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Oil Price Volatility, Organization Capital, and Firm Performance

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ABSTRACT
We examine the relationship between oil price volatility and firm performance, and the moderating role of organization capital on this relationship. Using U.S. firm-level data during the period of 1986-2017, our analysis reveals several key findings. Consistent with the real option theory, we find that oil price volatility negatively affects firm performance. However, this adverse effect of oil price volatility is reduced for firms with high levels of organization capital. Interestingly, this moderating effect of organization capital is more pronounced for firms with large cash holdings. Overall, our findings substantiate the idea that firms with high levels of organization capital can hedge oil price related volatilities effectively. Findings from several robustness tests support our key results.

KEYWORDS
Organization Capital, Oil Price Volatility, Firm Performance, Cash Holdings

JEL Classification: G10, M10, M40, Q40

INTRODUCTION

Oil is the key source of energy for firms in modern economies. Oil prices affect firms' investments and revenues directly by affecting either input or output prices, and indirectly by affecting the overall macro-economy (Crawford et al., 2021). A vast body of literature has emerged on the effects of oil prices on a range of macroeconomic outcomes as well as on firms' stock market performance (Smyth & Narayan, 2018). However, firm performance depends on both oil price changes and oil price uncertainty[1]. Although a sizable volume of previous literature examines the aggregate effect of oil price uncertainty, firm-level evidence on the impact of oil price volatility is rather scant. Available evidence focused primarily on the investment channel to show the detrimental effects of oil price uncertainty (Henriques & Sadorsky, 2011; Wang et al. 2017). This negative effect on firm performance may result from a reduction in investment and/or from declining sales of firms' durable products, as consumers increase precautionary savings in the face of heightened uncertainty (Elder & Serletis, 2010). The general finding of this stream of the literature is that elevated uncertainty reduces investment and, thus, affects firm performance adversely (Smyth & Narayan, 2018). For example, using

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[1] In this paper we use oil price uncertainty and oil price volatility interchangeably.

firm-level data from 54 countries, Phan et al. (2019) document that oil price uncertainty decreases investment. Firms postpone their irreversible investments, because the option value of waiting increases when firms forecast high oil price volatility in the future (e.g., Bernanke, 1983; Bloom, 2009; Bloom et al., 2007; Dixit & Pindyck,1994; Lee et al., 2011). Such postponement of investments exerts a detrimental effect on firm performance.

However, little is known on which firm-specific variables might reduce the adverse effects of oil price uncertainty on firm performance. In this paper, we propose organization capital as one such hitherto unexplored moderating variable. Organization capital is the accumulation of firm-specific knowledge that "enables superior operating, investment and innovation performance, represented by the agglomeration of technologies—business practices, processes and designs" (Lev et al., 2009, p. 277). Employee skills, managerial quality, and superior internal operating systems enable firms to predict and manage organizational risks efficiently. Algorithms of Amazon and Netflix to support their customers' choice, Apple's product development systems and Zara's supplier management systems are some of the examples of organization capital. A growing body of literature documents that organization capital leads to superior firm performance (e.g., Eisfeldt & Papanikolaou, 2013; Hasan & Cheung, 2018). Therefore, in the present study, we aim to investigate how organization capital moderates the negative relationship between oil price volatility and firm performance. Our findings should have practical implications for investors and policymakers with respect to firms' operational efficiency and financial market performance.

Firms with high levels of organization capital attain efficiency in production, stability in operations, and economies in transactions, leading to both enhanced productivity (e.g., Black & Lynch, 2005) and good firm performance (e.g., Hasan & Cheung, 2018; Lev et al., 2009). Recent studies also show that organization capital is related with cross-section of stock returns (Eisfeldt & Papanikolaou, 2013; Leung et al., 2018), superior deal performance during mergers and acquisitions (Li et al., 2018), low employee turnover, and marked diversity in skills and wages (Carlin et al., 2012). Prior literature shows that organization capital is embodied in a firm's key talents, but its efficiency is firm-specific; therefore, both shareholders and key talents have a claim to the cash flows generated from organization capital (e.g., Eisfeldt & Papanikolaou, 2013). These beneficial effects might suggest that firms with high levels of organization capital will be better able to cope with the adverse shocks stemming from volatile oil prices, compared with firms having low levels of organization capital. One possible reason for this observation can be related to a recent finding that suggests that high organization capital firms also hold more cash (Marwick et al., 2020). The agency motives for cash holdings suggest that firms entrenched managers hoard cash to extract private benefits. (e.g., Hope & Thomas, 2008; Jensen, 1986; Richardson, 2006). In addition, higher agency costs also make it difficult for firms to raise external finance, thereby, incentivizing firms to hold more cash (Marwick et al., 2020).

On the other hand, the 'precautionary motive' suggests that firms tend to retain cash as safeguard against adverse shocks (Bates et al., 2009; Opler et al., 1999) or when cost of external finance is high (e.g., Almeida et al., 2004; Han & Qiu, 2007). Such cash holdings allow firms to meet their obligations without liquidating assets, or raising costly external funds (e.g., Miller & Orr, 1966). Firms with high levels of organization capital tend to accumulate cash in order to avoid future underinvestment and maintain stable liquidity (Almeida et al., 2004; Chen et al., 2012; Marwick et al., 2020). As mentioned before, key talents of firms generate organization capital and, once they leave the firms, they can take some of that capital with them. Loss of key personnel adversely affects firm performance and increases future cash flow volatility. To avoid such adverse consequences, firms hold more cash as a precautionary motive to increase investments in human capital (He, 2018; Marwick et al., 2020). Therefore, investment in firms with high levels of organization capital is risky, leading to heightened discount rates (Eisfeldt & Papanikolaou, 2014) and external financing problems. However, increased cash holdings by high organization capital firms may reduce the risk of adverse macroeconomic shocks, such as oil price uncertainty-induced adverse shock. Thus, in line with the precautionary motive for cash holding, we posit that the moderating effect of organization capital on the negative association between oil price volatility and firm performance will be more pronounced for firms with increased cash holdings.

We test our hypotheses by deploying a sample of U.S. listed firms comprising of 77,264 firm-year observations from 1986 to 2017. First, we find a strong negative effect of oil price uncertainty (as measured by an annualized standard deviation of daily West Texas Intermediate future prices returns) on firms' return on asset (ROA) and stock returns (RET). This result is consistent with existing studies (e.g., Crawford et al., 2021; Phan et al., 2019; 2020). Economically, for every 1% increase in oil price uncertainty, return on asset and stock returns decreases by 0.06% and 0.14%, respectively. This finding supports our prediction that oil price uncertainty impairs firm performance. Second, we find that organization capital reduces the negative effect of oil price uncertainty on firm performance. Finally, we show that the moderating effect of organization capital on the association between oil price volatility and firm performance is significant for the "high cash holding" sub-sample only, thereby, supporting our prediction that increased cash holdings in firms with greater organization capital hedges against oil price uncertainties.

In an additional test we examine the moderating effect of organization capital on the association between oil price uncertainty and firm performance across three types of firms, namely, oil producing, oil consuming, and inert firms. However, we fail to find any differential incremental effect for the moderating role of organization capital on the association between oil price uncertainty and firm performance among the three groups. We conduct several robustness tests and find results that are consistent with our main findings. Our findings hold using the GARCH based oil price uncertainty measure. We also provide evidence that our results are not affected by episodes of economic downturn. We deploy the GFC period (2007-2008) and the NBER macroeconomic indicators to proxy for economic downturns. Our results remain robust to the inclusion of an additional control variable corresponding to periods of economic downturn and to the exclusion of observations pertaining to economic downturn periods (Phan et al., 2020; Wong & Hasan, 2021).

Our paper makes the following contributions to the literature. First, we add to the growing literature on the outcome of oil price uncertainty by unraveling a new firm-specific factor–organization capital–that can mitigate the negative effects of oil price uncertainty on firm performance. Second, we add to the evolving literature on the effect of organization capital on firms' performance. Previous literature reveals that organization capital carries a risk premium for stock returns (Eisfeldt & Papanikolaou, 2013), leads to superior M&A deal performance (Li et al., 2018), and affects firms liquidity policies (Marwick et al., 2020). However, whether organization capital shields a firm against adverse macroeconomic shocks, such as oil price uncertainty, remains unexplored. Our findings suggest that managers should increase investment in organization capital to shield against oil price volatility. Third, our result confirms 'precautionary motive' (Bates et al., 2009) rather than the 'agency motive' (Harford et al., 2008) of holding cash by documenting that organization capital in concert with more cash holdings shields firms against oil price uncertainty. This, therefore, suggests that accumulating cash is not necessarily a precursor to the agency problem. In this way, we contribute to the corporate cash holding literature.

