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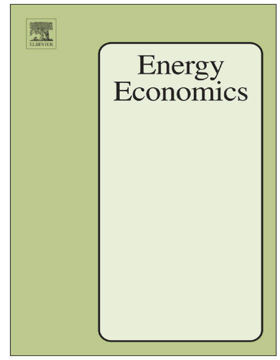

Qi Zhu, Sisi Jin, Yuxuan Huang, Cheng Yan

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Oil Price Uncertainty and Stock Price Informativeness: Evidence from Listed U.S. Companies

Qi Zhu[1] zhuqi1212@csu.edu.cn, Sisi Jin[1] jinsisi@csu.edu.cn, Yuxuan Huang[2,*] huangyuxuan@hnu.edu.cn and Cheng Yan[3,*] cheng.yan@essex. ac.uk

[1]Business School, Central South University

[2]Business School, Hunan University

[3]Essex Business School, University of Essex

[*]Corresponding authors at.: School, Hunan University, Changsha, China. Cheng Yan is associate professor, Essex Business School, Essex, United Kingdom

Abstract

This paper examines the relationship between oil price uncertainty and stock price information for managerial decision making. Under the investment-q sensitivity framework, we use the data of listed U.S. companies from 2008 to 2020 and find that oil price uncertainty has a positive impact on investment-q sensitivity that is mainly driven by the crowding of informed traders and the promotion of managerial learning. The interrelation between oil price uncertainty and investment-q sensitivity is more remarkable for firms with uncorrelated product demand with that of their peers, stronger CEO concerns and greater CEO equity incentives. Furthermore, we provide evidence that oil price uncertainty can enhance investment-q sensitivity, especially for firms in highly oil-intensive industries and non-oil-producing states. Overall, our research illustrates how oil price uncertainty affects stock price informativeness for firms' decision making.

JEL Classifications: G12, G14, M40; M41

Keywords: Oil price uncertainty; stock price informativeness; investment; Tobin's q; managerial learning.

1. Introduction

Over the past decade, crude oil prices have experienced unprecedented volatility and attracted worldwide attention (Aye et al., 2014). There is no doubt that crude oil prices affect the development of the microeconomy in many ways, and this fact has drawn many scholars to explore the impact of oil price uncertainty on the capital market. For instance, Bernanke (1983) and Pindyck (1991) first state that oil price uncertainty increases the value of defer options and consequently curbs the level of corporate investment. It has also been discovered that oil price uncertainty has a significant influence on stock returns (Xiao et al., 2018), debt costs (Haushalter et al., 2002), corporate leverage (Fan et al., 2021), and cash holdings (Zhang et al., 2020; Wu et al., 2021). In our paper, we further explore the effect of oil price uncertainty on firms' decision making and investors' reactions.

According to traditional efficient market theory, stock prices are the key to resource allocation in the capital market, and they potentially affect corporate investment decisions (Fama, 1970). Prices are formed by investors' ongoing transactions and the incorporate information owned by these investors. This information includes macroeconomic information, consumer demand information and so on (Dow and Gordon，1997). Although managers possess good knowledge of firms' internal information, they still do not know all firm information, especially external information that may be included by outside investors. Therefore, managers have an incentive to learn from stock prices to make proper investment decisions. Bond et al. (2012) state that stock prices can transmit the private information used by investors that managers unknown to managers, and they denote this concept as "revelatory price efficiency" (RPE). A large number of studies take investment-q sensitivity as a proxy to indirectly measure the degree to which managers learn from stock prices. Some studies probe the factors affecting investment-q sensitivity from the perspectives of stock price informativeness and insider trading (Chen et al., 2007; Edmans et al., 2017). However, few studies investigate the impact of oil price uncertainty on stock price information.

Oil price uncertainty is an important economic variable that affects the capital market, potentially influencing informed traders' private information and trading environments. Oil price uncertainty strengthens the information advantage of informed traders and enhances their trading motivations. When oil prices become highly uncertain, a firm's stock value may stray from its fundamentals (Haushalter et al., 2002). Informed traders can identify this deviation and profit from it through their professional information collection and analysis capabilities. Thus, informed traders possess increased motivation to participate in market transactions and promote stock price informativeness. Additionally, oil price uncertainty can encourage managers to learn from the market. In the face of oil price uncertainty, managers are not familiar with market information. They are inclined to seek more market information to make correct investment decisions (Chong and Chong, 1997). The findings of Gul and Chia (1994) confirm that when the external environment is highly uncertain, managers are likely to seek more external information to address the environmental complexity. Hence, managerial learning encourages a higher level of investment sensitivity to stock prices.

Our paper takes listed U.S. firms from 2008 to 2020 as samples to empirically examine the relationship between oil price uncertainty and investment-q sensitivity. The empirical results show that oil price uncertainty enhances investment-q sensitivity. This indicates that oil price uncertainty can stimulate the enthusiasm of outside investors to gather information and increase the private information conveyed to managers about stock prices.

However, our results may be driven by missing unobservable heterogeneity. To prevent potential endogeneity problems, our paper adopts three methods for conducting robustness checks. First, we employ the instrumental variable method. We take the number of hurricanes per year in the United States as a tool variable to test whether our studies neglect important variables. The results of the two-stage regression are significant, indicating that oil price uncertainty does indeed promote investment-q sensitivity. Second, we apply a high-dimensional fixed effect to control the time-varying heterogeneity across industries or specific state-specific time trends. Third, we exclude the sample of the 2008 financial crisis and re-estimate the benchmark regression. Relevant studies show that managers have stronger motivations to learn from the market when faced with financial crises, which may affect our results (Huang et al., 2021). Overall, our empirical results are consistent with the basic empirical results, suggesting that our results are robust.

Our research provides four contributions as follows. First, we contribute to the researches on the influence of oil price uncertainty on stock market information. Previous studies mainly focus on the mechanism by which oil price uncertainty impacts corporate investment and financing decisions, such as real options or financial frictions, stock price volatility, internal cash flows and financing constraints

(Henriques and Sadorsky, 2011; Doshi et al., 2014; Wu et al., 2021). Few papers study how oil price uncertainty influences firms' behaviors; however, our paper provides a novel perspective on revelatory price efficiency.

Second, our paper is a supplement to the problem of market efficiency and managerial learning. Previous literatures concentrate on analyzing the factors that affect the sensitivity of investment to stock price, such as mergers and acquisitions, mandatory information disclosure, insider trading and corporate social responsibility (Bhandari and Javakhadze, 2017; Ouyang and Szewczyk, 2018; Jang et al., 2020; Edmans et al., 2017; Huang et al., 2021). Our research shows that oil price uncertainty is one of the components that affect the investment-q sensitivity as well.

Third, our research expands the relationship between oil price uncertainty and extreme risks. It is widely acknowledged that extreme events, such as the global COVID-19 pandemic and terrorist attacks, have caused enormous losses to the international economy and exacerbated oil price volatility. We find that oil price uncertainty has captured the existence of extreme events.

Fourth, our paper has strong policy implications. On the one hand, oil price uncertainty inhibits firm investment level. The reduction of investment affects the future reproduction of firms, and slows down economic growth at the micro and macro levels. Therefore, market investors should fully consider the risks of the oil market and take measures to deal with the impact of uncertainty on the investment environment in advance. On the other hand, oil price uncertainty improves the investment efficiency of firms. Managers should make the best investment decisions according to the market changes.

The subsequent structure of this paper is organized as follows. Section 2 reviews the relevant literature and proposes our hypothesis. Section 3 presents the data and methodology, while Section 4 displays our empirical results. Section 5 is our conclusion.

2. Literature review and hypothesis

2.1 Literature review on oil price uncertainty

As the core source of global energy and one of the essential input factors of social production, crude oil plays an irreplaceable role in economic development. However, over the past decade, crude oil prices have experienced unprecedented fluctuations.

Prior studies have suggested that with the financialization of crude oil, investors' speculation is a potential cause of oil price uncertainty (Czudaj, 2019; Joëts, 2015). Additionally, supply and demand, economic policies and other factors can also lead to uncertain oil prices (Uddin et al, 2018).

As the oil market is becoming more closely related to the financial market, oil price uncertainty can have a significant impact on microeconomic activities. Numerous studies focus on the influence of oil price uncertainty on corporate investment decisions (e.g., Maghyereh and Abdoh, 2020; Phan et al., 2019; Yoon and Ratti, 2011; Henriques and Sadorsky, 2011). For example, Phan et al. (2019) explain the impact of oil price changes on corporate investment from the perspectives of "supply channels" and "demand channels". From the perspective of "supply channels", rising crude oil prices lead to an increase in the marginal cost of production. From the perspective of "demand channels", rising oil prices reduce consumer expenditures, thereby contributing to a faltering demand for corporate products. As a result, the cash flows of enterprises decrease, and enterprises are forced to abandon or postpone some investment projects (Pindyck, 1991). Thus, oil price uncertainty restrains corporate investment expenditures. Bernanke (1983) and Pindyck (1991) argue that uncertainty raises the value of the waiting options and that firms delay investments until new information emerges. Yoon and Ratti (2011) find that higher oil price uncertainty makes corporations more cautious regarding investment decision making and consequently reduces capital expenditures.

