

Oil Price Uncertainty and IPOs

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ABSTRACT

We examine the impact of oil price uncertainty on IPO volume in the oil and gas sector. By using the implied volatility of oil options, a forward-looking uncertainty measure, we identify the effect of uncertainty on the going-public decision. Oil price uncertainty exhibits a strong negative relation to IPO volume. A one standard deviation decrease in the implied volatility results in a 29% increase in the number of quarterly IPOs. The effect is concentrated among the price-sensitive upstream producers. We further report that uncertainty positively impacts the IPO withdrawal decision and increases the value of postponing the offering.

Keywords: Energy economics, IPOs, Implied crude oil volatility, Oil and gas sector, Oil price uncertainty

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1. INTRODUCTION

Oil price uncertainty can affect both firms' investment and financing decisions. The impact of oil price uncertainty on investments in the oil and gas sector is well documented (Kellogg, 2014; Elder, 2019; Dossani and Elder, 2022). The general consensus is that elevated uncertainty causes firms to defer investments in anticipation of better market conditions. Surprisingly, the relationship between oil price uncertainty and the financing of oil and gas firms has been neglected in the literature. To fill this gap, we study the impact of oil price uncertainty on the most important financing event in the firm's life-cycle—the initial public offering (IPO). Through the IPO firms raise substantial amounts of funds that have real effects on investment, employment and growth in the oil and gas sector. Therefore, it is important to understand how and why firms change their IPO decisions in response to oil price uncertainty.

Studying the oil and gas sector has several advantages over examining an aggregated market-wide sample. First, oil and gas firms' discount rates are directly linked to oil price uncertainty (Christoffersen and Pan, 2018), where especially upstream producers' cash flows are highly sensitive to oil price changes (Doshi et al., 2018). Second, we are able to construct a forward-looking measure of uncertainty by using the implied volatility of oil options. Being derived from options prices, implied volatility reflects the forward-looking price uncertainty assessments of the heterogeneous agents trading in futures markets (Singleton, 2014). Third, based on prior work [see, e.g., Kel-

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logg (2014); Elder (2019); Dossani and Elder (2022)], we can assume that our oil price uncertainty measure is, to a large extent, exogenously determined. This setting allows us to clearly identify the role of uncertainty in the IPO process.

Christoffersen and Pan (2018) offer a direct channel for oil price uncertainty to affect the cost of capital. They show that oil price uncertainty leads to a higher risk premium in the equity markets. Higher discount rates negatively impact valuations, and the lower valuations discourage firms to conduct an IPO. Due to the high sensitivity of oil and gas sector firms to the risk premium associated with oil, the negative relation between uncertainty and IPO volume should be more prominent in this sector. Real options theory offers a second explanation for why IPO volume is negatively related to uncertainty. In a real options framework, the option value of waiting increases with uncertainty as long as the investment is irreversible to some extent (Bernanke, 1983; Brennan and Schwartz, 1985; Majd and Pindyck, 1987; Pindyck, 1991; Davis and Cairns, 2017; Elder, 2019). This also holds true for an IPO (Pastor and Veronesi, 2005), the decision to go public is partially reversible until the issue date. After the company is taken public it is difficult to reverse the decision. Hence, IPO volume decreases with uncertainty through the cost of capital and real options channels. Therefore, our main Hypothesis (1) states that oil price uncertainty negatively impacts IPO volume.