A recent paper by Phan et al. (2020) has explored the implications of managerial ability for the oil price uncertainty-firm performance relationship and finds that the negative impact of oil price volatility on firm performance is less pronounced for firms having high compared with low managerial ability. Managerial ability represents a manager's talent, reputation, and leadership style. More able managers know the operating environment very well and have less career concerns compared with less able managers (Phan et al., 2020). These arguments are consistent with the Upper Echelons Theory (UET) of Hambrick and Mason (1984), who suggest that top management teams influence organizations' outcomes, strategic choices, and future firm performances. The central idea of the UET is that experiences, values, and personalities of the executives, not just the CEO, largely affect managers' personalized interpretations of the situation and the way they act to it (Hambrick, 2007). Organization capital, despite sharing some commonalities with managerial ability, is different, because organization capital includes an organization's overall business process, culture, and practices by combining both human skills and physical capital. According to Atkeson and Kehoe (2005), organizational capital is the accumulation of knowledge over the firms' life cycle. High organizational capital firms have low employee turnover (Carlin et al., 2012), and experience more promotion-based tournament incentives (Boubaker et al., 2022). Thus, organizational capital is not only relevant for the top management team but is equally important for the lower-level managers. Even if firms' key talents leave the firm, managerial practices remain with the firm, and significantly influence firms' productivity (Bloom & Van Rennen, 2007). Furthermore, the pairwise correlation between the continuous measure of organization capital and managerial ability score developed by Demerjian et al. (2012) is only 0.005 (untabulated), implying that these two variables represent different constructs. To ensure that our results are not confounded by managerial ability scores, we have controlled for managerial ability in all our regression specifications. The remainder of the paper is organized as follows. In the next section, we provide an overview of related literature and develop related hypotheses. In Section 3 we present data and methodology. Section 4 discusses the empirical results and robustness tests. Finally, section 5 concludes the paper.

RELATED LITERATURE AND HYPOTHESES

OIL PRICE UNCERTAINTY AND FIRM PERFORMANCE

Although oil price fluctuation is beyond the control of a firm, it impacts a firm's operation in various ways as oil is used as a critical input factor by any form of business. High oil prices directly and indirectly (through consumer demand) decrease corporate investments (Crawford et al., 2021; Elder & Serletis, 2010). Firms tend to delay their investments when faced with any form of uncertainty, including oil price uncertainty. This is because most investments are irreversible, and the cost of investment includes the value of the option, i.e., the right but not the obligation to exercise (Pindyck, 1988). Additionally, the real option theory suggests that the option value of waiting for more information increases during periods of heightened uncertainty, thereby, forcing managers to postpone irreversible investments (Bernanke, 1983; Bloom, 2009; Dixit & Pindyck, 1994; McDonald & Siegel, 1986). Oil price volatility reduces revenue for oil-exporting countries (Cherif & Hasanov, 2013), and curtails production (Lee & Ni 2002; Hamilton 1983). High oil prices also lead to a reduction in consumer income resulting in declines in current consumer demand (Baumeister & Kilian, 2016; Pescatori & Mowry, 2008), postponed future demand (Bernanke, 1983) or shifts in demand to less oil-intensive products from more oil-intensive products (Crawford et al., 2021). Overall, in the long-term, oil price volatility tends to the creation of new jobs, while making other jobs obsolete (Davis & Haltiwanger, 2001). Using U.S. firm level data, Crawford et al. (2021) find that oil price shocks reduce firms' revenue. Phan et al. (2020) find that oil price uncertainty impairs firm performance for a sample of international firms.

ORGANIZATION CAPITAL AND FIRM PERFORMANCE

Prescott and Visscher (1980, p. 447) define organization capital as "Information is an asset to the firm, for it affects the production possibility set and is produced jointly with output. We call this asset of the firm its organization capital". Based on this idea, organization capital is defined by Evenson and

Westphal (1995, p. 2237) as "…the knowledge used to combine human skills and physical capital into systems for producing and delivering want-satisfying products." Prior studies show that organization capital is associated with efficiency in production and stability in operations: factors contributing to superior firm productivity and performance (Fredrickson, 1986; Lev et al., 2009). Firms with more organization capital tend to have greater levels of both Tobin's Q and risk-adjusted returns compared to firms with lower organization capital, and executive compensation for such firms tend to be higher as well (Eisfeldt & Papanikolaou, 2013).

However, high levels of organization capital also entail risk (Eisfeldt & Papanikolou, 2013). This is because, as organization capital is incorporated in key talents of a firm, both shareholders of the firm as well the key talents have claims on the cash flows generated from organization capital. However, shareholders are exposed to more risk because the distribution of cash flow generated from organization capital between the investors and the key talents is dependent on the external opportunities available to the latter. Therefore, equity investors demand high risk premiums for investments in such firms to compensate for this additional source of risk. This makes raising external capital difficult and encourages firms with high organization capital to hold more cash for precautionary motives (Marwick et al., 2020).

HYPOTHESES DEVELOPMENT

We propose that oil price uncertainty affects firm performance adversely. Oil is the key factor of production for the firms, and oil price fluctuation directly or indirectly affects firms' production costs. High production costs, in turn, will delay firms' irreversible investments. Bredin et al. (2010) find that oil price volatility exerts a significant and negative effect on industrial production of the U.K., U.S., Canada and France. Śmiech et al. (2021) also find a depressing effect of oil price uncertainty on industrial production for four oil-exporting countries. Elder (2019) demonstrates that oil price volatility affects durable production and oil exploration negatively. By deploying Vector auto regression model, Jo (2014) documents that oil price uncertainty reduces world industrial production. Given the detrimental effect of oil price uncertainty on industrial production, firm performance deteriorates, owing to a loss of positive net present value (NPV)-generating investment opportunities. Furthermore, a reduction in consumer spending stemming from oil price uncertainty also affects firm performance adversely (Edelstein & Kilian, 2009). Based on these arguments, we formulate our first hypothesis as follows:

H1: Oil price uncertainty negatively affects firm performance.

Next, we propose that high levels of organization capital attenuate the negative effects of oil price uncertainty on firm performance. Our argument is premised on previous literature that suggests that organization capital leads to superior operation, investment and firm performance (Black & Lynch, 2005; Hasan & Cheung, 2018; Lev et al., 2009). Owing to superior operation and investment efficiency, higher organization capital firms can predict the future well, and make timely and improved decisions regarding the implementation or postponement of investment projects. This allows them to avoid forgoing profitable investment projects. This stable and superior investment performance results in less risky future cash flows, that mitigate the effects of uncertainty regarding future oil prices on firm performance. Firms with high levels of organization capital also have pools of employees, including a top management team with superior skills, that allow such firms to withstand adverse macroeconomic shocks, like oil price uncertainty in our setting. Furthermore, recent literature suggests that firms with high levels of organization capital hold more cash for precautionary reasons (Marwick et al., 2020) to withstand adverse shocks. Therefore, we argue that high levels of cash holding may be a channel through which organization capital attenuates the detrimental effects of macroeconomic shocks, such as oil price uncertainty. We, therefore, develop the following hypotheses based on the preceding arguments:

H2A: High levels of organization capital reduce the negative effects of oil price uncertainty on firm performance.

H2B: The moderating effect hypothesized in H2A above is more pronounced when high organization capital firms hold more cash.

MODEL AND DATA

EMPIRICAL MODEL

We deploy the following cross-sectional OLS regression models to test our predictions. Equation (1) below examines the effects of oil price volatility on firm performance, while Equation (2) incorporates organization capital into the regression specification.

$$PERFORMANCE_{i,t} = \beta_0 + \beta_1 OILV_{i,t} + \sum_{n=2}^{16} \beta_n CONTROL_{i,t} + \varepsilon \quad (1)$$

$$PERFORMANCE_{i,t} = \beta_0 + \beta_1 OILV_{i,t} + \beta_2 OC_{i,t} + \beta_3 OILV * OC_{i,t} + \sum_{m=4}^{19} \beta_m CONTROL_{i,t} + \varepsilon \quad (2)$$

We use two different measures to proxy for firm performance (PERFORMANCE) i.e., i) return on assets (ROA), and ii) stock returns (RET). Our primary independent variable in this analysis is OILV. We measure OILV as the annualized standard deviation of daily crude oil returns using equation (3) below (Henriques and Sadorsky, 2011; Phan et al., 2020; Sadorsky, 2008):

$$\sigma_t = \sqrt{\frac{1}{N-1} \sum_{t=1}^{N} [p_t^0 - E(p_t^0)]^2} \cdot \sqrt{N} \quad (3)$$

where p_t^0 is the daily return of crude oil price, and N is the number of trading days in that year.