Additionally, a growing number of studies document that oil price uncertainty has a material impact on corporate capital structures. Fan et al. (2021) propose that oil price uncertainty may give rise to a bank credit shortage; thus, firms are obliged to lower their debt ratios. Haushalter et al. (2002) discover that firms with higher debt ratios are more adversely influenced by uncertainty. Gupta and Krishnamurti (2018) propose that oil price uncertainty pushes up corporate risk aversion. Firms faced with high oil price uncertainty tend to head off risk and degrade their levels of risk-taking. In addition, Zhang et al. (2020) examine the relationship between oil price uncertainty and the cash holdings of firms. They suggest that firms confronted with oil price uncertainty often hold more cash in case of unexpected needs due to precautionary motives.

Overall, the significant impact of oil price uncertainty on corporate investment and financial decisions has been widely acknowledged.

2.2 Literature review on investment-q sensitivity

Stock price information is the theoretical foundation of investment-q sensitivity. Fama (1970) proposes the “efficient market hypothesis” stating that in fully functional and competitive stock markets, all valuable information is fully reflected in stock prices. This information includes the current and future values of the firms. Financial markets gather many investors with various types of information. Prices aggregate information through these investors’ continuous trading actions and then form an assessment of corporate value (Bond et al., 2012). Hence, Bond et al. (2012) believe that price reflects fundamental corporate information and predicts future cash flow. They term this concept as “forecasting price efficiency” (FPE). However, Dow and Gorton (1997) note that price not only contains fundamental information but also reflects information that managers do not know, e.g., the effects of historical corporate decisions and future investment opportunities. Bond et al. (2012) denote this scenario as “revelatory price efficiency” (RPE). It is widely acknowledged that RPE can reflect the private information owned by informed traders and guide managerial decision making (Edmans et al., 2017). And the value of a market lies in RPE, that is, the amount of unknown information that stock prices reveal to managers (Jayaraman and Wu, 2019).

Market efficiency strengthens with the increase in stock price information and managerial learning motivation; this is manifested as an increase in investment-q sensitivity (Chen et al., 2007; Foucault and Frésard, 2012). Chen et al. (2007) employ the informed trading probability (PIN) metric to measure stock price informativeness and find a positive relationship between stock price informativeness and investment-q sensitivity. And Jiang et al. (2011) find that investment-q sensitivity increases if managers have a stronger propensity to learn from the market. Additionally, the increase in the number of informed traders in the market can also strengthen investment-q sensitivity. Informed traders communicate their private information to the stock market through arbitrage, and consequently, the information contained in stock prices increases (Easley et al., 1996). The improvement of stock price informativeness contributes to stronger managerial learning motivation, thus strengthening investment-q sensitivity (Edmans et al., 2017; Chen et al., 2007).

2.3 Hypothesis development

Oil price uncertainty crowds in informed traders and has a significant impact on stock price informativeness. Based on previous analyses, the increase in the private information of informed traders contained in stock prices indicates that managers can obtain more useful information from stock prices. Oil price uncertainty improves the information advantage of informed traders because an increase in oil price uncertainty causes firms' market values to deviate from their fundamental values. The market responds to new information, which may affect the production cost of an enterprise (Pantzalis et al., 2000). Miller (1977) finds that uninformed traders up against uncertainty may bid up stock prices so that they exceed their fundamental values. A study conducted by Singleton (2014) supports the theory that oil price uncertainty leads to price drifts away from fundamental values. Informed traders know the real values of companies and can identify the value deviations because they specialize in gathering and analyzing information and combining it with the current macroeconomic situation. Thus, informed traders can gain benefits by transacting on information that the market and management do not know. Accordingly, they have stronger motivations to participate in market transactions and increase the private information contained in stock prices. Fricke et al. (2014) discover that informed traders in uncertain environments are motivated to collect more unknown market information to obtain expected returns. Gao et al. (2019) also find that the informed trading volume adds when people are faced with higher uncertainty. Therefore, oil price uncertainty consequently affects stock price informativeness and investment-q sensitivity via influencing the behaviors of informed traders.

Furthermore, oil price uncertainty encourages managers to learn from stock prices. Managers have an advantage in terms of firm-specific information, such as technical expertise (Jiang et al., 2011). However, in regard to market-wide information, they forfeit this advantage. Oil price uncertainty is one of the factors leading to macroeconomic risks. When macroeconomic risks occur, market information is more vital than firm-specific information. However, managers may not be able to judge the macroeconomic situation in time and fail to identify the deviations of stock prices when confronted with high oil price uncertainty. Thus, they are likely to make mistakes. In order to make appropriate investment decisions, managers apt to learn information from the market. Jiang et al. (2017) propose that uncertainty applies pressure to managers when making financial and investment plans. The findings of Yoon and Ratti (2011) suggest that managers facing high oil price uncertainty make decisions more cautiously and are eager to collect more external information to judge whether their decisions are correct. In addition, when in an uncertain environment, a company has a higher probability of bankruptcy (Huang et al., 2019). Thus, managers may lose their jobs. In order to avoid the risk of bankruptcy, managers do their best to make appropriate investment decisions and achieve the goal of maximizing the values of shareholders. Therefore, managers in uncertain oil price environments have a tendency to learn from stock prices.

Collectively, oil price uncertainty strengthens investment-q sensitivity from the perspectives of "informed traders" and "managerial learning motivations". In the "informed trader" channel, oil price uncertainty crowds in informed traders and increases the proportion of private information included in stock prices, thereby stimulating managerial market learning motivations. In the "managerial learning motivation" channel, the uncertainty of oil prices impairs the information advantage of managers and encourages them to pay more attention to external information when making decisions. Thus, they have stronger motivations to learn from stock prices. Therefore, we propose the following hypothesis:

Hypothesis: Oil price uncertainty strengthens investment-q sensitivity.

3. Data and methodology

3.1 Sample construction

We obtain firm-level financial data and stock price information from Compustat and CRSP, which cover listed U.S. companies for the period of 2008-2020. We collect crude oil volatility index (OVX) data from the Chicago Board Options Exchange (CBOE).[1] We choose 2008 as the first year in our study since the OVX data are only available starting in 2007. Then, we exclude observations with missing accounting data and stock price data. Following previous studies, firms with Standard Industrial Classification (SIC) codes between 6000-6999 and 4900-4999 are extracted. We winsorize all continuous variables at their 1st and 99th percentiles to control for the potential influence of outliers. After employing these data selection filters, our final sample includes 40,573 firm-year observations for 3,957 listed firms.

3.2 Methodology

To test the influence of oil price uncertainty on investment-q sensitivity, we add the interactions between oil price uncertainty and stock prices to the classical investment-price sensitivity model. The baseline model for estimation is as follows:

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[1] See https://cdn.cboe.com/api/global/us_indices/daily_prices/OVX_History.csv.

$$Inv_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 OVX_{i,t} + \beta_3 Q_{i,t-1} \times OVX_{i,t} + \beta_4 CF_{i,t-1} \times OVX_{i,t} + \beta_5 CF_{i,t-1} + \beta_6 Size_{i,t-1} + \theta_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

where $Inv_{i,t}$ is corporate investment for firm *i* in year *t*, which is defined as its capital expenditures (CAPX) plus its R&D costs, scaled by its lagged total assets. The variable $Q_{i,t-1}$ is Tobin's q value of firm *i* in year *t-1*. We employ two approaches to measure Tobin's q: (i) the market value of equity plus the book value of debt scaled by the book value of assets (*AT*) and (ii) the ratio of the market value of assets minus deferred taxes (*TXDB*) to the book value of assets (*AT*).

Our major explanatory variable of interest is $OVX_{i,t}$, which captures the market's expectation regarding the 30-day volatility of crude oil prices based on the market prices of options on the United States Oil Fund (USO) (López, 2018). A high OVX value indicates a greater degree of oil price uncertainty. Different from other methods to measure oil price uncertainty, OVX contains historical information as well as future information about oil prices. Therefore, it is a better way to measure oil price uncertainty.

Following the previous market efficiency literature (Foucault and Fresard,2014), we control the following variables that may affect the relationship between oil price uncertainty and investment-q sensitivity. *CF* is the cash flow derived from operations, which is defined as the income before extraordinary items plus depreciation and amortization expenses plus R&D expenses, scaled by the book value of total assets. It measures a firm's non-price-based investment opportunities (Edmans et al., 2017). We similarly control for the interaction between *CF* and *OVX* to capture the net impact of oil price uncertainty on investment-q sensitivity. Since firm size influences a firm's investment level and transaction costs, we also control for size, which is appraised as the natural logarithm of the book value of assets (AT) (Nooteboom, 1993).

Furthermore, we include firm fixed effects (θ_i) and year fixed effects (μ_t) to control for the unobservable heterogeneity across different firms and over time. We also cluster the standard errors at the firm level (Petersen, 2009). The appendix shows the detailed definitions of all variables used in our study.

4. Empirical results and analysis

4.1 Summary statistics

Table 1 shows the summary statistics for the variables used in our main empirical analysis. *Inv* has a mean of 0.115 and a median of 0.067, which are similar to the values obtained in previous studies (De Simone et al., 2021). This indicates that the average corporate capital expenditure accounts for 11.5% of prior-year total assets. In addition, the means (medians) of Q_1 and Q_2 are 1.979 (1.505) and 1.661 (1.194), respectively. Furthermore, *OVX* has a mean of 35.929 and a standard deviation of 9.608. Generally, the summary statistics of independent variables and control variables are consistent with those reported in other relevant studies (Huang et al., 2021; López, 2018).