Our main tests explore how implied oil volatility impacts the time-series variation of IPO volume. We measure IPO volume both in terms of the number of IPOs and the total proceeds raised. We find strong support for our main hypothesis by using a sample of 450 completed oil and gas IPOs during the time-period 1/1/1987-12/31/2019. A one standard deviation decrease in implied volatility corresponds to 29% (22%) increase in the number of IPOs (proceeds). Since oil price uncertainty can be linked to other macro-economic factors driving the going-public decision, we further study oil and gas IPO volume in relation to market-wide IPO volume. This measure allows us to identify the oil and gas-specific variation in IPO volume. Again, we find strong support for our main hypothesis. Oil and gas sector IPOs are negatively affected by oil price uncertainty. We create placebo tests exploring how our parsimonious model captures IPO volume in the less oil price-sensitive Hi-tech sector. The placebo tests show that oil price uncertainty is not a direct driver of relative IPO volume among Hi-tech firms. Since the beginning of our sample period, the oil industry has undergone significant changes. The fracking revolution in the post-2012 era nearly doubled the U.S. oil production (Gilje et al., 2016), which increased the number of oil and gas IPOs. Therefore, we explore the impact of oil price uncertainty on oil and gas IPOs before and after the fracking revolution and report similar findings for the two time periods.

To further identify the effect of oil price uncertainty on IPO volume, we study upstream firms in isolation. Upstream firms differ from the others in the oil and gas sector due to their sensitivity to crude oil prices (Kumar and Rabinovitch, 2013). Upstream producers engage in exploration and production, whereas downstream refiners focus on refining and marketing. Upstream producers sell their output on the physical market; their cash flows are highly sensitive to the underlying commodity price. In contrast, other firms, such as refiners, see different dynamics since they can take advantage of the crack spread, the difference between the prices of refined products and the cost of crude oil as an input (Suenaga and Smith, 2011). This built-in margin allows downstream firms to transfer part of the price variation to their customers. The economic impact of crude oil price uncertainty on IPO activity differs between upstream and other oil and gas sector firms. Therefore, Hypothesis (2) states that upstream firms' IPO volume should be more adversely affected by the level of uncertainty.

To test Hypothesis (2) we split our sample into upstream and other (midstream and downstream) oil and gas sector firms, exploring the effect of uncertainty on IPO volume in the two groups.

Our findings lend support to Hypothesis (2), upstream firms are highly sensitive while other firms IPO activity is unrelated to oil price uncertainty. Our findings are not surprising. Upstream firms' cash flows are theoretically more linked to oil price fluctuations, as their discount rates are highly sensitive to the risk premium associated with oil. The elevated discount rates and the resulting lower valuations make upstream firms refrain from going-public during times of high uncertainty. The same applies to the real options channel, where upstream firms' higher sensitivity to oil price uncertainty increases the value of deferring the IPO.

The effect of oil price uncertainty on IPOs does not only affect the IPO at the pre-filing stage but also after the filing of the IPO. Elevated uncertainty during this stage of the IPO process can cause a firm to either choose to postpone the issue or reverse it completely. Firms may prefer to postpone their IPO in anticipation of more favorable market conditions (Pastor and Veronesi, 2005). This mechanism leads us to develop Hypothesis (3a), stating that the time between the filing and IPO date increases with uncertainty. Two not mutually exclusive reasons can cause a firm's complete IPO withdrawal. First, through a DCF framework, increased uncertainty during the IPO process lowers valuation through increased cost of equity capital. This makes the IPO less favorable for the incumbent shareholders ultimately leading to a complete withdrawal. Second, Busaba et al. (2001) and Busaba (2006) argue that the IPO filing is coupled with a valuable option. At the time of the IPO filing, the issuer does not know the exact market valuation, so the offer price is uncertain. The firm will exercise this option if the market valuation exceeds the incumbent shareholders reservation value of the firm. When the market valuation is below the reservation value, the firm will withdraw its offering, and the option expires worthless. Hence, Hypothesis (3b) states that firms are more likely to reverse their IPO decision following increased oil price uncertainty.

To test Hypothesis (3a), we study the impact of oil price uncertainty on the number of days between the filing and the issue date of the IPO (*window length*). The findings support Hypothesis (3a), *window length* is positively linked to oil price uncertainty. This suggests that uncertainty also increases the value of the option to postpone the issue. Managers respond to elevated uncertainty by deferring the listing in anticipation of better market conditions. To test Hypothesis (3b), we explore the impact of oil price uncertainty on IPO withdrawals. Our findings reveal that uncertainty increases the likelihood of withdrawals in the oil and gas sector.