We follow Peters and Taylor (2017) to estimate the stock of organization capital based on SG&A expenses. A significant portion of SG&A expenses consist of training and development related expenditure, consulting, and IT expenses, which cannot be attributed directly to a particular unit of output: however, such expenditures increase organization capital of an entity (Eisfeldt & Papanikolaou, 2013; Lev et al., 2009). This organization capital measure based on SG&A expenses has been widely used (Amatachaya & Saengchote, 2020; Eisfeldt & Papanikolaou, 2013, 2014; Hasan & Cheung, 2018; Li et al., 2018; Marwick et al., 2020; Peters & Taylor, 2017). Based on the perpetual inventory method, we calculate the stock of organization capital (OC) for each firm in each year by accumulating a proportion of past SG&A expenses based on the following equation:

$$OC_{i,t} = OC_{i,t-1}(1 - \delta_0) + (SG\&A_{i,t} \times \theta_0) \quad (4.1)$$

where $OC_{i,t}$ (and δ_0) denote the firm-specific stock of organization capital at time t (and the depreciation rate of OC), and SG&A and θ_0 represent the SG&A expenses and the fraction of SG&A expense that is invested into organization capital, respectively.

Next, we estimate the initial stock of organization capital as follows:

$$OC_{i,t_0} = \frac{(SG\&A_{i,t_0} \times \theta_0)}{g+\delta_0} \tag{4.2}$$

where t_0 = initial year for the firm in the sample. Following prior studies (Eisfeldt & Papanikolaou, 2013; Hasan & Cheung, 2018; Peters & Taylor, 2017), we use 30% of SG&A in estimating the stock of organization capital. Peters and Taylor (2017) document that results hold when lower or higher percentage is used; however, 30% results in highest R2. Furthermore, we use a depreciation rate (δ_0) of 20 percent (Peters and Taylor, 2017). Growth (g) in the flow of organization capital is estimated as the average real growth of firm-level SG&A expenses. Following Peters and Taylor (2017), we replace the missing values of SG&A with zero. In the empirical tests, we scale the OC by total assets, and create an indicator variable, which takes the value 1 (representing high levels of organization capital) if above or equal to the median organization capital value, and 0 otherwise.

We include several control variables in the regression models. We include firm size (SIZE), leverage (LEV), firm risk (RISK), growth in sales (SALEG), capital expenditure (CAPX), working capital (WC), market value of equity to book value of equity (MTB), research and development expense (RD), Tobin's Q (TOBINQ), and the managerial ability score (MA)[2] developed by Demerjian et al. (2012). Following Crawford et al. (2021) we also control for up to three years lag of oil price volatility. We include GDP growth rate (GDP), federal funds rate (IRATE), and economic policy uncertainty (EPU) as the three macro-level variables that have been shown to affect firm performance and are also correlated with OILV. In order to avoid the undesirable influence of outliers, we winsorize all the continuous variables at the extreme 1% of their respective distributions. To control for unobservable industry and year characteristics related to oil price volatility and firm performance, our regression models include year and industry dummy variables. All variables are defined in Table 1.

[2] Data collected from Demerjian's database available at https://peterdemerjian.weebly.com/managerialability.html.

Table 1. Variable Definition

Variable	Definition
Firm performance variables	
ROA	*Return on assets calculated as net income dividend by total assets.*
RET	*Raw stock returns from CRSP.*
Explanatory variables	
OILV	*Annualized standard deviation of daily crude oil returns following Phan et al. (2020) methodology.*
OC	*See section 3.1 for estimation procedure. We include a dummy/binary variable that equals 1 if above or equal to the median organization capital value, 0 otherwise. Organization capital data collected from WRDS (Peters and Taylor Total Q). We also use the decile ranking of OC.*
Control variables	
SIZE	*Firm size calculated as the natural logarithm of total assets.*
LEV	*Firm leverage calculated as long-term liabilities plus current liabilities scaled by total assets.*
RISK	*Firm risk calculated as the standard deviation of monthly share returns (CRSP).*
SALEG	*Sales growth calculated as* $sales_t$ *minus* $sales_{t-1}$ *scaled by* $sales_{t-1}$.
CAPX	*Capital expenditure scaled by total assets.*
WC	*Working capital measure as current assets minus current liabilities scaled by total assets.*
MTB	*Market to book ratio.*
RD	*Research and development expenditure scaled by sales.*
TOBINQ	*Tobin's Q calculated as book value of assets plus market value of equity minus book value of equity minus deferred tax, scaled by the book value of assets.*
OILV_L1	*One-year lag of annualized standard deviation of daily crude oil returns.*
OILV_L2	*Two years lag of annualized standard deviation of daily crude oil returns.*
OILV_L3	*Three years lag of annualized standard deviation of daily crude oil returns.*
MA	*Managerial ability score (data collected from https://peterdemerjian.weebly.com/managerialability.html)*
GDP	*GDP growth rate.*
IRATE	*First difference of effective federal funds rate.*
EPU	*Baker et al. (2016) EPU index, defined as the natural log of articles that mention the uncertainty in future economic policy of the government in major newspapers.*

SAMPLE SELECTION

Our sample consists of U.S. listed firms for the period, 1986 to 2017. Required data for this study has been collected from various sources. Firm-level financial data are retrieved from Compustat, stock return data have been collected from the CRSP, WTI crude oil future prices data comes from the U.S. Energy Information Administration (EIA) website[3], GDP and federal funds rate are retrieved from the Federal Reserve Economic Data[4], and the EPU data comes from Baker et al. (2016). Our initial sample comprises 400,532 firm-year observations. We excluded 24,891 firm-year observations from the regulated industries (two-digit SIC code 48-49) and 132,725 firm-year observations pertaining to financial institutions (two-digit SIC codes 60-69). After excluding missing observations for the regression variables, we derive a final sample consisting of 77,264 firm-year observations.

EMPIRICAL RESULTS

DESCRIPTIVE STATISTICS AND CORRELATION

Descriptive statistics of the key variables are reported in Table 2. The mean (median) of two of our performance measures, ROA and RET, are -0.09 (0.03) and 0.01 (0.01), respectively, over the sample period. The mean (median) of OILV is 0.37 (0.35). On average firms are moderately large (SIZE=5.24), with modest amounts of leverage (LEV=0.20), exposed to moderate levels of risk (RISK=0.16), and experienced growth in demand (SALEG=0.27). An average firm spent 5% on capital expenditure (CAPX) and 25% on research and development (RD) and had a market to book value of 3.08.

Table 2. Descriptive Statistics

Variables	Observations	Mean	Std.Dev.	25%	Median	75%
ROA	*77,264*	*-0.09*	*0.46*	*-0.09*	*0.03*	*0.07*
RET	*76,948*	*0.01*	*0.06*	*-0.02*	*0.01*	*0.04*
OILV	*77,264*	*0.37*	*0.12*	*0.28*	*0.35*	*0.43*
OC_D	*77,264*	*0.51*	*0.50*	*0.00*	*1.00*	*1.00*
SIZE	*77,264*	*5.24*	*2.22*	*3.60*	*5.03*	*6.73*
LEV	*77,264*	*0.20*	*0.24*	*0.01*	*0.14*	*0.30*
RISK	*77,264*	*0.16*	*0.10*	*0.09*	*0.13*	*0.20*
SALEG	*77,264*	*0.27*	*0.95*	*-0.02*	*0.09*	*0.26*
CAPX	*77,264*	*0.05*	*0.05*	*0.02*	*0.04*	*0.07*
WC	*77,264*	*0.30*	*0.34*	*0.13*	*0.30*	*0.49*
MTB	*77,264*	*3.08*	*7.13*	*1.19*	*2.11*	*3.81*
RD	*77,264*	*0.25*	*1.23*	*0.01*	*0.04*	*0.14*
TOBINQ	*77,264*	*0.59*	*0.64*	*0.13*	*0.47*	*0.94*
OILV_L1	*77,264*	*0.36*	*0.13*	*0.28*	*0.35*	*0.43*
OILV_L2	*77,264*	*0.35*	*0.13*	*0.25*	*0.35*	*0.43*
OILV_L3	*77,264*	*0.34*	*0.14*	*0.25*	*0.35*	*0.40*
MA	*77,264*	*0.01*	*0.12*	*-0.06*	*-0.01*	*0.05*
GDP	*77,264*	*0.03*	*0.02*	*0.02*	*0.03*	*0.04*
IRATE	*77,264*	*-0.21*	*1.29*	*-0.57*	*-0.04*	*0.64*
EPU	*77,264*	*4.62*	*0.23*	*4.40*	*4.66*	*4.78*

Note: This table reports the descriptive statistics of the key variables. Refer to Table 1 for variable definitions.

