)	-1.219 (-0.603)	-6.548*** (-3.584)	-0.663 (-0.745)	0.001*** (6.252)	0.044 (0.930)	0.097 (0.052)	-3.823*** (-5.156)	-0.138 (-0.140)	0.001*** (3.008)	0.124* (1.863)	-1.599 (-0.590)	-11.675** (-2.142)	-0.915 (-0.128)
Telecom & IT	0.016*** (7.924)	0.814* (1.792)	6.440 (0.426)	5.710 (0.263)	-9.844 (-0.951)	0.014*** (4.890)	1.589*** (2.670)	-31.393* (-1.828)	-10.321 (-1.222)	6.039 (0.681)	0.015*** (5.945)	0.720 (1.295)	18.459 (1.440)	77.963 (0.929)	-6.405 (-0.385)
Oman															
All Stocks	0.013*** (31.307)	0.755*** (6.803)	-0.280 (-0.076)	3.606 (1.577)	23.865 (1.461)	0.014*** (29.829)	0.708*** (9.994)	-2.238 (-1.115)	26.435 (1.342)	30.910* (1.720)	0.013*** (18.365)	0.721*** (3.537)	3.386 (0.490)	-0.136 (-0.036)	-12.314** (-2.327)
Banks & Financials	0.013*** (26.069)	0.867*** (6.890)	-2.095 (-0.516)	3.403 (1.387)	3.377 (0.602)	0.014*** (22.987)	0.778*** (8.483)	-3.283 (-1.384)	22.682 (1.016)	9.581 (1.524)	0.013*** (15.243)	0.874*** (3.688)	0.750 (0.095)	-0.023 (-0.005)	-18.97*** (-4.362)

(continued on next page)

Table 4 (continued)

Industry	Whole Sample				Down Market (Market index)				Up Market (Market index)						
	β_0	β_1	β_2	β_3	β_4	β_0	β_1	β_2	β_3	β_4	β_0	β_1	β_2	β_3	β_4
Industrial	0.015*** (26.450)	0.547*** (4.613)	2.895 (0.7960)	9.775*** (2.652)	88.591 (1.346)	0.015*** (20.783)	0.616*** (6.084)	-0.983 (-0.501)	79.237 (1.101)	98.268 (1.349)	0.015*** (18.018)	0.394*** (2.017)	8.855 (1.398)	3.961 (1.143)	15.060 (1.261)
Services & Insurance	0.011*** (20.492)	0.782*** (7.123)	-0.569 (-0.168)	-0.184 (-0.094)	7.576 (0.976)	0.012*** (16.989)	0.689*** (7.749)	-1.715 (-0.824)	10.276 (0.819)	14.785* (1.764)	0.011*** (13.166)	0.794*** (4.226)	2.180 (0.364)	-3.279 (-1.001)	-23.56*** (-3.123)

Note: Up and down market represents positive and negative movements in the stock market index. Dummy variables D_t^U (D_t^D) represent extreme up (down) movements in the price of crude oil on day t . ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

conditions. Since these methodologies examine firm level volatility, these tests have significant implications for investors who are currently undiversified. Finding evidence of herding using these methodologies suggests that currently undiversified investors would need to include a larger number of assets in their portfolios in order to achieve a certain desirable level of diversification. In other words, comparing a market where this methodology rejects the existence of investor herds, investors in the Taiwanese market would need to invest in more stocks in order to reduce the same amount of firm specific risk. However, for those investors who are not concerned about diversification, such as style investors or funds that concentrate on certain sectors, this would be good news as they would be able to achieve the same sector specific performance they desire by investing in fewer stocks in each industry.

5. Conclusions and suggestions for future research

The economies of the Gulf Cooperation Council (GCC) countries have experienced tremendous growth during much of the 2000's thanks to the boom in oil prices. Flush with petrodollars, policy makers in these countries have implemented structural reforms in order to enhance the efficiency of financial markets and heavily invested in the domestic infrastructure in order to reduce their economies' dependence on oil exports. Furthermore, these countries recycled their revenues from energy exports by heavily investing in foreign assets, either through sovereign investment funds or private funds, bolstering their position as a key player in international markets. As a result, the GCC markets have not just become more attractive to foreign investors, and thus, been able to draw high levels of foreign direct investment, but also become more important in the global financial arena and attracted an increasing number of key financial players.

The growing interest by foreign investors into their equity markets, the emerging nature of financial institutions and increasing participation by domestic investors make it especially interesting to examine the informational efficiency of these markets. In this paper, we examine the investment behavior of market participants in seven GCC stock markets. More specifically, we use firm level data from GCC stock markets and study whether investors in different industries exhibit herd behavior. The second contribution of this study is to examine the effect of oil prices on the formation of investor herds in these markets. For this purpose, we modify a model suggested by Chang et al. (2000) and test the asymmetric effects of oil price shocks on herd behavior in these markets.

Our findings support the existence of investor herds in all the GCC countries with the exception of Oman and Qatar. We find the strongest evidence for herding across all industries in the Saudi market which happens to be the dominant market in the union in terms of market capitalization and the number of transactions. The evidence for herding in other countries are found to be more industry specific such as Real Estate in Dubai; Energy and Financials in Abu Dhabi; and Financials and Industrials in Kuwait. We find herding to be more prevalent during periods of market losses, possibly indicating loss aversion by traders. Furthermore, we find significant oil price effects on the formation of herds among investors, more consistently during extreme upward moves in oil prices. This might indicate that investors follow oil market movements, rather than firm specific fundamentals, in order to make investment decisions in these markets. An unexpected boom in oil prices strengthens investor optimism toward these markets which in turn leads them to flock into investing in these firms without looking into their fundamentals, but instead by following market consensus. In short, our findings suggest that investors' tendency to act as a herd in these markets is significantly affected by the

developments in the oil market.

This study provides the initial evidence in the literature suggesting a link between oil market signals and investor behavior in equity markets. As our results are based on return dispersion based testing methodologies, one possible extension is to employ other testing methodologies suggested in the literature and compare with our findings. Similarly, trade data for domestic and foreign investors could be used in order to see how the balance of buy and sell orders change given signals from the oil market.

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