4.2 Baseline results

First, we examine how oil price uncertainty affects investment-q sensitivity. We estimate Equation (1), and the results are reported in Table 2. The major coefficient of interest in our study is that of the interaction between *Q* and *OVX*, that is, β_2. Columns (1) to (4) adopt Q_1, while Columns (5) to (8) adopt Q_2.

In Column (1), Q_1 is positively associated with investment, which corresponds to the results of the study of Chen et al. (2007). This indicates that managerial decision making regarding investments depends on stock prices. Meanwhile, the estimated coefficients of *CF* are positive. This proves the finding of Chen et al. (2007) that investment is sensitive to cash flows. Furthermore, *Size* exhibits a negative relationship with investment, which is in accordance with the results of Foucault and Fresard (2014). Our empirical results well support classical investment-q sensitivity theory.

In Column (2), the coefficient of $OVX \times Q_1$ is positive and statistically significant at the 1% level (coefficient=0.0002; t value=3.966), indicating that oil price uncertainty enhances investment-q sensitivity. In Column (3), we add industry fixed effect as well as year fixed effect to control for the unobservable heterogeneity derived from industry and over time. In Column (4), we adopt firm fixed effect and yearly fixed effect to address the concern that investment may vary with firms rather than stock prices. The estimated coefficient of $OVX \times Q_1$ is positive and statistically significant with an expected sign at the 1% level, which is consistent with the results of Column (2). Our empirical results effectively prove our hypothesis.

To test the robustness of our model, we replace Q_1 with Q_2 and present the re-estimated results in Columns (5) to (8). The results show that oil price uncertainty strengthens investment-q sensitivity, which is in accordance with the results obtained for Q_1.

It is worth mentioning that the coefficient of $CF \times OVX$ is non-significantly negative. Consistent with the results of the study of Edmans et al. (2017), the increase in investment-q sensitivity is not a portion of an overall trend of investment being generally more sensitive to investment opportunities. That is, oil price uncertainty has a greater impact on price-based information than fundamental information.

Additionally, oil price uncertainty lowers the corporate investment level; that is, the coefficient for *OVX* is negative and statistically significant at the 1% level. This finding supports the finding of Phan et al. (2019) that high oil price uncertainty increases the option value of waiting to invest and consequently encourages firms to postpone investment.

Moreover, our results are also significant in the economic sense. For example, in Column (4), the marginal effect of *OVX* is 0.38%; that is, a one-standard-deviation increase in *OVX* leads to a 0.38% (1.979×0.0002×9.608) increase in investment sensitivity to stock prices.

Overall, the above results support our hypothesis that oil price uncertainty increases investment-q sensitivity.

4.3 Endogeneity

In the previous section, we find a positive relationship between oil price uncertainty and investment-q sensitivity. However, there still exists a concern that this causality may be influenced by potential endogeneity issues. Then, in this section, we adopt three approaches to mitigate endogeneity concerns.

4.3.1 Instrumental variable approach

One type of endogeneity bias that we are concerned about most is whether we ignore unobservable omitted variables. Due to global economic integration, oil is playing an increasingly significant role in the global world. Junttila et al. (2018) suppose a closely associated relationship between the oil market and stock market. For instance, investor herding destabilizes prices and causes bubbles and crashes in both markets, particularly during a global financial crisis period (Balcılar et al., 2017). Consequently, our results may be affected by this endogeneity bias.

To address this problem, we adopt an instrumental variable approach to control for unobservable variables that are correlated with oil price uncertainty as well as investment. Following with Yang (2005), we take hurricane events as our instrumental variable and 2SLS to estimate our basic hypothesis. According to Yang (2005), we employ the time of hurricanes or tropical storms that have landed in U.S. states each year.[2] This instrumental variable satisfies two conditions. The first is the relevance condition. Hurricane events weaken refinery's refining capacity and oil transport by sea, thus aggravating oil price fluctuations (Caldara et al., 2019). The second condition is exogeneity. Hurricane events are exogenous shocks that are obviously irrelevant to corporate capital expenditures. Therefore, our instrumental variable is valid.

Table 3 shows the empirical results of the instrumental variable approach. In the first-stage regression, the coefficient of *Hurricane* is predictably positively associated with OVX_{t-1}. In the second-stage regression, the original variable is replaced by *Instrumed-*OVX_{t-1}. The coefficient of *Instrumed-*$OVX_{t-1} \times Q_{t-1}$ is still positive and statistically significant at the 5% level, which indicates that *Instrumed-*OVX_{t-1} is positively connected with investment-q sensitivity. Collectively, the results suggest that the positive correlation between oil price uncertainty and investment-q sensitivity is not caused by an unobservable omitted variable.

4.3.2 High-dimensional fixed effects

In our benchmark regression, we have controlled for observable firm characteristics, firm fixed effects as well as year fixed effects. However, we may disregard the time-invariant heterogeneity across industries or the time-varying heterogeneity across states. Therefore, the influence of oil price uncertainty on investment-q sensitivity may be biased. In order to obtain a more rigorous relationship between oil price uncertainty and investment-q sensitivity, we adopt high-dimensional fixed effects in accordance with Gormley and Matsa (2014).

The empirical results are reported in Table 4. In Columns (1) and (3), our basic regression controls for firm fixed effects and time-varying industry effects. In Columns (2) and (4), we re-estimate the basic regression by controlling for firm fixed effects and time-varying state effects. Since *OVX* do not vary with industry and state, it is collinear with industry fixed effects and state fixed effects. So, its result is omitted. Similar to the basic results, the re-estimated results also support the notion that oil price uncertainty enhances investment-q sensitivity. Our basic results are robust after controlling for the high-dimensional fixed effects.

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[2] See https:// www.aoml.noaa.gov/hrd/hurdat/uststorms.html and https://www.aoml.noaa.gov/hrd/hurdat/All_U.S._Hurricanes.html

4.3.3 Excluding subsamples during stock market crisis

Our study period includes the 2008-2009 global financial crisis, which is characterized by a higher informed trading volume (Gao et al., 2019). During a financial crisis, informed traders can gain more benefits by utilizing private information that markets unknown. Therefore, they have stronger incentives to mine private information than in normal periods. For managerial market learning, Huang et al. (2021) also point out that managers are more inclined to learn from stock prices when they are confronted with a crisis on account of the increased probability of bankruptcy. Meanwhile, the financial crisis encourages uncertainty in the raw oil market (Sharif et al., 2020). Hence, we have good reasons to worry about whether the positive correlation between oil price uncertainty and investment-q sensitivity is driven by the crisis.

To settle this concern, we exclude the subsamples obtained during the global financial crisis to gain the pure effect of oil price uncertainty on investment-q sensitivity, and the results are reported in Table 5. The coefficients of the interaction between oil price uncertainty and investment-q sensitivity are positive and statistically significant at the 1% level, which is in line with our expectations. The results indicate that our benchmark regression results are not caused by a stock market crisis.

4.4 Subsample analyses

Thus far, we have proven that oil price uncertainty strengthens investment-q sensitivity. To further explore the channel mechanism of this relation, we divide the total sample into two subsamples from the perspectives of the information environment and managers' market learning motivations: correlated demand for products, CEO concerns and CEO incentives. Then, if the managerial learning incentive drives the impact of oil price uncertainty on investment-q sensitivity, we expect to observe the firms that rely more on outside investors' private information hold more sensitivity of investment on stock prices.

4.4.1 Correlated demand for products

First, we test whether the connection between oil price uncertainty and investment-q sensitivity can be affected by a firm's product demand correlations with its peers. Managers use peers' decisions as sources of information and mimic them; examples include capital structures (Leary and Roberts, 2014), cash holdings (Hoberg et al., 2014), investment decisions (Foucault and Fresard, 2014) and payout policies (Kaustia and Rantala, 2015). Then, if the relevance of the given firm's product demands to its peers increases, managers tend to learn from peers' valuations rather than stock prices (Foucaulta and Fresard, 2014). Therefore, we expect that correlated product demand would mitigate the positive impact of oil price uncertainty on investment-q sensitivity.

Following with Foucaulta and Fresard (2014), we adopt the correlation between a firm's stock returns and those of its peers (computed monthly over the prior three years) to represent the relativity between the demands for firms' products, that is, ρ_{returns}. A higher value of ρ_{returns} is linked with a stronger degree of similarity, which indicates a stronger motivation to learn from peers. We employ the original SIC code to classify industries. According to the medians of ρ_{returns}, we divide the primary samples into high-ρ_{return} and low-ρ_{return} subsamples and re-estimate the benchmark regression.

Table 6 presents the estimated results of the subsample analysis. In Columns (1) and (2), we adopt Q_1 to represent Tobin's q, and in Columns (3) and (4), we take Q_2 as a proxy. In Column (1), the estimated coefficients of the interaction between Q_1 and OVX are positive and statistically significant at the 5% level, while they are positive but not statistically significant in Column (2). The results of Columns (3) and (4) are similar. These results are consistent with our expectation that the correlated demand for peers' products inhibits the positive impact of oil price uncertainty on investment-q sensitivity and suggest that in firms exhibiting product demand correlations with their peers, managers have a better information environment and obtain information from peer firms so that they do not rely on outside traders' private information when facing oil price uncertainty.