[3] https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D
[4] https://fred.stlouisfed.org

Figure 1 plots the crude oil price volatility over our sample period (1986 to 2017). During the Gulf War in 1990, the global financial crisis (GFC) in 2008, and the shale oil revolution of 2016, oil price volatility increased. From 2014 to 2016, which includes the shale oil revolution, oil prices dropped drastically. Before the shale oil revolution, oil prices ranged between $90 and $120 per barrel; however, following increased production in the US and declining demand in emerging countries prices dropped to $30 per barrel (Naeem et al., 2020).

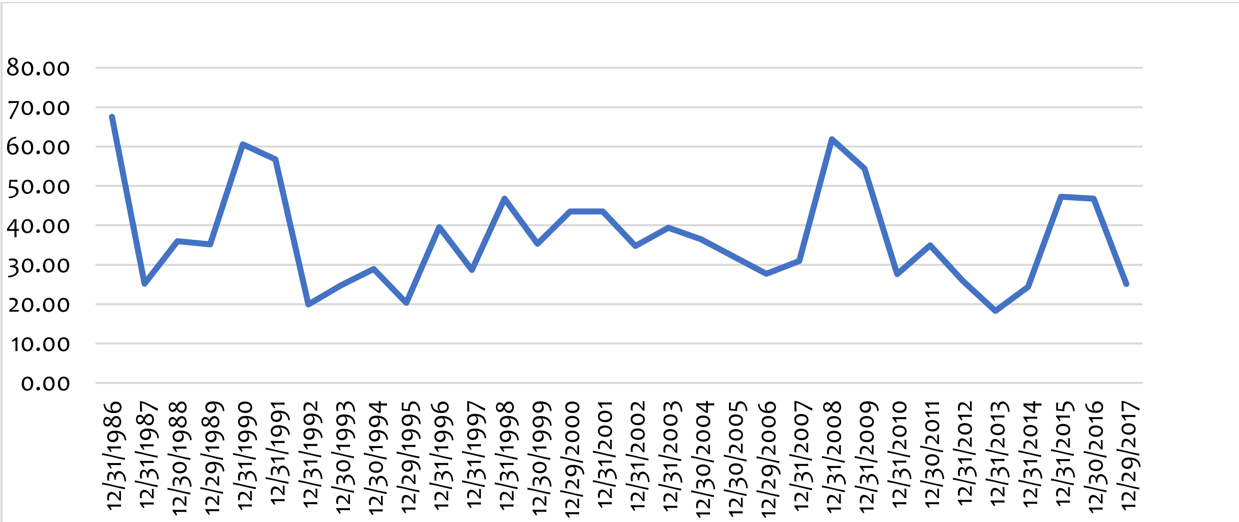

Figure 1. Plot of Crude Oil Price Volatility Over the Sample Period (1986 to 2017).

Table 3 reports the correlation between all the key variables. Most of the correlations are significant at the conventional level. It is evident from Table 3 that OILV is significantly and negatively correlated with both firm performance measures: ROA (-0.029, p<0.001) and RET (-0.068, p<0.001). ROA and RET are significantly and positively correlated (0.159, p<0.001). Organization capital (OC) is correlated significantly and positively with both firm performance measures: ROA (0.054, p<0.001) and RET (0.218, p<0.001) (we used the binary specification of the OC variable in the correlation analysis); and negatively correlated with OILV (-0.099, p<0.001). The managerial ability score (MA) has significant and positive correlations with both ROA (0.127, p<0.001) and RET (0.074, p<0.001); however, its correlation with OILV is insignificant.

Table 3. Correlation Analysis

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
ROA [1]	-									
RET [2]	*0.159**	-								
OILV [3]	*-0.029**	*-0.068**	-							
OC [4]	*0.054**	*0.218**	*-0.099**	-						
SIZE [5]	*0.317**	*0.026**	*-0.044**	*0.085**	-					
LEV [6]	*-0.230**	*-0.075**	*0.038**	*-0.052**	*0.090**	-				
RISK [7]	*-0.307**	*0.262**	*0.131**	*-0.037**	*-0.412**	*0.028**	-			
SALEG [8]	*-0.067**	*0.061**	*-0.022**	*0.177**	*-0.100**	*-0.047**	*0.128**	-		
CAPX [9]	*-0.026**	*-0.052**	*0.012**	*0.073**	*-0.007*	*0.046**	*-0.029**	*0.053**	-	

WC [10]	*0.379**	*0.082**	*-0.019**	*0.073**	*-0.149**	*-0.543**	*-0.003*	*0.084**	*-0.172**	-
MTB [11]	*0.004*	*0.145**	*-0.028**	*0.221**	*-0.026**	*-0.100**	*0.047**	*0.096**	*0.026**	*0.069**
RD [12]	*-0.204**	*-0.015**	*-0.009*	*0.073**	*-0.110**	*-0.047**	*0.103**	*0.105**	*-0.043**	*0.119**
TOBINQ [13]	*-0.179**	*0.316**	*-0.087**	*0.656**	*-0.107**	*-0.065**	*0.124**	*0.228**	*0.059**	*0.046**
OILV_L1 [14]	*-0.010*	*0.114**	*0.009*	*-0.029**	*-0.009*	*0.012**	*0.125**	*-0.025**	*-0.046**	*-0.013**
OILV_L2 [15]	*0.005*	*0.038**	*-0.227**	*-0.012*	*0.015**	*-0.022**	*0.021**	*-0.004*	*-0.045**	*0.002*
OILV_L3 [16]	*0.003*	*0.028**	*-0.263**	*-0.019**	*0.033**	*-0.041**	*-0.040**	*-0.019**	*-0.037**	*0.004**
MA [17]	*0.127**	*0.074**	*0.001*	*0.122**	*0.096**	*-0.137**	*-0.046**	*0.045**	*-0.029**	*0.099**
GDP [18]	*0.008*	*0.185**	*-0.308**	*0.074**	*-0.134**	*0.009*	*0.006*	*0.030**	*0.076**	*0.022**
IRATE [19]	*0.043**	*0.002*	*-0.497**	*0.094**	*0.021**	*-0.011*	*-0.149**	*0.059**	*0.018**	*0.019**
EPU [20]	*0.014**	*0.003*	*0.263**	*-0.095**	*0.083**	*0.011*	*-0.018**	*-0.068**	*-0.071**	*-0.022**

	[11]	**[12]**	**[13]**	**[14]**	**[15]**	**[16]**	**[17]**	**[18]**	**[19]**
ROA [1]									
RET [2]									
OILV [3]									
OC [4]									
SIZE [5]									
LEV [6]									
RISK [7]									
SALEG [8]									
CAPX [9]									
WC [10]									
MTB [11]	-								
RD [12]	*0.046**	-							
TOBINQ [13]	*0.362**	*0.166**	-						
OILV_L1 [14]	*-0.009*	*-0.009*	*-0.029**	-					
OILV_L2 [15]	*-0.009*	*-0.003*	*-0.023**	*0.099**	-				
OILV_L3 [16]	*-0.008*	*-0.002*	*-0.002*	*-0.134**	*0.186**	-			
MA [17]	*0.081**	*-0.085**	*0.220**	*0.003*	*-0.002*	*0.004*	-		
GDP [18]	*0.042**	*0.001*	*0.097**	*0.029**	*-0.027**	*-0.147**	*0.006*	-	
IRATE [19]	*0.026**	*0.008*	*0.084**	*-0.282**	*-0.023**	*0.052**	*-0.003*	*0.229**	-
EPU [20]	*-0.045**	*-0.022**	*-0.118**	*0.263**	*0.228**	*0.101**	*0.001*	*-0.307**	*-0.476**

Note: This table presents the correlation analysis. Asterisk (*) correlation values are significant at p<0.01 (two-tailed). Refer to Table 1 for variable definitions.

REGRESSION RESULTS

We report the OLS regression results on the association between oil price volatility and firm performance (Equation 1) in Table 4. In order to control for any unobservable industry and year characteristics associated with firm performance and oil price volatility, we include year and industry dummy variables in all our regression specifications. To take into account the time series and cross-sectional dependence in the error terms of our regressions, we calculate t-statistics using standard errors that are clustered by firm.

Columns (1) to (3) of Table 4 document regression results using ROA as the dependent variable, whilst columns (4) to (6) report results for RET as the dependent variable. Columns (1) and (3) include firm-level control variables and lagged oil price uncertainty. Columns (2) and (4) incorporate managerial ability as a control variable in addition to firm-level control variables and lagged oil price uncertainty. Columns (3) and (6) comprise all the control variables including three macro-level variables i.e., GDP growth rate, federal funds rate, and EPU.