In sum we show that oil price uncertainty has a real impact on the going-public decision. However, the IPO decision is affected by several factors such as stock market, political and macro-economic uncertainty as well as the level of the WTI and debt market conditions. We effectively control for all these factors and still report a strong negative link between the oil price uncertainty and IPO volume. Even though we control for all these factors, omitted variables can cause biases. We test for the severity of a potential omitted variable bias (OVB) by using the Oster (2019) test, and report that our results are not severely affected by OVB

To the best of our knowledge, we are the first to explore the role of oil price uncertainty on financing decisions. We contribute to two strands of literature. First, we contribute to the vast literature on how oil price uncertainty affects corporate decision-making. The effect of oil price uncertainty in a macro-economic context is either focused on oil price uncertainty as an output predictor (Aye et al, 2014; Jo, 2014; Gao et al, 2022; Rahman and Serletis, 2011) or aggregated investments (Elder and Serletis, 2010). Moreover, a vast amount of literature examines how oil price uncertainty affects firm-level investment decisions. The empirical literature focuses on the impact of oil price uncertainty on firm-level capital expenditure (Henriques and Sadorsky, 2011; Phan et al, 2019; Maghyereh and Abdoh, 2020), and reports a negative relation. Kettunen et al. (2011) and Chronopoulos et al. (2016) theoretically explore the link in real options settings. Kellogg (2014),

Doshi et al, (2018), Dossani and Elder (2022) instead solely focus on investments among upstream firms. Several studies examine the impact of oil price uncertainty on M&A activity (Fan, 2000; Barrows et al, 2020). The consensus is that oil price uncertainty negatively affects both investment and output. Differing from all the above studies, our focus is on the firm-level financing decisions instead of output and investments.

Second, we contribute to the broader literature on how uncertainty affects the going-public decision. Prior work focuses on the effect of macro-economic (Lowry, 2003; Thanh, 2020), political (Colak, 2017; Luo et al., 2017), COVID-19 induced (Baig and Chen, 2021), and other uncertainty (Barth et al., 2017; Crain et al., 2021). Unlike prior work, we offer an uncertainty measure directly impacting the firm's cash flows. Furthermore, we differ from the above papers by conducting a single sector study. Conducting a within industry study allows us to use a forward-looking industry-specific measure of uncertainty directly linked to the output and input prices. Working with a homogenous set of firms similarly affected by oil price uncertainty facilitates identification. Jin and Jorion (2006) argue that potential endogeneity concerns are alleviated in a single industry setting. Furthermore, Rajan and Servaes (1997), Pagano et al. (1998) and Ritter (1984) all argue for a substantial industry heterogeneity in the time-series of IPO volume. Hence, understanding the role of uncertainty at the industry level also adds to the understanding of aggregated IPO volume.

After the introduction, the remainder of the paper is structured as follows: part two discusses data and empirical setting; part three describes the empirical findings; part four concludes the study.