4.4.2 CEO concerns

Third, we verify whether the association between oil price uncertainty and investment-q sensitivity can be affected by CEO concerns. Fama (1980) argues that the market appraisals of CEOs directly determine their future reputations and careers. The labor market usually evaluates CEOs' abilities through corporate financial performance. If CEOs do not perform well, they risk wage cuts or dismissal (Hubbard et al., 2017). Hubbard et al. (2017) indicate that CEOs' future employment prospects depend largely on corporate financial performance. Therefore, the stronger CEO career concerns are, the more motivated they are to learn from the market and make optimal investment decisions. Thus, we hypothesize that CEO concerns reinforce the positive impact of oil price uncertainty on investment-q sensitivity.

Following with Demers and Wang (2010), we adopt CEO age to measure CEO concerns. CEO age is related to their experience and reputation levels. Younger CEOs lack experience, and the appraisal of the labor market mainly comes from firms' performance. Therefore, young CEOs exhibit more career concerns than older CEOs.

The median value of CEO age in our sample is 57, which is consistent with the findings of Byun et al. (2021). Then, we split the entire sample into young and old subsamples based on the median CEO age and re-estimate the regression individually for each subsample. The estimated results are displayed in Table 7. In Column (1), the estimated coefficients of the interaction between Q_1 and *OVX* are positive and statistically significant at the 5% level, while they are not statistically significant in Column (2). The results of Columns (3) and (4) are semblable. Our results support the forecast that CEOs who are more concerned have stronger market learning motivations when faced with oil price uncertainty.

4.4.3 CEO incentives

Finally, we examine whether CEO incentives affect the influence of oil price uncertainty on investment-q sensitivity. Andreou et al. (2017) find that CEOs attach great importance to firm performance because performance is tied to their personal wealth. The board takes a firm's market performance into consideration when making CEO compensation decisions. However, if managers have more shares, they are more likely to make investment decisions from the perspective of shareholders. Core and Guay (1999) argue that providing managers with equity incentives can effectively improve corporate performance. Equity incentives are of great benefit for aligning the goals of CEOs and shareholders, so as to motivate CEOs to achieve the target of maximizing shareholders' value. Hence, we believe that the correlation between oil price uncertainty and investment-q sensitivity is more remarkable in subsamples with incentivized CEOs.

Following Bae and Zhang (2018), we take stock awards as our proxy for CEO incentives. We divide our sample into two subsamples based on the median *CEO Incentive* and re-estimate the regression individually for each subsample. The estimated results are demonstrated in Table 8. In Column (1), the estimated coefficients of the interaction between Q_1 and *OVX* are positive but not statistically significant, while they are positive and statistically significant at the 10% level in Column (2). The results of Columns (3) and (4) are alike. Our results prove our expectation that in firms with CEO incentives, managers are more motivated to learn from stock prices when faced with oil price uncertainty.

4.5 Further analysis

4.5.1 State-level differences

We further explore whether the positive interrelation between oil price uncertainty and investment-q sensitivity varies between oil-producing states and non-oil-producing states. If a firm is located in a state that does not produce oil, it is a passive recipient of international oil prices. When oil prices fluctuate sharply, these firms are greatly affected. In contrast, firms in oil-producing states are less influenced by oil price volatility for they are closer to oil producers and enjoy priority with regard to obtaining oil resources. Therefore, we assume that firms in non-oil-producing states are more sensitive to oil price changes.

According to the EIA, we divide the total samples into oil-producing state and non-oil-producing state subsamples and re-estimate the benchmark regression, respectively. Table 9 represents the re-estimated results. The estimated coefficients of $Q \times OVX$ are positive and statistically significant for non-oil-producing states at less than 1% level, as shown in Columns (1) and (3). The estimated coefficients of $Q \times OVX$ are statistically significant at the 5% and 10% level respectively for oil-producing states, as shown in Columns (2) and (4). And the value of the estimated coefficient is greater for the subsample of firms in non-oil-producing state than that of the subsample in oil-producing state. Our results prove that the connection between oil price uncertainty and investment-q sensitivity is more pronounced in non-oil-producing states.

4.5.2 Higher frequency data

In the previous section, we estimated the results from low-frequency annual data. However, the results may be inaccurate for choosing a too long window size to examine the relationship between oil price uncertainty and investment-q sensitivity. The long-run model may cause varying degrees of information loss, while the short-run model based on quarterly data contains more frequency detail. Therefore, we verify whether the baseline results could be a different picture when higher frequency data is applied.

We obtain quarterly firm-level financial data from Compustat, which cover listed U.S. companies for the period of 2008Q3-2020Q4 since the OVX data are only available from 2007Q3. Then, we employ the data selection filters as before and apply the quarterly error correction for *Inv* and *CF*. Our final sample includes 156,340 firm-quarter observations for 3,957 listed firms.

Table 10 represents the baseline results with employing higher frequency data. The coefficients of the interaction between oil price uncertainty and investment-q sensitivity are positive and statistically significant at the 1% level in both column, which is in accordance with our expectations. The results suggest that oil price uncertainty promotes investment-q sensitivity whether in long-run model or short-run model.

4.5.3 The effect of extreme events

In recent years, extreme risk events have occurred frequently around the world, and the breadth and depth of the impact have been dramatically enhanced. International crude oil price uncertainty is evidently rising, particularly under the impact of extreme events, such as the global COVID-19 pandemic and terrorist attacks. This triggers a capital market upheaval. Salisu et al. (2022) find that extreme events contain market-related risk information that can better help investors make judicious decisions when facing risks. Therefore, in this part, we estimate the extreme risk of oil price uncertainty and test its effect on investment-q sensitivity.

We take two approaches to measure extreme risk. Firstly, tail risk. As one of the important factors inducing systemic financial risk, tail risk is extremely destructive, which can evoke extreme market turbulence and cause unexpected losses. Following with Guo and Ye (2021), we capture the mean of value above upper 5% quantile as proxy for tail risk of oil price uncertainty. Its high value indicates more tremendous tail risk. Secondly, we deploy the volatility of *OVX* as our proxy for extreme events. The larger the volatility is, the more intense the oil price uncertainty changes, and the greater the risk is.

And we replace oil price uncertainty with oil tail risk and the volatility of *OVX* individually to re-estimate the results. As shown in Table 11, the estimated coefficients of $Q \times OVX\_TK$ as well as $Q \times OVX\_Vol$ are highly significant with an expected positive sign in both Column. Our results give the evidence that oil tail risk still positively affects investment-q sensitivity. Moreover, it’s worth mentioning that the economic sense is significant as before. For example, in Column (1), a one-standard-deviation increase in *OVX_TK* leads to a 0.36% (1.979×0.0001×18.307) increase in investment sensitivity to stock prices. And in Column (3), a one-standard-deviation increase in *OVX_Vol* leads to a 0.38% (1.979×0.00002×95.446) increase in investment sensitivity to stock prices. The results suggest that *OVX* has captured the extreme risk.

4.5.4 Difference-in-differences framework

In this section, we apply difference-in-differences framework to evaluate the causal effects of changes in business scope. In the previous chapter, we have found that managers tend to learn from peers when their products are homogeneous. However, when firms’ main business scope changes, they face greater uncertainty. It is hard for managers to learn from peers result from weakened correlated demand for products. Therefore, managers are more inclined to learn from the market, and investment-q sensitivity reinforce consequently. As such, we assume that the changes in business scope enhances the facilitation of oil price uncertainty on investment-price sensitivity.

We recognize a matching sample of treatment firms and control firms in accordance with Agrawala and Nasser (2012). Firms in highly oil-intensive industries are assigned as treatment firms, while firms in lowly oil-intensive industries are classified as control firms. Elyasiani et al. (2011) find that the impacts of oil price fluctuations on different sectors are dissimilar due to the various dependencies on the oil industry. In highly oil-intensive sectors, oil is regarded as a significant raw material, and its price uncertainty leads to fluctuations in costs and other relevant factors. Thus, the responses of industries to oil price uncertainty may be diverse, affecting the relationship between oil price uncertainty and investment-q sensitivity. Following Yoon and Ratti (2011), we divide the total sample into highly oil-intensive industry and low oil-intensive industry subsamples according to the SIC. On the basis of the Energy Information Administration (EIA), we consider industries such as “food, chemicals, paper, petroleum refining, metal, nonmetallic minerals, and coal products” to be highly oil-intensive industries. These industries consume substantial amounts of oil. The rest of the industries are automatically classified as lowly oil-intensive industries. The selection process leads to a DID sample of 2,209 unique treatment firms and 1,748 control firms.

The DID regression model is specified as follows:

$$\begin{aligned} Inv_{i,t} = {} & \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 CF_{i,t-1} + \beta_3 OVX_{i,t-1} + \beta_4 Q_{i,t-1} \times OVX_{i,t-1} + \beta_5 CF_{i,t-1} \times OVX_{i,t-1} \\ & + \beta_6 Size_{i,t-1} + \beta_8 SCOPE \times Q_{i,t-1} \times OVX_{i,t-1} + \beta_9 SCOPE \times OVX_{i,t-1} \times CF_{i,t-1} \\ & + \beta_{10} SCOPE \times Q_{i,t-1} + \beta_{11} SCOPE \times CF_{i,t-1} + \beta_{12} SCOPE \times OVX_{i,t-1} + \theta_j + \mu_t + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where *SCOPE* is an indicator that equal to one for observations in oil-related industries and with alternating business scope, and zero otherwise. The residual variables are as defined previously. Since the firms' business scope information are available from 2014, we exclude firm-year observations before 2014. Our major coefficient of interest is the interaction variable *SCOPE*×*Q*×*OVX*. If shifting main business scope push managers to focus on stock prices and managers are more sensitive to oil price uncertainty in highly oil-intensive industries, the coefficients on the *SCOPE*×*Q*×*OVX* are expectedly to be positive ($\beta_7 > 0$).