Consistent with our expectation that oil price volatility has an adverse impact on firm performance, it is evident from the results reported in Table 4 that the coefficients on OILV are negative and statistically highly significant across all six columns. For instance, it is evident from columns (3) and (6) that after controlling for firm-level financials, managerial ability, and macro-level variables, oil price uncertainty negatively affects both ROA (coefficient -0.058, p<0.10) and RET (coefficient -0.139, p<0.01). Our results imply that for every 1% increase in oil price uncertainty, ROA (RET) decreases by 0.06% (0.14%). The control variables are statistically significant in all the column including the coefficient on MA.[5]

[5] Phan et al. (2020) did not include MA as a standalone variable in their empirical tests. Instead, the authors interacted oil volatility (OILV) with high and low MA (see Table 6 of their paper) and left out MA variable altogether. We, therefore, could not compare the magnitude of the coefficient on MA reported in our paper with that in Phan et al. (2020).

Table 4. Regression Results: Oil Price Volatility and Firm Performance

Dependent Variable	(1) ROA	(2) ROA	(3) ROA	(4) RET	(5) RET	(6) RET
OILV	-0.454*** [-3.55]	-0.383*** [-3.63]	-0.058* [-1.87]	-0.149*** [-9.58]	-0.155*** [-10.03]	-0.139*** [-26.83]
SIZE	0.078*** [38.47]	0.067*** [34.96]	0.066*** [35.43]	0.006*** [43.40]	0.006*** [41.94]	0.006*** [41.94]
LEV	-0.099*** [-3.20]	-0.063** [-2.13]	-0.041* [-1.74]	-0.014*** [-11.22]	-0.014*** [-10.81]	-0.014*** [-10.81]
RISK	-0.579*** [-18.26]	-0.582*** [-20.57]	-0.586*** [-21.16]	0.213*** [66.22]	0.210*** [64.10]	0.210*** [64.10]
SALEG	-0.012*** [-4.06]	-0.008*** [-2.73]	-0.007*** [-2.65]	-0.001*** [-4.48]	-0.001*** [-2.73]	-0.001*** [-2.73]
CAPX	0.104 [1.42]	0.170** [2.58]	0.192*** [3.16]	-0.055*** [-11.57]	-0.055*** [-11.34]	-0.055*** [-11.34]
WC	0.633*** [19.90]	0.602*** [19.12]	0.604*** [19.52]	0.010*** [8.20]	0.012*** [9.92]	0.012*** [9.92]
MTB	0.004*** [6.10]	0.003*** [5.71]	0.003*** [6.01]	0.000*** [5.54]	0.000*** [5.34]	0.000*** [5.34]
RD	-0.026*** [-21.69]	-0.063*** [-15.35]	-0.065*** [-15.25]	-0.001*** [-19.27]	-0.004*** [-13.06]	-0.004*** [-13.06]
TOBINQ	-0.124*** [-14.40]	-0.099*** [-15.03]	-0.095*** [-15.26]	0.026*** [59.13]	0.026*** [57.84]	0.026*** [57.84]
OILV_L1	-0.388*** [-6.76]	-0.287*** [-7.26]	0.243*** [2.58]	-0.033*** [-6.01]	-0.025*** [-4.69]	0.086*** [5.46]
OILV_L2	-0.116 [-0.96]	-0.085 [-1.05]	0.131*** [2.95]	-0.036*** [-2.66]	-0.047*** [-3.55]	-0.004 [-0.55]
OILV_L3	-1.258*** [-7.92]	-1.020*** [-6.96]	-0.024 [-0.72]	-0.283*** [-14.82]	-0.283*** [-14.89]	-0.076*** [-12.99]
MA	-	0.204*** [10.39]	0.203*** [10.66]	-	-0.007*** [-4.00]	-0.007*** [-4.00]
GDP	-	-	-1.494 [-1.12]	-	-	-0.827*** [-3.57]
IRATE	-	-	-0.124*** [-3.61]	-	-	-0.035*** [-6.07]
EPU	-	-	-0.073 [-1.35]	-	-	0.013 [1.44]
Constant	0.044 [0.40]	0.005 [0.05]	-0.202 [-0.80]	0.074*** [5.48]	0.080*** [5.95]	-0.063 [-1.46]
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	79,708	77,264	77,264	79,367	76,948	76,948
Adj. R-squared	0.43	0.39	0.39	0.33	0.33	0.33

Note: This table reports the results from OLS regressions of the association between oil price volatility and firm performance. Robust t-statistics are in brackets and are based on standard errors that are clustered by firm. *** p<0.01, ** p<0.05, * p<0.10. Refer to Table 1 for variable definitions.

Table 5 reports regression results for the moderating effects of organization capital on the relationship between oil price volatility and firm performance (Equation 2). Columns (1) and (2) include organization capital as dummy variable, and columns (3) and (4) include the decile rank version of organization capital. From columns (1) and (2) it is evident that the standalone variable OILV is associated significantly and negatively with both ROA (coefficient -0.09, p<0.01) and RET (coefficient -0.15, p<0.01).

Our variable of interest from Table 5 is the interaction term OILV*OC. We find that the coefficient on OILV*OC is positive and significant across all four columns. From column (1) it is evident that the coefficient on OILV*OC is positive and significant (coefficient 0.093, p<0.01) when ROA is used as the firm performance measure. The findings indicate that for firms with above median organization capital, a 1% increase in oil price uncertainty leads to an increase in ROA (RET) of 0.093% (0.017%). In other words, high levels of organization capital achieved through operational efficiency, and sustainable competitive advantage, works as a shield against oil price uncertainty and induces better firm performance.

Table 5. Oil Price Volatility, Organization Capital, and Firm Performance.

Dependent Variable	(1) Binary Specification of OC ROA	(2) Binary Specification of OC RET	(3) Decile Ranking of OC ROA	(4) Decile Ranking of OC RET
OILV	*-0.089**** *[-2.67]*	*-0.149**** *[-28.04]*	*0.010* *[0.21]*	*-0.155**** *[-22.24]*
OC	*0.121**** *[14.06]*	*-0.003**** *[-2.77]*	*0.049**** *[23.50]*	*0.000* *[1.43]*
OILV*OC	*0.093**** *[4.61]*	*0.017**** *[6.09]*	*0.022**** *[6.30]*	*0.004**** *[7.04]*
SIZE	*0.062**** *[34.67]*	*0.006**** *[41.48]*	*0.053**** *[32.64]*	*0.006**** *[38.76]*
LEV	*-0.071*** *[-2.44]*	*-0.014**** *[-10.98]*	*-0.083**** *[-2.88]*	*-0.015**** *[-11.20]*
RISK	*-0.534**** *[-19.06]*	*0.211**** *[64.25]*	*-0.474**** *[-17.23]*	*0.213**** *[64.38]*
SALEG	*-0.011**** *[-3.95]*	*-0.001**** *[-2.97]*	*-0.017**** *[-6.06]*	*-0.001**** *[-3.83]*
CAPX	*0.104* *[1.59]*	*-0.057**** *[-11.65]*	*-0.000* *[-0.00]*	*-0.061**** *[-12.71]*
WC	*0.580**** *[18.70]*	*0.011**** *[9.57]*	*0.542**** *[17.72]*	*0.010**** *[8.39]*
MTB	*0.003**** *[6.42]*	*0.000**** *[5.55]*	*0.003**** *[7.21]*	*0.000**** *[5.98]*
RD	*-0.061**** *[-15.36]*	*-0.004**** *[-12.99]*	*-0.058**** *[-14.77]*	*-0.003**** *[-12.54]*
TOBINQ	*-0.181**** *[-21.16]*	*0.024**** *[44.25]*	*-0.312**** *[-26.25]*	*0.020**** *[27.33]*

OILV_L1	*0.262**** *[2.58]*	*0.087**** *[5.49]*	*-0.375**** *[-2.69]*	*0.071**** *[3.39]*
OILV_L2	*0.121**** *[2.64]*	*-0.003* *[-0.43]*	*-0.112*** *[-2.00]*	*-0.009* *[-1.00]*
OILV_L3	*0.070** *[1.95]*	*-0.076**** *[-12.88]*	*-0.162**** *[-3.18]*	*-0.081**** *[-10.28]*
MA	*0.235**** *[12.26]*	*-0.006**** *[-3.67]*	*0.291**** *[14.97]*	*-0.004*** *[-2.24]*
GDP	*-2.885*** *[-1.98]*	*-0.842**** *[-3.59]*	*8.881**** *[3.81]*	*-0.549* *[-1.57]*
IRATE	*-0.158**** *[-4.33]*	*-0.036**** *[-6.18]*	*0.127*** *[2.26]*	*-0.029**** *[-3.40]*
EPU	*-0.122*** *[-2.09]*	*0.013* *[1.35]*	*0.308**** *[3.52]*	*0.023** *[1.76]*
Constant	*0.029* *[0.11]*	*-0.056* *[-1.29]*	*-2.109**** *[-5.09]*	*-0.105** *[-1.69]*
Industry	*Yes*	*Yes*	*Yes*	*Yes*
Year	*Yes*	*Yes*	*Yes*	*Yes*
Observations	*77,264*	*76,948*	*77,264*	*76,948*
Adj. R-squared	*0.41*	*0.33*	*0.43*	*0.33*

Note: This table reports the results from OLS regressions of the moderating effects of organization capital on the association between oil price volatility and firm performance. Robust t-statistics are in brackets and are based on standard errors that are clustered by firm. *** p<0.01, ** p<0.05, * p<0.10. Refer to Table 1 for variable definitions.