2. DATA

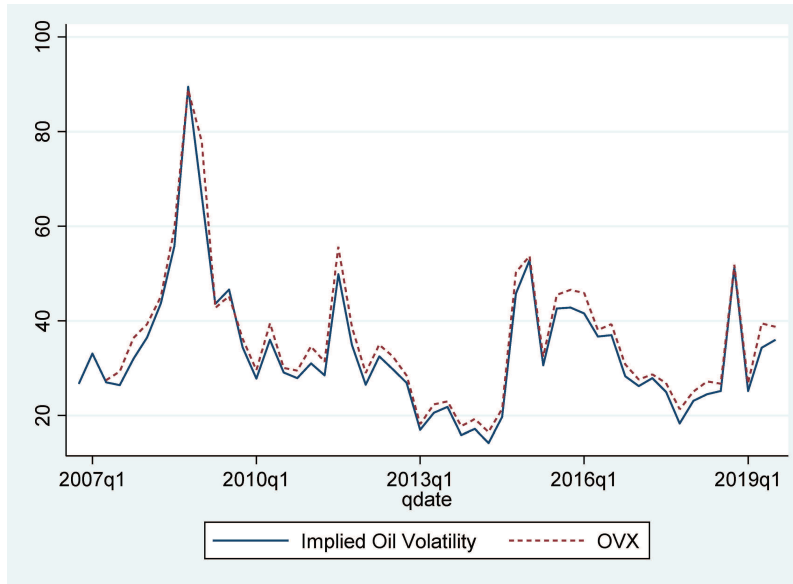
We consider all U.S. IPOs in the Thomson Financial Securities Data Company (SDC) database between 1/1/1987 and 12/31/2019. To be considered an oil and gas IPO, firms must have one of the following 4-digit SIC codes: 1300-1399, 2911, 2990, 5171, 5172, 2911, 2992, 3533, 4612, 4613, 4619, 4922, 4923, 4924, 4925, 5541, 5983 and 6792. After the initial screening, we end up with 562 IPO filings, where 112 represent withdrawn IPOs, resulting in a final sample of 450 completed IPOs raising on average \$89 million in 2019 dollars. We further distinguish between upstream IPOs (SIC codes: 1300-1399) and other oil IPOs (See, Appendix A2 for a more detailed overview of the IPO classification). The other oil and gas IPO group mainly consists of downstream firms (e.g. refineries) and a few midstream operators (e.g. trading companies). Our final IPO sample includes 308 upstream and 142 other oil and gas IPOs.

We use two IPO volume measures as main dependent variables, the number of quarterly IPOs (*#IPOs*) and the natural logarithm of inflation-adjusted aggregated quarterly proceeds [*ln(Proceeds)*]. In additional measures, we control for market-wide changes in IPO volume by scaling the dependent variables by the total number of IPOs (*#Oil IPO share*) and by market-wide proceeds (*\$Oil IPO share*). We further distinguish between upstream and other oil and gas sector IPOs by creating two variables (*#Upstream* and *#Other*) to capture the number of upstream and other oil and gas IPOs. In auxiliary tests, we examine the role of uncertainty on the number of days between filing and issuance (*Window Length*), and the effect on IPO withdrawals (*Withdrawn IPO*).

As a measure of oil price uncertainty (*Implied Oil Volatility*), we use the implied volatility of West Texas Intermediate (WTI) crude oil contracts calculated based on at-the-money second nearby options, which the Commodity Research Group provides. The implied volatility measure is calculated using the Black and Scholes (1973) option pricing model modified for commodities. Once the front-month option expires, the options are rolled over into the second month. Implied

volatility of the WTI crude oil contract is collected from 1/1/1987 and ending at 12/31/2019. Our measure of oil price uncertainty is slightly different from CBOE's traditional oil VIX (OVX). Differing from us, CBOE value weighs the quoted volatility of numerous "out-of-the-money" options to calculate OVX. One significant advantage of our measure is that it has been available since 1987, while OVX started in 2007. To ensure the reader that our measure is closely related to the more granular OVX we have plotted the series over time in Figure 1. As shown in the figure, the two oil price uncertainty measures exhibit a high pairwise correlation (0.98).

Figure 1: Implied oil volatility and the OVX



This figure shows the Implied Oil Volatility and the CBOE's OVX index over time at a quarterly frequency.

Implied oil price volatility potentially has advantages over other uncertainty measures. Alquist et al. (2013) suggest that implied volatility is a better measure of oil price uncertainty relative to standard measures such as GARCH and historical volatility. Kellogg (2014) similarly reports that implied volatility better predicts investments in the upstream oil sector compared to the other measures. On the other hand, Dossani and Elder (2022) show that GARCH and implied volatility yield similar results. Hence, using implied oil volatility derived from option prices should at least be as good proxy for oil price uncertainty as econometric uncertainty measures.