Table 12 shows the re-estimated results from estimating Equation (2). The coefficients on the interaction term *Q*×*OVX* are still statistically significant, which suggests that firms with fixed business scope are influenced by oil price uncertainty yet. What's more, the estimated coefficients of the interaction term *SCOPE*×*Q*×*OVX* are positive and statistically significant at the 5% level in Columns (1) and (2), and the value of coefficients are higher than the coefficients of *Q*×*OVX*. The results attest that the changes in business scope hastens managers' market learning motivation, especially in highly oil-intensive firms.

5. Conclusions

This paper concentrates on the correlation between oil price uncertainty and investment-q sensitivity. Using a sample of listed U.S. companies during 2008-2020, we discover that oil price uncertainty has a positive influence on investment-q sensitivity. Moreover, this paper employs three methods to control potential endogeneity problems and finds that the empirical results are still robust.

Additionally, we explore whether the informed trader channel and managerial learning motivation channel drive the impact of oil price uncertainty on investment-q sensitivity. Based on the correlation between the product demand of a firm with that of its peers, CEO concerns as well as CEO equity incentives, we verify that managers who are more dependent on informed traders' private information are more sensitive to stock price changes. Furthermore, our empirical results show that investment-q sensitivity is stronger in highly oil-intensive industries and non-oil-producing states.

Generally, our findings provide evidence on how oil price uncertainty affects investment-q sensitivity and make several contributions. First, we contribute to the literature on the effect of oil price uncertainty on stock price informativeness. Second, our paper is a supplement to the problems of market efficiency and managerial market learning. Third, we expand the research on the economic impact of energy price uncertainty in the U.S. market. Fourth, this paper provides policy reference for investors and managers to deal with the risk of uncertainty.

Appendix

This table provides detailed variable definitions and the corresponding data sources. CBOE refers to the Chicago Board Options Exchange.

Variables	Definitions	Source
Dependent Variables		
Investment	Capital expenditures plus R&D costs, scaled by lagged total assets (data item AT).	Compustat
Independent Variables		
Q_1	Defined as the market value of equity plus the book value of debt scaled by the book value of assets (*AT*). The market value of assets is the sum of long-term debt (*DLTT*), the short-term debt (*DLC*) and the product of the stock price (*PRCC_F*) multiplied by the number of outstanding shares (*CSHPRI*).	Compustat
Q_2	Ratio of the market value of assets minus the deferred taxes (*TXDB*) over the book value of assets (*AT*).	Compustat
OVX	Crude oil volatility index.	CBOE
Control Variables		
CF	Income before extraordinary items plus depreciation and amortization expenses plus R&D expenses scaled by the book value of total assets.	Compustat
Size	Natural logarithm of the book value of assets (*AT*).	Compustat
$\rho_{returns}$	Correlation between a firm's monthly returns and the average returns of its peers.	CRSP
CEO age	CEO age at each year.	Execucomp
CEO incentive	Defined as the amount of CEO's stock awards.	Execucomp

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References

[1] Agrawal, A., & Nasser, T. (2012). Insider trading in takeover targets. Journal of Corporate Finance, 18(3), 598-625.

[2] Andreou, P. C., Louca, C., & Petrou, A. P. (2017). CEO age and stock price crash risk. Review of Finance, 21(3), 1287-1325.

[3] Aye, G. C., Dadam, V., Gupta, R., & Mamba, B. (2014). Oil price uncertainty and manufacturing production. Energy Economics, 43, 41-47.

[4] Bae, J., & Zhang, R. (2018). Anti-pledging policy, CEO compensation, and investment. Available at SSRN 3445348.

[5] Balcılar, M., Demirer, R., & Ulussever, T. (2017). Does speculation in the oil market drive investor herding in emerging stock markets?. Energy Economics, 65, 50-63.

[6] Bernanke, B. S. (1983). Irreversibility, uncertainty, and cyclical investment. The quarterly journal of economics, 98(1), 85-106.

[7] Bhandari, A., & Javakhadze, D. (2017). Corporate social responsibility and capital allocation efficiency. Journal of Corporate Finance, 43, 354-377.

[8] Bond, P. , Edmans, A. & Goldstein, I., (2012). The real effects of financial markets. Annual Review of Financial Economics 4, 339–360.

[9] Byun, K. A. K., & Al-Shammari, M. (2021). When narcissistic CEOs meet power: Effects of CEO narcissism and power on the likelihood of product recalls in consumer-packaged goods. Journal of Business Research, 128, 45-60.

[10] Caldara, D., Cavallo, M., & Iacoviello, M. (2019). Oil price elasticities and oil price fluctuations. Journal of Monetary Economics, 103, 1-20.

[11] Chen, Q. , Goldstein, I. & Jiang, W., (2007). Price informativeness and investment sensitivity to stock price. Review of Financial Studies 20, 619–650.

[12] Chong, V. K., & Chong, K. M. (1997). Strategic choices, environmental uncertainty and SBU performance: a note on the intervening role of management accounting systems. Accounting and Business Research, 27(4), 268-276.

[13] Core, J., & Guay, W. (1999). The use of equity grants to manage optimal equity incentive levels. Journal of accounting and economics, 28(2), 151-184.

[14] Czudaj, R. L. (2019). Crude oil futures trading and uncertainty. Energy Economics, 80, 793-811.

[15] De Simone, L., Klassen, K. J., & Seidman, J. K. (2021). The effect of income-shifting aggressiveness on corporate investment. Available at SSRN 3232036.

[16] Demers, E., & Wang, C. (2010). The impact of CEO career concerns on accruals based and real earnings management. Available at SSRN 1466029.

[17] Doshi, H., Kumar, P., & Yerramilli, V. (2014). Uncertainty and Capital Investment:

Real Options or Financial Frictions. SSRN Scholarly Paper ID, 2315217.

[18] Dow, J., & Gorton, G. (1997). Stock market efficiency and economic efficiency: Is there a connection?. The Journal of Finance, 52(3), 1087-1129.

[19] Easley, D., Kiefer, N. M., O'hara, M., & Paperman, J. B. (1996). Liquidity, information, and infrequently traded stocks. Journal of Finance, 51(4), 1405-1436.

[20] Edmans, A., Jayaraman, S. & Schneemeier. J. (2017). The source of information in prices and investment-price sensitivity. Journal of Financial Economics 126: 74–96.

[21] Elyasiani, E., Mansur, I., & Odusami, B. (2011). Oil price shocks and industry stock returns. Energy Economics, 33(5), 966-974.

[22] Fama, E. F. (1970). Efficient market hypothesis: A review of theory and empirical work. Journal of Finance, 25(2), 28-30.

[23] Fama, E. F. (1980). Agency problems and the theory of the firm. Journal of political economy, 88(2), 288-307.

[24] Fan, Z., Zhang, Z., & Zhao, Y. (2021). Does oil price uncertainty affect corporate leverage? Evidence from China. Energy Economics, 98, 105252.

[25] Foucault, T., & Frésard, L. (2012). Cross-listing, investment sensitivity to stock price, and the learning hypothesis. The Review of Financial Studies, 25(11), 3305-3350.

[26] Foucault, T., & Fresard, L. (2014). Learning from peers' stock prices and corporate investment. Journal of Financial Economics, 111(3), 554-577.

[27] Fricke, E., Fung, S., & Sinan Goktan, M. (2014). Google Search, Information Uncertainty, and Post-Earnings Announcement Drift. Journal of Accounting & Finance (2158-3625), 14(2).

[28] Gao, Y., Han, X., Li, Y., & Xiong, X. (2019). Overnight momentum, informational shocks, and late informed trading in China. International Review of Financial Analysis, 66, 101394.

[29] Gormley, T. A., & Matsa, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity. The Review of Financial Studies, 27(2), 617-661.

[30] Gul, F. A., & Chia, Y. M. (1994). The effects of management accounting systems, perceived environmental uncertainty and decentralization on managerial performance: a test of three-way interaction. Accounting, Organizations and Society, 19(4-5), 413-426.

[31] Guo, R., & Ye, W. (2021). A model of dynamic tail dependence between crude oil prices and exchange rates. The North American Journal of Economics and Finance, 58, 101543.

[32] Gupta, K., & Krishnamurti, C. (2018). Do macroeconomic conditions and oil prices influence corporate risk-taking?. Journal of Corporate Finance, 53, 65-86.

[33] Haushalter, G. D., Heron, R. A., & Lie, E. (2002). Price uncertainty and corporate value. Journal of Corporate Finance, 8(3), 271-286.

[34] Henriques, I., & Sadorsky, P. (2011). The effect of oil price volatility on strategic investment. Energy Economics, 33(1), 79-87.

[35] Hoberg, G., Phillips, G., & Prabhala, N. (2014). Product market threats, payouts, and financial flexibility. The Journal of Finance, 69(1), 293-324.