To investigate empirically our theoretical postulation that high cash holdings by firms with more organization capital might explain the results reported in Table 5, we re-estimate Equation (2) for the high- versus low-levels of cash holding sub-samples. We follow the sub-sampling procedure to allow the coefficients on all the control variables to vary between the groups. Cash holding is calculated as cash and marketable securities divided by total assets. The high (low) cash holding group consists of firm-year observations, above (below) the median, respectively.

Table 6 reports the results using subsample analysis. It is evident from columns (1) and (2) that our variable of interest OILV*OC is insignificant in the low cash holding group (coefficient 0.04); but positive and highly significant for the high cash holding group (coefficient 0.172, p<0.01) when ROA is used as measure of firm performance. The coefficients, however, are positive and significant for both the low and high cash holding group when RET is deployed as the firm performance measure. Overall, the empirical findings support our assumption that increased cash holdings by firms with more organization capital hedge against oil price uncertainties.

Table 6. Oil Price Volatility, Organization Capital, and Firm Performance Moderated by Low and High Cash Holding

Dependent Variable	(1) Low Cash Holding Binary Specification of OC ROA	(2) High Cash Holding Binary Specification of OC ROA	(3) Low Cash Holding Decile Ranking of OC RET	(4) High Cash Holding Decile Ranking of OC RET
OILV	*-0.136**** *[-3.22]*	*-0.079* *[-1.52]*	*-0.168**** *[-24.05]*	*-0.137**** *[-17.27]*
OC	*0.115**** *[9.57]*	*0.083**** *[6.65]*	*-0.004*** *[-2.39]*	*-0.003** *[-1.84]*
OILV*OC	*0.038* *[1.39]*	*0.172**** *[5.57]*	*0.020**** *[5.21]*	*0.014**** *[3.47]*
SIZE	*0.040**** *[23.70]*	*0.087**** *[28.61]*	*0.005**** *[29.13]*	*0.007**** *[29.19]*
LEV	*-0.045* *[-1.48]*	*-0.224**** *[-4.47]*	*-0.013**** *[-6.31]*	*-0.022**** *[-11.70]*
RISK	*-0.313**** *[-7.96]*	*-0.559**** *[-14.94]*	*0.205**** *[41.64]*	*0.233**** *[54.42]*
SALEG	*0.006* *[0.85]*	*-0.012**** *[-4.50]*	*0.002**** *[3.71]*	*-0.001**** *[-4.71]*
CAPX	*0.304**** *[5.70]*	*-0.135* *[-1.20]*	*-0.038**** *[-6.37]*	*-0.084**** *[-11.53]*
WC	*0.672**** *[15.70]*	*0.586**** *[13.33]*	*0.021**** *[7.95]*	*0.008**** *[4.17]*
MTB	*0.003**** *[5.76]*	*0.002*** *[2.41]*	*0.000* *[0.21]*	*0.000**** *[4.43]*
RD	*-0.319**** *[-6.15]*	*-0.046**** *[-14.83]*	*-0.020**** *[-6.09]*	*-0.003**** *[-11.17]*
TOBINQ	*-0.149**** *[-12.21]*	*-0.130**** *[-12.39]*	*0.025**** *[27.35]*	*0.027**** *[38.76]*
OILV_L1	*0.514**** *[4.01]*	*0.108* *[0.67]*	*0.157**** *[7.48]*	*0.040** *[1.74]*
OILV_L2	*0.197**** *[2.99]*	*0.078* *[1.16]*	*0.024*** *[2.29]*	*-0.019** *[-1.74]*
OILV_L3	*0.164**** *[3.60]*	*0.007* *[0.13]*	*-0.047**** *[-6.14]*	*-0.094**** *[-10.99]*
MA	*0.051*** *[2.40]*	*0.388**** *[16.84]*	*-0.012**** *[-5.18]*	*0.002* *[0.95]*
GDP	*-7.335**** *[-3.67]*	*0.210* *[0.10]*	*-1.829**** *[-5.91]*	*-0.271* *[-0.78]*
IRATE	*-0.208**** *[-4.35]*	*-0.122*** *[-2.16]*	*-0.062**** *[-8.03]*	*-0.018*** *[-2.12]*

EPU	*-0.306**** *[-4.02]*	*0.008* *[0.09]*	*-0.030*** *[-2.42]*	*0.039**** *[2.84]*
Constant	*1.050**** *[2.93]*	*-0.780** *[-1.87]*	*0.148*** *[2.57]*	*-0.181**** *[-2.82]*
Industry	*Yes*	*Yes*	*Yes*	*Yes*
Year	*Yes*	*Yes*	*Yes*	*Yes*
Observations	*38,608*	*38,609*	*38,442*	*38,482*
Adj. R-squared	*0.51*	*0.39*	*0.29*	*0.38*

Note: This table reports the results from OLS regressions of the association between oil price volatility, organization capital and firm performance moderated by cash holding. Robust t-statistics are in brackets and are based on standard errors that are clustered by firm. *** p<0.01, ** p<0.05, * p<0.10. Refer to Table 1 for variable definitions.

ADDITIONAL TEST

So far, our evidence indicates that oil price uncertainty adversely affects firm performance, but organization capital plays a moderating role in mitigating this adverse impact of oil price volatility on firm performance. We conduct an additional analysis to examine whether this effect holds across firm types. We follow Crawford et al. (2021) and categorize our sample firms into i) oil producing firms, ii) oil consuming firms, and iii) inert firms.

We deploy the following model developed by Crawford et al. (2021).

$$\Delta VAR_k = \propto_1 + \propto_2 Q2_k + \propto_3 Q3_k + \propto_4 Q4_k + \varepsilon_k \quad (5)$$

where ΔVAR is either ΔRAWSALE or ΔRAWEXP, Q2, Q3, and Q4 are dummy variables which take the value: one, if quarter *k* is the second, third, or fourth quarter of the firm's fiscal period, respectively, and zero otherwise. ΔRAWSALE is calculated as sales at quarter *k* minus sales at quarter *k*-1, scaled by total assets at quarter *k*-1. ΔRAWEXP is calculated as total expenses at quarter *k* minus total expenses at quarter *k*-1, scaled by total assets at quarter *k*-1. We use the above model to mitigate seasonality concerns by using a 16-quarter window ending at the firm's quarter *k*.

Oil producing firms include observations which are in the top tercile of $(\Delta SALE/\Delta OIL)_t$. $\Delta SALE_t$ is the annualized residual of the regression of $\Delta RAWSALE_t$ on fiscal quarter dummies using Equation (5) and ΔOIL is calculated as oil price at quarter *k* scaled by oil price at quarter *k*-1, minus 1. We have annualized the quarterly value. Oil consuming firms include observations that are in the top tercile of $(\Delta EXP/\Delta OIL)_t$, where ΔEXP_t is the annualized residual of the regression of $\Delta RAWEXP_t$ on fiscal quarter dummies using Equation (5). Inert firms consist of observations which do not belong to either of these groups (Crawford et al., 2021). Table 7 reports the results using Equation (2) for oil producers (columns (1) and (4)), oil consumers (columns (2) and (5)), and inert firms (columns (3) and (6)). Result show that the coefficients on the interactive variable OILV*OC are positive and significant across all but column (2). We, therefore, fail to find any differential incremental moderating effect of organization capital on the oil volatility and firm performance relationship. The only notable observation from Table 7 is that organization capital plays a stronger role in mitigating the adverse effect of oil volatility on firm performance for oil producing firms (column (1) coefficient 0.109, p<0.01) compared with inert firms (column (3) coefficient 0.087, p<0.01).