To capture the valuation impact of uncertainty through the cost of the capital channel we control for variables affecting the other main valuation determinant—cash flows. Therefore, we control for the WTI index (*WTI Level*). While implied oil volatility captures uncertainty about the cash flows of the IPO firms, the level of WTI is an important determinant of the cash flow levels (Kumar and Rabinovitch, 2013). Hence, we capture both cash flow and discount rate dynamics by including both the WTI and implied oil price volatility. To capture if the oil futures market is in contango or backwardation, we include the WTI Roll Yield. We measure WTI Roll Yield as the difference between the price of the front contract and the 6th contract. A positive roll means backwardation and a negative indicates contango. To consider the lack of liquidity during the last day of the contract, we roll the position from the front to the second nearest contract and from the 6th to the 7th contract.

We include additional control variables in line with prior IPO prediction models analyzing the number of quarterly IPOs [see, e.g., Lowry (2003)]. Our control variables capture market-wide uncertainty and other market-wide factors identified in the literature to drive IPO volume, including the *Fed Funds Rate*, *GDP Growth*, *Equity Uncertainty*, *Political Uncertainty* and an IPO market heat indicator (*IPO Market Heat*). All control variables are defined in Appendix A1.

Table 1: Descriptive Statistics

	Quarters	Mean	Std dev	ADF test
# Oil IPOs	132	3.39	2.91	-3.73***
ln(Proceeds)	132	4.71	2.73	-4.93***
#IPO share %	132	3.92	3.53	-4.08***
\$IPO share %	132	6.36	7.13	-3.64***
# Upstream IPOs	132	2.33	2.25	-4.74***
# Downstream IPOs	132	1.07	1.24	-3.26**
Window Length in days	132	81.15	27.98	-3.27**
Implied Oil Volatility	132	32.84	13.59	-4.46***
WTI Level	132	45.06	29.24	-1.63
WTI Return	132	0.65	14.49	-5.20***
Fed Funds Rate	132	3.35	2.70	-2.00
Δ Fed Funds Rate	132	-0.04	0.46	-4.47***
GDP Growth	132	0.01	0.01	-3.97***
Equity Uncertainty	132	112.77	129.98	-3.75***
Political Uncertainty	132	109.71	33.36	-2.260
Δ Political Uncertainty	132	0.26	28.69	-5.87***
Hot IPO Market	132	0.20	0.40	-2.26*
WTI Roll Yield	132	0.006	2.46	-4.341***

This table shows descriptive statistics at the quarterly level. The fourth column shows augmented Dickey and Fuller unit root tests. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

To assess the impact of oil price uncertainty on IPO volume, we aggregate our dependent variables [*#IPOs* and *ln(Proceeds)*] at the quarterly level. Table 1 shows that the average quarter has 3.39 oil and gas IPOs raising an average proceeds of \$110 million. Lowry (2003) predicts IPO volume across all industries and finds that the number of IPOs are non-stationary [cannot reject the Dickey-Fuller test]. We evaluate the stationarity of the variables using the augmented Dickey-Fuller test, as described by Elder and Kennedy (2001). We include four lags in our calculation following Schwert's (1989) rule of thumb. In contrast to overall IPOs, *#Oil IPOs* is stationary; thus, we can reject the augmented Dickey-Fuller test at the 1% level (ADF stat = -3.73), i.e. oil IPOs revert towards a normal quarterly volume. Our second main dependent variable [*ln(Proceeds)*] exhibits similar properties, rejecting the null of the unit root test at the 1% level (ADF stat = -4.93).

We further examine the properties of the main independent variable (*Implied Oil Volatility*). By rejecting the null of the Dickey-Fuller test at the 1% level, we can conclude that our main independent variable is stationary. Furthermore, as all independent variables are stationary, enter the model with a one-quarter lag and oil price uncertainty is exogenously determined, our tests should not exhibit reverse causality issues.