[36] Huang, Y., Yang, S., Zhu, Q., Wang, Y., & Tian, Y. (2021). Corporate environmental responsibility and managerial learning: Evidence from US listed firms. Sustainable Production and Consumption, 27, 1961-1974.

[37] Hubbard, T. D., Christensen, D. M., & Graffin, S. D. (2017). Higher highs and lower lows: The role of corporate social responsibility in CEO dismissal. Strategic Management Journal, 38(11), 2255-2265.

[38] Jang, I. J., Kang, N., & Yezegel, A. (2020). Common ownership, price informativeness, and corporate investment. Price Informativeness, and Corporate Investment (November 2020).

[39] Jiang, L., Kim, J. B., & Pang, L. (2011). Control-ownership wedge and investment sensitivity to stock price. Journal of Banking & Finance, 35(11), 2856-2867.

[40] Joëts, M. (2015). Heterogeneous beliefs, regret, and uncertainty: The role of speculation in energy price dynamics. European Journal of Operational Research, 247(1), 204-215.

[41] Junttila, J., Pesonen, J., & Raatikainen, J. (2018). Commodity market based hedging against stock market risk in times of financial crisis: The case of crude oil and gold. Journal of International Financial Markets, Institutions and Money, 56, 255-280.

[42] Kaustia, M., & Rantala, V. (2015). Social learning and corporate peer effects. Journal of Financial Economics, 117(3), 653-669.

[43] Leary, M. T., & Roberts, M. R. (2014). Do peer firms affect corporate financial policy?. The Journal of Finance, 69(1), 139-178.

[44] López, R. (2018). The behaviour of energy-related volatility indices around scheduled news announcements: Implications for variance swap investments. Energy Economics, 72, 356-364.

[45] Maghyereh, A., & Abdoh, H. (2020). Asymmetric effects of oil price uncertainty on corporate investment. Energy Economics, 86, 104622.

[46] Miller, E. M. (1977). Risk, uncertainty, and divergence of opinion. The Journal of finance, 32(4), 1151-1168.

[47] Nooteboom, B. (1993). Firm size effects on transaction costs. Small Business Economics, 5(4), 283-295.

[48] Ouyang, W., & Szewczyk, S. H. (2018). Stock price informativeness on the sensitivity of strategic M&A investment to Q. Review of Quantitative Finance and Accounting, 50(3), 745-774.

[49] Pantzalis, C., Stangeland, D. A., & Turtle, H. J. (2000). Political elections and the resolution of uncertainty: the international evidence. Journal of banking & finance, 24(10), 1575-1604.

[50] Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. Review of Financial Studies, 22(1), 435-480.

[51] Phan, D. H. B., Tran, V. T., & Nguyen, D. T. (2019). Crude oil price uncertainty and corporate investment: New global evidence. Energy Economics, 77, 54-65.

[52] Pindyck, R. S. (1991). Irreversibility, uncertainty, and investment, Journal of Economic Literature, 29(3), 1110-1148.

[53] Salisu, A. A., Olaniran, A., & Tchankam, J. P. (2022). Oil tail risk and the tail risk of the US Dollar exchange rates. Energy Economics, 109, 105960.

[54] Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. International Review of Financial Analysis, 70, 101496.

[55] Singleton, K. J. (2014). Investor flows and the 2008 boom/bust in oil prices. Management Science, 60(2), 300-318.

[56] Uddin, G. S., Rahman, M. L., Shahzad, S. J. H., & Rehman, M. U. (2018). Supply and demand driven oil price changes and their non-linear impact on precious metal returns: A Markov regime switching approach. Energy Economics, 73, 108-121.

[57] Wu, X., Wang, Y., & Tong, X. (2021). Cash holdings and oil price uncertainty exposures. Energy Economics, 99, 105303.

[58] Xiao, J., Zhou, M., Wen, F., & Wen, F. (2018). Asymmetric impacts of oil price uncertainty on Chinese stock returns under different market conditions: Evidence from oil volatility index. Energy Economics, 74, 777-786.

[59] Yang, D. (2005). Coping with disaster: The impact of hurricanes on international financial flows, 1970-2001. Ford school of public policy working paper, (2005-003).

[60] Yoon, K. H., & Ratti, R. A. (2011). Energy price uncertainty, energy intensity and firm investment. Energy Economics, 33(1), 67-78.

[61] Zhang, X., Zhang, Z., & Zhou, H. (2020). Oil price uncertainty and cash holdings: Evidence from China. Energy Economics, 87, 104732.

Tables

Table 1. Summary statistics

This table shows the summary statistics calculated for the variables used in this paper. The final sample consists of 40,573 firm-year observations covered by the CBOE and Compustat during 2008-2020 after excluding firms in the financial industry. All the continuous variables are winsorized at their 1st and 99th percentiles. The thorough definitions of our variables are reported in the Appendix.

Variable	Obs.	Mean	S.D.	Min	p25	p50	p75	Max
Dependent Variables								
INV	40573	0.115	0.134	0.002	0.031	0.067	0.139	0.611
Independent Variables								
Q_1	40573	1.979	1.308	0.720	1.085	1.505	2.363	5.684
Q_2	40573	1.661	1.277	0.433	0.780	1.194	2.056	5.254
Control variables								
OVX	40573	35.929	9.608	22.460	29.789	33.331	44.702	52.008
CF	40573	0.047	0.200	-0.725	0.016	0.087	0.147	0.373
Size	40573	6.256	2.430	1.329	4.449	6.299	7.995	11.260
$\rho_{returns}$	40573	0.732	2.941	-5.765	-0.003	0.036	0.419	20.823
CEO age	16087	56.998	8.273	29.000	52.000	57.000	62.000	96.000
CEO incentive	16250	2471.426	3221.960	0.000	158.800	1300.000	3465.779	16924.463
OVX_TK	40573	54.496	18.307	28.698	40.199	54.646	59.797	94.994
OVX_Vol	40573	80.112	95.446	7.713	14.737	61.117	91.201	359.800

Table 2. OVX and investment-q sensitivities

This table represents the basic regression results regarding the impact of OVX on investment-q sensitivity. The dependent variables are *Inv*. The main variable of interest is $Q_i \times OVX$. The final sample consists of 40,573 firm-year observations during 2008-2020, and all thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	$INV_t(Q_i=Q_1)$					$INV_t(Q_i=Q_2)$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Q_{i,t-1}$	0.0230***	0.0168***	0.0164***	0.0152***	0.0234***	0.0174***	0.0169***	0.0160***
	(23.741)	(9.564)	(9.159)	(8.513)	(23.320)	(9.935)	(9.424)	(8.937)
OVX_{t-1}		-0.0004***	-0.0090***	-0.0063***		-0.0003***	-0.0088***	-0.0061***
		(-5.054)	(-12.596)	(-8.141)		(-5.010)	(-12.459)	(-7.827)
$OVX_{t-1} \times Q_{i,t-1}$		0.0002***	0.0002***	0.0002***		0.0002***	0.0002***	0.0001***
		(3.966)	(4.083)	(3.512)		(3.773)	(3.873)	(3.286)
$OVX_{t-1} \times CF_{t-1}$		-0.0002	-0.0001	-0.0003		-0.0002	-0.0002	-0.0004
		(-0.542)	(-0.414)	(-1.052)		(-0.625)	(-0.507)	(-1.152)
CF_{t-1}	0.0225***	0.0282**	0.0244*	0.0331**	0.0204***	0.0270**	0.0234*	0.0325**
	(3.901)	(2.069)	(1.792)	(2.432)	(3.570)	(1.986)	(1.723)	(2.393)
$Size_{t-1}$	-0.0254***	-0.0254***	-0.0198***	-0.0357***	-0.0259***	-0.0259***	-0.0204***	-0.0368***
	(-25.876)	(-25.762)	(-20.577)	(-18.832)	(-26.219)	(-26.100)	(-21.000)	(-19.375)
Constant	0.2278***	0.2425***	0.4297***	0.4967***	0.2376***	0.2501***	0.4329***	0.5005***
	(32.231)	(30.672)	(12.589)	(21.548)	(33.581)	(32.228)	(12.697)	(21.951)
Industry Fixed Effect	No	No	Yes	No	No	No	Yes	No
Year Effect	No	No	Yes	Yes	No	No	Yes	Yes
Firm Fixed Effect	No	No	No	Yes	No	No	No	Yes
Observations	40,573	40,573	40,573	40,573	40,573	40,573	40,573	40,573
R^2	0.130	0.131	0.134	0.142	0.130	0.131	0.134	0.142

Table 3. Instrumental variable approach

This table reports the results of a 2-SLS IV regression to test whether we ignore unobservable omitted variables. We take hurricane events as our instrumental variable and employ the time of hurricanes that landed in U.S. states per year to measure hurricane events. The final sample consists of 40,573 firm-year observations during 2008-2020, and all thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t (Q_i=Q_1)	INV_t (Q_i=Q_2)
	(1)	(2)
$Q_{i,t-1}$	0.0103*	0.0103*
	(1.927)	(1.919)
Instrumed-OVX$_{t-1}$	-0.0037***	-0.0032***
	(-3.519)	(-3.065)
Instrumed-OVXt-1$\times Q_{i,t-1}$	0.0003**	0.0003**
	(1.973)	(2.038)
Instrumed-OVXt-1$\times CF_{t-1}$	-0.0029***	-0.0031***
	(-2.824)	(-2.937)
CF_{t-1}	0.1269***	0.1301***
	(3.385)	(3.447)
$Size_{t-1}$	-0.0358***	-0.0370***
	(-18.967)	(-19.508)
Constant	0.4339***	0.4288***
	(12.038)	(12.021)
Firm Fixed Effect	Yes	Yes
Year Effect	Yes	Yes
Observations	40,573	40,573
R^2	0.142	0.142
First Stage		
$Hurricane_{t-1}$	1.1675***	1.1675***
	(130.126)	(130.126)