Table 7. Effect of Oil Price Volatility and Organization Capital on Firm Performance across Oil producers and Oil Consumers

Dependent Variable	(1) ROA Oil Producers	(2) ROA Oil Consumers	(3) ROA Inert	(4) RET Oil Producers	(5) RET Oil Consumers	(6) RET Inert
OILV	-0.258*** [-2.81]	-0.157* [-1.85]	-0.009 [-0.22]	-0.232*** [-21.83]	-0.217*** [-19.15]	-0.108*** [-17.01]
OC	0.124*** [7.51]	0.131*** [6.99]	0.110*** [11.44]	-0.006*** [-2.82]	-0.007*** [-3.15]	-0.001 [-0.58]
OILV*OC	0.109*** [2.58]	0.067 [1.38]	0.087*** [3.84]	0.032*** [5.82]	0.036*** [5.79]	0.013*** [3.99]
SIZE	0.064*** [26.10]	0.067*** [26.37]	0.057*** [24.14]	0.006*** [29.83]	0.007*** [30.57]	0.005*** [30.83]
LEV	-0.016 [-0.43]	-0.110*** [-3.18]	-0.081* [-1.82]	-0.012*** [-6.57]	-0.012*** [-5.72]	-0.015*** [-8.62]
RISK	-0.439*** [-10.04]	-0.429*** [-10.20]	-0.631*** [-16.62]	0.236*** [46.89]	0.235*** [44.82]	0.191*** [43.52]
SALEG	-0.016*** [-3.73]	-0.004 [-1.24]	-0.013** [-2.29]	-0.002*** [-4.29]	-0.000 [-0.99]	-0.001*** [-2.98]
CAPX	0.216** [2.27]	0.146** [2.12]	0.061 [0.60]	-0.044*** [-6.07]	-0.047*** [-6.39]	-0.057*** [-9.19]
WC	0.625*** [10.47]	0.516*** [11.66]	0.550*** [12.67]	0.018*** [8.06]	0.017*** [7.99]	0.009*** [5.50]
MTB	0.004*** [3.81]	0.003*** [4.73]	0.002*** [3.77]	0.000 [1.56]	0.000*** [3.44]	0.000*** [3.79]
RD	-0.071*** [-7.64]	-0.066*** [-9.27]	-0.063*** [-11.45]	-0.004*** [-6.61]	-0.004*** [-7.51]	-0.004*** [-10.55]
TOBINQ	-0.201*** [-13.76]	-0.199*** [-16.04]	-0.148*** [-14.16]	0.022*** [25.53]	0.022*** [24.70]	0.024*** [34.14]
OILV_L1	0.848** [2.37]	0.107 [0.29]	0.013 [0.10]	0.337*** [8.93]	0.230*** [5.35]	-0.038** [-2.06]
OILV_L2	0.541*** [4.12]	0.341** [2.51]	-0.129* [-1.86]	0.160*** [10.33]	0.115*** [6.69]	-0.099*** [-9.69]
OILV_L3	0.172 [1.45]	-0.215 [-1.62]	0.037 [0.81]	-0.059*** [-4.43]	-0.101*** [-6.33]	-0.096*** [-14.11]
MA	0.341*** [12.15]	0.349*** [11.39]	0.153*** [6.54]	-0.000 [-0.11]	-0.000 [-0.14]	-0.012*** [-5.74]
GDP	-12.723*** [-2.82]	-5.142 [-1.06]	1.975 [1.00]	-5.191*** [-9.85]	-3.623*** [-6.11]	1.526*** [5.34]
IRATE	-0.412*** [-3.50]	-0.178 [-1.48]	-0.038 [-0.78]	-0.140*** [-10.80]	-0.103*** [-7.11]	0.020*** [2.91]

EPU	-0.471** [-2.40]	0.006 [0.03]	0.052 [0.68]	-0.113*** [-5.24]	-0.044* [-1.76]	0.093*** [8.21]
Constant	1.609* [1.80]	-0.463 [-0.48]	-0.734** [-2.04]	0.539*** [5.41]	0.219* [1.92]	-0.428*** [-8.14]
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,459	22,520	42,816	25,356	22,432	42,649
Adj. R-squared	0.42	0.41	0.39	0.40	0.38	0.32

Note: This table reports the results from OLS regressions of the association between oil price volatility, organization capital and firm performance across oil producers, oil consumers, and inert companies. Robust t-statistics are in brackets and are based on standard errors that are clustered by firm. *** p<0.01, ** p<0.05, * p<0.10. Refer to Table 1 for variable definitions.

ROBUSTNESS TESTS ALTERNATIVE MEASURE OF OIL PRICE VOLATILITY

We deploy GARCH (1,1) to estimate the variance of crude oil returns as an alternative measure of oil price volatility (Henriques & Sadorsky, 2011; Phan et al., 2020; Wang et al., 2017). Table 8 reports the results. The coefficient on OILV is significant and negative (coefficient -0.002, p<0.05) and that on OILV*OC is significant and positive (coefficient 0.002, p<0.01) when firm performance is proxied by ROA (column 1). We find a similar result using RET as our firm performance proxy in column (2).

Table 8. Robustness Test using an Alternative Measure of Oil Price Volatility

Dependent Variable	**(1) ROA**	**(2) RET**
OILV	-0.002** [-2.21]	-0.005*** [-27.59]
OC	0.142*** [21.62]	0.001 [1.41]
OILV*OC	0.002*** [3.55]	0.000*** [4.05]
SIZE	0.062*** [34.66]	0.006*** [41.51]
LEV	-0.071** [-2.44]	-0.014*** [-10.98]
RISK	-0.534*** [-19.05]	0.211*** [64.27]
SALEG	-0.011*** [-3.95]	-0.001*** [-2.97]
CAPX	0.103 [1.59]	-0.057*** [-11.66]
WC	0.580*** [18.70]	0.011*** [9.58]
MTB	0.003*** [6.41]	0.000*** [5.54]
RD	-0.061*** [-15.36]	-0.004*** [-12.99]

TOBINQ	*-0.180**** *[-21.15]*	*0.024**** *[44.30]*
OILV_L1	*0.268**** *[2.72]*	*0.072**** *[4.72]*
OILV_L2	*0.120**** *[2.72]*	*-0.017*** *[-2.26]*
OILV_L3	*0.066*** *[2.04]*	*-0.105**** *[-18.97]*
MA	*0.235**** *[12.27]*	*-0.006**** *[-3.65]*
GDP	*-2.945*** *[-2.14]*	*-0.429** *[-1.94]*
IRATE	*-0.162**** *[-4.46]*	*-0.036**** *[-6.23]*
EPU	*-0.122*** *[-2.24]*	*0.035**** *[3.94]*
Constant	*0.012* *[0.05]*	*-0.175**** *[-4.34]*
Industry	*Yes*	*Yes*
Year	*Yes*	*Yes*
Observations	*77,264*	*76,948*
Adj. R-squared	*0.41*	*0.33*

Note: This table reports the results from OLS regressions of the association between oil price volatility, organization capital and firm performance. Oil price volatility has been measured using the GARCH based model. Robust t-statistics are in brackets and are based on standard errors that are clustered by firm. *** p<0.01, ** p<0.05, * p<0.10. Refer to Table 1 for variable definitions.

ECONOMIC DOWNTURN, OIL PRICE VOLATILITY, AND FIRM PERFORMANCE

For our next set of robustness tests, we explore the contexts of economic downturn. We consider the GFC period (2007-2008) as one of the settings for economic downturn. Prior studies document that the GFC period affects firm performance (e.g., Bailey, 2019; Bhagat & Bolton, 2019; Nemlioglu & Mallick, 2017). Following Phan et al. (2020) and Wong and Hasan (2021) we deploy two alternative methods to alleviate concerns stemming from the GFC period. Table 9 reports results relating to the GFC period. We re-examine Equation 2 by, firstly, including an additional control variable: GFC (results reported in columns (1) and (2)), and secondly, removing observations from the sample for the GFC period i.e., 2007-2008 (results reported in columns (3) and (4)).

From column (1) it is evident that GFC has an adverse impact on ROA (coefficient -0.67, p<0.01). A similar result is documented in column (2), when RET is used. The coefficients on our variable of interest OILV*OC are positive and significant for both ROA (coefficient 0.09, p<0.01) and RET (coefficient 0.017, p<0.01). From columns (3) and (4) it is evident that after eliminating observations for the GFC period from our sample, the coefficient on OILV*OC remains significant and positive for both ROA (coefficient 0.077, p<0.01) and RET (coefficient 0.013, p<0.01), respectively.