Table 1 also shows the characteristics and properties of the dependent and control variables used in auxiliary tests. Oil and gas IPOs represent 4% of the total IPOs in terms of the number of IPOs (*#IPO share*) and 6% of the total proceeds (*\$IPO share*). Upstream IPOs (2.33) are more prevalent in the sample compared to downstream and midstream IPOs (*#Other* = 1.07). The average time between filing and issue date is 81.15 days. All dependent variables reject the null of the Dickey-Fuller test at conventional levels, meaning that our variables are stationary. Table 1 further shows the characteristics and properties of our control variables. All control variables except the level of

the WTI index, *Fed Funds Rate* and *Political Uncertainty* are stationary. Therefore, we use the return of the WTI (*WTI Return*) and the first difference of the federal funds rate (Δ *Fed Funds Rate*) and *Political Uncertainty* (Δ *Political Uncertainty*) in our analysis.

Table 2 reports the pairwise correlations between the variables. Among the control variables the highest correlation is found between *WTI Roll Yield* and *WTI Return* (0.48). Except the high correlation between the *GDP Growth* and *Implied Oil Volatility*, the second highest correlation is found between *GDP Growth* and *Implied Oil Volatility* (-0.47).

2.1. Empirical design

To test our main hypothesis, that oil price uncertainty negatively impacts IPO volume in the oil and gas sector, we perform several reduced-form estimations. In our baseline specifications (1a and 1b), we explain the number of IPOs (*#IPOs*) and the total proceeds [*ln(Proceeds)*] raised with oil price uncertainty (*Implied Oil Volatility*) plus a vector of control variables. Therefore, our main specifications take the following form:

$$\#IPOs_t = \alpha + \beta * \text{Implied Oil Volatility}_{t-1} + \gamma * \text{Controls}_{t-1} + \varepsilon \quad (1a)$$

$$\ln(\text{Proceeds})_t = \alpha + \beta * \text{Implied Oil Volatility}_{t-1} + \gamma * \text{Controls}_{t-1} + \varepsilon \quad (1b)$$

where t is a time index at the quarterly level. The vector of control variables consists of: *WTI Return*, Δ *Fed Funds Rate*, *GDP Growth*, *Equity Uncertainty*, Δ *Political Uncertainty*, *Hot IPO Market*. We estimate three versions of the models: 1.) we only include the oil VIX to test for the univariate relation (excluding controls); 2.) we include the control variables; 3.) we acknowledge the seasonality of IPO volume and include quarter indicators. All models are estimated using Newey and West (1987) standard errors with 4 lags.

Since overall IPO volume is highly cyclical and correlated with several macro-economic factors [See, e.g., Lowry, (2003); Ritter (1984)], our findings may be driven by underlying factors that affect both oil price uncertainty and overall IPO volume. To ensure that we do not solely capture a general IPO effect, we scale our dependent variables by market-wide IPO numbers. This allows us to capture the oil and gas sector IPO variation distinct from market-wide fluctuations in IPO volume. We scale *#Oil IPOs* and total proceeds by the total number of U.S. IPOs and aggregated proceeds to create *#Oil IPO Share* and *\$Oil IPO Share*. We estimate the following models:

$$\#Oil\ IPO\ Share_t = \alpha + \beta * \text{Implied Oil Volatility}_{t-1} + \gamma * \text{Controls}_{t-1} + \varepsilon \quad (2a)$$

$$\$Oil\ IPO\ share_t = \alpha + \beta * \text{Implied Oil Volatility}_{t-1} + \gamma * \text{Controls}_{t-1} + \varepsilon \quad (2b)$$