Table 4. High-dimensional fixed effects

This table shows the high-dimensional fixed effect results for the relationship between OVX and investment-q sensitivity. In Columns (1) and (3), we control for firm fixed effects and time-varying industry effects. In Columns (2) and (4), we apply firm fixed effects and time-varying state effects. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t $(Q_i=Q_1)$		INV_t $(Q_i=Q_2)$	
	(1)	(2)	(3)	(4)
$Q_{i,t-1}$	0.0159***	0.0155***	0.0168***	0.0163***
	(8.056)	(7.827)	(8.453)	(8.210)
OVX_{t-1}				
$OVX_{t-1} \times Q_{i,t-1}$	0.0001**	0.0002***	0.0001**	0.0002***
	(2.292)	(3.283)	(2.047)	(3.039)
$OVX_{t-1} \times CF_{t-1}$	-0.0005	-0.0005	-0.0005	-0.0005
	(-1.543)	(-1.484)	(-1.624)	(-1.619)
CF_{t-1}	0.0355**	0.0338**	0.0348**	0.0337**
	(2.442)	(2.276)	(2.396)	(2.282)
$Size_{t-1}$	-0.0385***	-0.0369***	-0.0397***	-0.0382***
	(-18.832)	(-17.674)	(-19.347)	(-18.252)
Constant	0.3154***	0.2944***	0.3282***	0.3085***
	(23.065)	(22.799)	(25.061)	(23.977)
Firm Fixed Effect	Yes	Yes	Yes	Yes
Industry Effect×Year Effect	Yes	No	Yes	No
State Effect×Year Effect	No	Yes	No	Yes
Observations	40,249	33,044	40,249	33,044
R^2	0.784	0.782	0.784	0.782

Table 5. Excluding subsamples during the stock market crisis

This table reports the re-estimated empirical results obtained after excluding subsamples from the stock market crisis period. The final sample consists of 34,475 firm-year observations during 2010-2020, and all thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t $(Q_i=Q_1)$	INV_t $(Q_i=Q_2)$
	(1)	(2)
$Q_{i,t-1}$	0.0160***	0.0169***
	(8.460)	(8.859)
OVX_{t-1}	0.0004***	0.0004***
	(2.618)	(2.947)
$OVX_{t-1} \times Q_{i,t-1}$	0.0001***	0.0001***
	(3.099)	(2.948)
$OVX_{t-1} \times CF_{t-1}$	-0.0001	-0.0001
	(-0.306)	(-0.411)
CF_{t-1}	0.0201	0.0196
	(1.443)	(1.413)
$Size_{t-1}$	-0.0377***	-0.0389***
	(-17.819)	(-18.316)
Constant	0.2842***	0.2961***
	(16.588)	(17.351)
Firm Fixed Effect	Yes	Yes
Year Effect	Yes	Yes
Observations	34,475	34,475
R^2	0.144	0.145

Table 6. The effect of the correlated demand for products

This table shows the baseline regression results regarding the effect of the correlated demand for products on the correlation between oil price uncertainty and investment-q sensitivity. According to the medians of ρ_{returns}, we divide the primary samples into high-ρ_{return} and low-ρ_{return} subsamples and re-estimate the benchmark regression. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t			INV_t	
	(1)	(2)		(3)	(4)
	Low $\rho_{returns}$	High $\rho_{returns}$		Low $\rho_{returns}$	High $\rho_{returns}$
$Q_{1,t-1}$	0.0172***	0.0148***	$Q_{2,t-1}$	0.0180***	0.0157***
	(6.518)	(6.630)		(6.773)	(7.135)
OVX_{t-1}	-0.0069***	-0.0056***	OVX_{t-1}	-0.0064***	-0.0055***
	(-5.437)	(-5.903)		(-5.082)	(-5.861)
$OVX_{t-1} \times Q_{1,t-1}$	0.0001**	0.0001	$OVX_{t-1} \times Q_{2,t-1}$	0.0001**	0.0001
	(2.228)	(1.614)		(2.133)	(1.256)
$OVX_{t-1} \times CF_{t-1}$	-0.0002	-0.0007	$OVX_{t-1} \times CF_{t-1}$	-0.0002	-0.0006
	(-0.488)	(-1.290)		(-0.595)	(-1.187)
CF_{t-1}	0.0186	0.0744***	CF_{t-1}	0.0179	0.0721***
	(1.086)	(3.486)		(1.050)	(3.383)
$Size_{t-1}$	-0.0391***	-0.0330***	$Size_{t-1}$	-0.0406***	-0.0337***
	(-14.032)	(-13.530)		(-14.532)	(-13.868)
Constant	0.5071***	0.4771***	Constant	0.5040***	0.4858***
	(12.721)	(18.128)		(12.795)	(18.479)
Firm Fixed Effect	Yes	Yes	Firm Fixed Effect	Yes	Yes
Year Effect	Yes	Yes	Year Effect	Yes	Yes
Observations	20,290	20,283	Observations	20,290	20,283
R^2	0.134	0.164	R^2	0.135	0.163

Table 7. The effect of CEO concerns

This table shows the baseline regression results regarding the effect of CEO concerns on the connection between oil price uncertainty and investment-q sensitivity. We apply CEO age to measure CEO concerns. Then, we split the entire sample into young and old subsamples based on the median CEO age and re-estimate the regressions individually. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t			INV_t	
	(1)	(2)		(3)	(4)
	Young	*Old*		*Young*	*Old*
$Q_{1,t-1}$	0.0063*	0.0124***	$Q_{2,t-1}$	0.0058*	0.0114***
	(1.899)	(3.623)		(1.729)	(3.262)
OVX_{t-1}	-0.0015	-0.0043***	OVX_{t-1}	-0.0014	-0.0044***
	(-1.010)	(-3.086)		(-0.941)	(-3.096)
$OVX_{t-1}\times Q_{1,t-1}$	0.0002**	0.0000	$OVX_{t-1}\times Q_{2,t-1}$	0.0002**	0.0001
	(2.121)	(0.513)		(1.974)	(0.790)
$OVX_{t-1}\times CF_{t-1}$	-0.0010	-0.0011	$OVX_{t-1}\times CF_{t-1}$	-0.0011	-0.0012
	(-1.383)	(-1.297)		(-1.460)	(-1.413)
CF_{t-1}	0.0904***	0.0797**	CF_{t-1}	0.0954***	0.0851**
	(2.953)	(2.221)		(3.083)	(2.338)
$Size_{t-1}$	-0.0396***	-0.0304***	$Size_{t-1}$	-0.0403***	-0.0310***
	(-10.012)	(-6.875)		(-10.194)	(-6.975)
Constant	0.4022***	0.4200***	Constant	0.4095***	0.4317***
	(9.885)	(12.216)		(10.053)	(12.448)
Firm Fixed Effect	Yes	Yes	Firm Fixed Effect	Yes	Yes
Year Effect	Yes	Yes	Year Effect	Yes	Yes
Observations	7,935	8,152	Observations	7,935	8,152
R^2	0.198	0.161	R^2	0.194	0.158

Table 8. The effect of CEO incentives

This table shows the baseline regression results regarding the effect of CEO incentives on the interrelation between oil price uncertainty and investment-q sensitivity. We take stock awards as our proxy for CEO incentives. We divide our sample into two subsamples based on the medians of *CEO incentive*. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t			INV_t	
	(1)	(2)		(3)	(4)
	Low Incentive	*High Incentive*		*Low Incentive*	*High Incentive*
$Q_{1,t-1}$	0.0100***	0.0102***	$Q_{2,t-1}$	0.0092***	0.0101***
	(2.989)	(3.836)		(2.710)	(3.741)
OVX_{t-1}	-0.0014	-0.0065***	OVX_{t-1}	-0.0014	-0.0065***
	(-0.863)	(-6.054)		(-0.902)	(-5.974)
$OVX_{t-1}\times Q_{1,t-1}$	0.0001	0.0001*	$OVX_{t-1}\times Q_{2,t-1}$	0.0001	0.0001*
	(0.950)	(1.957)		(1.135)	(1.727)
$OVX_{t-1}\times CF_{t-1}$	-0.0002	-0.0003	$OVX_{t-1}\times CF_{t-1}$	-0.0003	-0.0004
	(-0.230)	(-0.534)		(-0.341)	(-0.571)
CF_{t-1}	0.0427	0.0700***	CF_{t-1}	0.0465	0.0744***
	(1.339)	(2.600)		(1.426)	(2.801)
$Size_{t-1}$	-0.0380***	-0.0251***	$Size_{t-1}$	-0.0385***	-0.0258***
	(-9.465)	(-8.337)		(-9.586)	(-8.562)
Constant	0.3600***	0.4626***	Constant	0.3690***	0.4724***
	(8.679)	(14.544)		(8.855)	(14.704)
Firm Fixed Effect	Yes	Yes	Firm Fixed Effect	Yes	Yes
Year Effect	Yes	Yes	Year Effect	Yes	Yes
Observations	8,122	8,128	Observations	8,122	8,128
R^2	0.163	0.192	R^2	0.161	0.187