Table 9. Robustness Test Controlling for the Global Financial Crisis

Dependent Variable	(1) ROA	(2) RET	(3) ROA	(4) RET
OILV	-0.089*** [-2.67]	-0.149*** [-28.04]	-0.086** [-2.57]	-0.147*** [-27.66]
OC	0.121*** [14.06]	-0.003*** [-2.77]	0.127*** [14.33]	-0.002* [-1.84]
OILV*OC	0.093*** [4.61]	0.017*** [6.09]	0.077*** [3.57]	0.013*** [4.27]
SIZE	0.062*** [34.67]	0.006*** [41.48]	0.061*** [34.23]	0.006*** [40.69]
LEV	-0.071** [-2.44]	-0.014*** [-10.98]	-0.070** [-2.30]	-0.013*** [-9.53]
RISK	-0.534*** [-19.06]	0.211*** [64.25]	-0.532*** [-18.73]	0.216*** [64.60]
SALEG	-0.011*** [-3.95]	-0.001*** [-2.97]	-0.010*** [-3.85]	-0.001*** [-2.60]
CAPX	0.104 [1.59]	-0.057*** [-11.65]	0.093 [1.40]	-0.053*** [-10.70]
WC	0.580*** [18.70]	0.011*** [9.57]	0.576*** [18.27]	0.012*** [9.44]
MTB	0.003*** [6.42]	0.000*** [5.55]	0.003*** [6.49]	0.000*** [5.73]
RD	-0.061*** [-15.36]	-0.004*** [-12.99]	-0.060*** [-14.98]	-0.003*** [-12.62]
TOBINQ	-0.181*** [-21.16]	0.024*** [44.25]	-0.183*** [-21.22]	0.024*** [42.54]
OILV_L1	0.262*** [2.58]	0.087*** [5.49]	0.275*** [2.71]	0.088*** [5.55]
OILV_L2	0.121*** [2.64]	-0.003 [-0.43]	0.128*** [2.78]	-0.003 [-0.36]
OILV_L3	0.070* [1.95]	-0.076*** [-12.88]	0.075** [2.09]	-0.075*** [-12.82]
MA	0.235*** [12.26]	-0.006*** [-3.67]	0.246*** [12.53]	-0.006*** [-3.34]
GDP	-2.885** [-1.98]	-0.842*** [-3.59]	-3.184** [-2.19]	-0.868*** [-3.71]
IRATE	-0.158*** [-4.33]	-0.036*** [-6.18]	-0.163*** [-4.46]	-0.036*** [-6.22]
EPU	-0.122** [-2.09]	0.013 [1.35]	-0.132** [-2.27]	0.012 [1.25]
GFC	-0.666*** [-3.72]	-0.180*** [-6.26]	-	-

Constant	*0.029* [0.11]	*-0.056* [-1.29]	*0.087* [0.32]	*-0.052* [-1.20]
Industry	*Yes*	*Yes*	*Yes*	*Yes*
Year	*Yes*	*Yes*	*Yes*	*Yes*
Observations	*77,264*	*76,948*	*72,760*	*72,467*
Adj. R-squared	*0.41*	*0.33*	*0.41*	*0.31*

Note: This table reports the results from OLS regressions of the association between oil price volatility, organization capital and firm performance controlling for GFC period. Columns (1) and (2) include GFC period (2007-2008) as an additional control variable (GFC). Columns (3) and (4) exclude observations for GFC period (2007-2008) from the sample. Robust t-statistics are in brackets and are based on standard errors that are clustered by firm. *** p<0.01, ** p<0.05, * p<0.10. Refer to Table 1 for variable definitions.

Next, we consider economic recession as another setting to capture economic downturn. Prior research documents that firm performance is affected by recession (Alviarez et al., 2017; Ang & Smedema, 2011; Nason & Patel, 2016). We use the NBER's turning point dates to identify recession. As with the GFC, to mitigate concerns relating to recession, we re-estimate Equation 2 by firstly, including an additional control variable RECE for the recession period, and secondly, excluding observations for the recession periods from our sample period. Table 10 reports the results. RECE has an adverse impact on ROA (coefficient -0.24, p<0.01) (column 1), but the coefficient on OILV*OC continues to be significant and positive (coefficient 0.09, p<0.01). From column (3) it is evident that after removing observations for recession periods from our sample, the coefficient on OILV*OC remains significant and positive (coefficient 0.077, p<0.01). Results are consistent when RET is deployed as proxy for firm performance. Overall, we can conclude that our results are robust to controlling for economic downturns.

Table 10. Robustness Test Controlling for Recession

Dependent Variable	(1) ROA	(2) RET	(3) ROA	(4) RET
OILV	*-0.089*** [-2.67]*	*-0.149*** [-28.04]*	*-0.079** [-2.34]*	*-0.148*** [-27.50]*
OC	*0.121*** [14.06]*	*-0.003*** [-2.77]*	*0.125*** [12.16]*	*-0.003** [-2.12]*
OILV*OC	*0.093*** [4.61]*	*0.017*** [6.09]*	*0.077*** [2.83]*	*0.016*** [4.60]*
SIZE	*0.062*** [34.67]*	*0.006*** [41.48]*	*0.062*** [33.19]*	*0.006*** [41.63]*
LEV	*-0.071** [-2.44]*	*-0.014*** [-10.98]*	*-0.088*** [-2.71]*	*-0.013*** [-9.63]*
RISK	*-0.534*** [-19.06]*	*0.211*** [64.25]*	*-0.480*** [-16.79]*	*0.208*** [56.22]*
SALEG	*-0.011*** [-3.95]*	*-0.001*** [-2.97]*	*-0.014*** [-4.71]*	*-0.001*** [-3.54]*
CAPX	*0.104 [1.59]*	*-0.057*** [-11.65]*	*0.164** [2.43]*	*-0.050*** [-9.87]*

WC	*0.580**** *[18.70]*	*0.011**** *[9.57]*	*0.580**** *[17.18]*	*0.011**** *[8.25]*
MTB	*0.003**** *[6.42]*	*0.000**** *[5.55]*	*0.003**** *[5.55]*	*0.000**** *[5.28]*
RD	*-0.061**** *[-15.36]*	*-0.004**** *[-12.99]*	*-0.059**** *[-15.21]*	*-0.003**** *[-12.51]*
TOBINQ	*-0.181**** *[-21.16]*	*0.024**** *[44.25]*	*-0.183**** *[-20.44]*	*0.025**** *[42.18]*
OILV_L1	*0.262**** *[2.58]*	*0.087**** *[5.49]*	*0.256*** *[2.50]*	*0.087**** *[5.49]*
OILV_L2	*0.121**** *[2.64]*	*-0.003* *[-0.43]*	*0.119*** *[2.57]*	*-0.003* *[-0.44]*
OILV_L3	*0.070** *[1.95]*	*-0.076**** *[-12.88]*	*0.065** *[1.82]*	*-0.075**** *[-12.83]*
MA	*0.235**** *[12.26]*	*-0.006**** *[-3.67]*	*0.241**** *[12.28]*	*-0.007**** *[-3.96]*
GDP	*-2.885*** *[-1.98]*	*-0.842**** *[-3.59]*	*-2.765** *[-1.89]*	*-0.837**** *[-3.56]*
IRATE	*-0.158**** *[-4.33]*	*-0.036**** *[-6.18]*	*-0.154**** *[-4.19]*	*-0.036**** *[-6.22]*
EPU	*-0.122*** *[-2.09]*	*0.013* *[1.35]*	*-0.120*** *[-2.03]*	*0.013* *[1.38]*
RECE	*-0.241**** *[-3.63]*	*-0.021*** *[-2.05]*	-	-
Constant	*0.029* *[0.11]*	*-0.056* *[-1.29]*	*0.010* *[0.04]*	*-0.059* *[-1.35]*
Industry	*Yes*	*Yes*	*Yes*	*Yes*
Year	*Yes*	*Yes*	*Yes*	*Yes*
Observations	*77,264*	*76,948*	*65,790*	*65,528*
Adj. R-squared	*0.41*	*0.33*	*0.42*	*0.29*

Note: This table reports the results from OLS regressions of the association between oil price volatility, organization capital and firm performance after controlling for economic recession proxied by the NBER-based recession indicator. Columns (1) and (2) include recessionary periods as an additional control variable (RECE). Columns (3) and (4) exclude observations for recessionary periods from the sample. Robust t-statistics are in brackets and are based on standard errors that are clustered by firm. *** p<0.01, ** p<0.05, * p<0.10. Refer to Table 1 for variable definitions.

CONCLUSION

We investigate the association between oil price uncertainty and firm performance for U.S. listed firms and consider organization capital as a possible moderator of the relationship between oil price uncertainty and performance. Using 77,264 firm-year observations, we document that oil price uncertainty affects firm performance adversely. However, organization capital plays a key role in mitigating this adverse impact of oil price volatility on firm value. This occurs primarily through the cash holdings channel by firms with high levels of organization capital. Our findings remain consistent using GARCH-based oil price uncertainty as an alternative measure. Further investigation provides evidence that our results are insensitive to economic downturns. Our findings have practical implications for practitioners as we document that the increased cash holdings by firms with high levels of organization capital hedges against oil price uncertainty-induced negative firm performance. This suggests that firms with high organization capital can send a positive signal to the market participants regarding their rationale for high cash holdings.

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