Table 9. State-level differences

This table re-estimates the influence of oil price uncertainty on investment-q sensitivity to examine whether the results vary by state. We split our sample into oil-producing states and non-oil-producing states and estimate the basic regression. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t			INV_t	
	(1)	(2)		(3)	(4)
	Non-oil-producing state	*Oil-producing state*		*Non-oil-producing state*	*Oil-producing state*
$Q_{1,t-1}$	0.0151***	0.0163***	$Q_{2,t-1}$	0.0156***	0.0169***
	(5.154)	(6.119)		(5.389)	(6.204)
OVX_{t-1}	-0.0025**	-0.0084***	*OVXt-1*	-0.0021*	-0.0082***
	(-2.096)	(-6.517)		(-1.793)	(-6.338)
$OVX_{t-1}\times Q_{1,t-1}$	0.0002***	0.0001**	$OVX_{t-1}\times Q_{2,t-1}$	0.0002***	0.0001*
	(3.018)	(2.068)		(2.999)	(1.919)
$OVX_{t-1}\times CF_{t-1}$	-0.0010**	-0.0001	$OVX_{t-1}\times CF_{t-1}$	-0.0010**	-0.0002
	(-2.027)	(-0.313)		(-2.005)	(-0.470)
CF_{t-1}	0.0451**	0.0321	CF_{t-1}	0.0432**	0.0331
	(2.098)	(1.507)		(1.997)	(1.575)
$Size_{t-1}$	-0.0343***	-0.0385***	$Size_{t-1}$	-0.0357***	-0.0399***
	(-11.015)	(-13.631)		(-11.367)	(-14.101)
Constant	0.3400***	0.5823***	Constant	0.3424***	0.5881***
	(10.190)	(15.279)		(10.418)	(15.517)
Firm Fixed Effect	Yes	Yes	Firm Fixed Effect	Yes	Yes
Year Effect	Yes	Yes	Year Effect	Yes	Yes
Observations	15,250	17,386	Observations	15,250	17,386
R^2	0.151	0.146	R^2	0.151	0.146

Table 10. Higher frequency data

This table tests whether the baseline results could be a different picture when higher frequency data is employed. Our sample consists of 156,340 firm-quarter observations during 2008Q3-2020Q4. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t ($Q_i=Q_1$)	INV_t ($Q_i=Q_2$)
	(1)	(2)
$Q_{i,t-1}$	0.00355***	0.00364***
	(7.731)	(7.820)
OVX_{t-1}	-0.00333***	-0.00328***
	(-19.947)	(-19.702)
$OVX_{t-1} \times Q_{i,t-1}$	0.00003***	0.00003***
	(4.024)	(4.156)
$OVX_{t-1} \times CF_{t-1}$	0.00001	-0.00001
	(0.052)	(-0.073)
CF_{t-1}	-0.00533	-0.00643
	(-0.655)	(-0.786)
$Size_{t-1}$	-0.00679***	-0.00742***
	(-8.917)	(-9.675)
Constant	0.22268***	0.22598***
	(30.927)	(31.556)
Firm Fixed Effect	Yes	Yes
Quarter Effect	Yes	Yes
Observations	156,340	156,340
R^2	0.086	0.085

Table 11. The effect of extreme events

This table examine the impact of extreme events. We take oil tail risk and the volatility of *OVX* as our proxy for extreme events. Our sample consists of 40,573 firm-year observations during 2008-2020. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t (Q_i=Q_1)	INV_t (Q_i=Q_2)		INV_t (Q_i=Q_1)	INV_t (Q_i=Q_2)
	(1)	(2)		(3)	(4)
$Q_{i,t-1}$	0.0164***	0.0162***	$Q_{i,t-1}$	0.01972***	0.02021***
	(10.552)	(10.160)		(18.554)	(18.374)
OVX_TK_{t-1}	-0.0026***	-0.0025***	OVX_Vol_{t-1}	-0.00113***	-0.00108***
	(-8.150)	(-8.166)		(-7.971)	(-7.681)
$OVX\_TK_{t-1}\times Q_{i,t-1}$	0.0001***	0.0001***	$OVX\_Vol_{t-1}\times Q_{i,t-1}$	0.00002***	0.00001***
	(3.384)	(4.044)		(2.945)	(2.699)
$OVX\_TK_{t-1}\times CF_{t-1}$	-0.0003	-0.0002	$OVX\_Vol_{t-1}\times CF_{t-1}$	-0.00006**	-0.00006*
	(-1.645)	(-1.557)		(-2.013)	(-1.950)
CF_{t-1}	0.0357***	0.0335***	CF_{t-1}	0.02677***	0.02488***
	(3.091)	(2.893)		(3.807)	(3.561)
$Size_{t-1}$	-0.0357***	-0.0365***	$Size_{t-1}$	-0.03573***	-0.03689***
	(-18.834)	(-19.197)		(-18.819)	(-19.360)
Constant	0.4069***	0.4148***	Constant	0.32017***	0.33174***
	(28.242)	(29.402)		(28.057)	(29.234)
Firm Fixed Effect	Yes	Yes	Firm Fixed Effect	Yes	Yes
Quarter Effect	Yes	Yes	Quarter Effect	Yes	Yes
Observations	40,573	40,573	Observations	40,573	40,573
R^2	0.142	0.143	R^2	0.142	0.142

Table 12. Difference-in-differences framework

This table check the relationship between oil price uncertainty and investment-q sensitivity by employing difference-in-differences test. *SCOPE* is an indicator that equal to one for observations in oil-related industries and with alternating business scope, and zero otherwise. Our sample consists of 20,889 firm-year observations during 2014-2020. All thorough definitions of the variables are reported in the Appendix. The t-statistics clustered at the firm level are reported in brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	INV_t $(Q_i=Q_1)$	INV_t $(Q_i=Q_2)$
	(1)	(2)
Q_{t-1}	0.0127***	0.0135***
	(5.505)	(5.799)
OVX_{t-1}	-0.0016***	-0.0015***
	(-7.767)	(-7.499)
$SCOPE \times Q_{t-1}$	-0.0058	-0.0060
	(-0.666)	(-0.680)
$SCOPE \times CF_{t-1}$	0.0480	0.0448
	(0.753)	(0.707)
$SCOPE \times OVX_{t-1}$	-0.0012***	-0.0012***
	(-2.944)	(-3.413)
$SCOPE \times OVX_{t-1} \times Q_{t-1}$	0.0004**	0.0005**
	(2.001)	(2.254)
$SCOPE \times OVX_{t-1} \times CF_{t-1}$	-0.0007	-0.0005
	(-0.438)	(-0.326)
$OVX_{t-1} \times Q_{t-1}$	0.0002***	0.0001**
	(2.838)	(2.373)
$OVX_{t-1} \times CF_{t-1}$	0.0003	0.0002
	(0.693)	(0.371)
CF_{t-1}	-0.0046	-0.0017
	(-0.285)	(-0.103)
$Size_{t-1}$	-0.0495***	-0.0508***
	(-16.568)	(-17.047)
Constant	0.4428***	0.4530***
	(23.084)	(24.178)
Firm Fixed Effect	Yes	Yes
Year Effect	Yes	Yes
Observations	20,889	20,889
R^2	0.154	0.154

Qi Zhu: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data Curation, Writing - Original Draft, Visualization.
Sisi Jin: Conceptualization, Data curation, Validation, Formal analysis, Investigation, Visualization, Writing- Original Draft, Visualization.
Yuxuan Huang: Supervision, Validation, Writing - Original Draft, Writing- Reviewing and Editing.
Cheng Yan: Supervision, Validation, Writing - Original Draft, Writing- Reviewing and Editing.

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Oil Price Uncertainty and Stock Price Informativeness: Evidence from Listed U.S. Companies

Qi Zhu[1], Sisi Jin[1], Yuxuan Huang[†2] and Cheng Yan[†3]

[1] *Business School, Central South University*
[2] *Business School, Hunan University*
[3] *Essex Business School, University of Essex*

Abstract

This paper examines the relationship between oil price uncertainty and stock price information for managerial decision making. Under the investment-q sensitivity framework, we use the data of listed U.S. companies from 2008 to 2020 and find that oil price uncertainty has a positive impact on investment-q sensitivity that is mainly driven by the crowding of informed traders and the promotion of managerial learning. The interrelation between oil price uncertainty and investment-q sensitivity is more remarkable for firms with uncorrelated product demand with that of their peers, stronger CEO concern, and greater CEO equity incentives. Furthermore, we provide evidence that oil price uncertainty can enhance investment-q sensitivity, especially for firms in highly oil-intensive industries and non-oil-producing states. Overall, our research illustrates how oil price uncertainty affects stock price informativeness for firms' decision making.

JEL Classifications: G12, G14, M40; M41

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Corresponding author: Yuxuan Huang and Cheng Yan. Yuan Huang is post-doctor, Business School, Hunan University, Changsha, China. Cheng Yan is associate professor, Essex Business School, Essex, United Kingdom. E-mail addresses: zhuqi1212@csu. edu.cn (Q.Zhu), jinsisi@csu.edu.cn (S.Jin), huangyuxuan@hnu.edu.cn (Y.Huang), cheng.yan@essex. ac.uk (C.Yan).