To further identify the effect of oil price uncertainty on IPO volume, we split our sample into upstream and other oil and gas sector firms. Upstream firms differ from other type of firms in the oil and gas sector due to their sensitivity to crude oil prices (Kumar and Rabinovitch, 2013). Therefore, the economic impact of crude oil price uncertainty on IPO activity differs between upstream and other oil and gas sector firms. Upstream IPO volume should be more adversely affected by increased oil price uncertainty. We create variables for the number of upstream IPOs (*#Upstream*) and the number of other oil and gas sector IPOs (*#Other*) and estimate the following models:

$$\#Upstream_t = \alpha + \beta * \text{Implied Oil Volatility}_{t-1} + \gamma * \text{Controls}_{t-1} + \varepsilon \quad (3a)$$

$$\#Other_t = \alpha + \beta * \text{Implied Oil Volatility}_{t-1} + \gamma * \text{Controls}_{t-1} + \varepsilon \quad (3b)$$

Table 2: Correlation Matrix

	# Oil IPOs	ln(Proceeds)	#IPO Share	\$IPO share	#Upstream IPOs	#Downstream IPOs	Window Length in days	Implied Oil Volatility	WTI Return	Δ Fed Funds Rate	GDP Growth	Equity Uncertainty	Δ Political Uncertainty	Hot IPO Market	WTI Roll Yield
# Oil IPOs	1.00														
ln(Proceeds)	0.73	1.00													
#IPO Share	0.76	0.64	1.00												
\$IPO share	0.70	0.69	0.80	1.00											
# Upstream IPOs	0.92	0.63	0.69	0.61	1.00										
# Downstream IPOs	0.69	0.56	0.53	0.52	0.34	1.00									
Window Length in days	0.09	0.21	0.16	0.06	0.04	0.15	1.00								
Implied Oil Volatility	-0.30	-0.38	-0.12	-0.18	-0.32	-0.13	0.11	1.00							
WTI Return	0.09	0.21	0.18	0.18	0.10	0.04	0.11	-0.31	1.00						
Δ Fed Funds Rate	0.10	0.16	-0.01	0.06	0.08	0.10	-0.02	-0.27	0.15	1.00					
GDP Growth	0.00	0.12	-0.12	-0.11	-0.02	0.04	0.04	-0.47	0.28	0.43	1.00				
Equity Uncertainty	-0.30	-0.29	-0.18	-0.21	-0.31	-0.13	0.01	0.33	-0.04	-0.24	-0.13	1.00			
Δ Political Uncertainty	0.08	0.06	0.12	0.06	0.04	0.11	-0.08	0.13	0.02	0.05	-0.09	0.24	1.00		
Hot IPO Market	0.05	0.01	-0.27	-0.25	0.09	-0.06	-0.06	-0.24	-0.03	-0.08	0.19	-0.09	-0.03	1.00	
WTI Roll Yield	-0.03	-0.01	-0.08	-0.10	0.00	-0.07	-0.09	-0.16	0.48	0.01	0.28	0.17	0.04	0.11	1.00

This table shows the pairwise correlation between all included variables. Variable definitions can be found in Appendix A1.

In auxiliary tests, we examine how uncertainty affects the time between the IPOs filing date and the issue date (*Window Length*). We argue that elevated uncertainty causes firms to postpone their IPOs, which would manifest itself through a positive relation between *Oil VIX* and *Window Length*. In many cases increased uncertainty not only forces the firm to postpone the issue but also causes a withdrawal of the filed IPO. To study the effect of oil price uncertainty on withdrawals, we use a sample of all withdrawn IPOs at the firm level. We then create an indicator variable taking the value of one if the withdrawal is in the oil and gas sector. By using Probit models, we test if changes in the Oil VIX between filing and the withdrawal date can explain the withdrawal likelihood. We further acknowledge that several of our dependent variables (*#Oil IPOs*, *#Upstream* and *#Other*) are not continuous variables but instead of count data type. Therefore, we re-estimate all our models using Poisson regressions allowing for a one lag autocorrelation (Schwartz et al, 2006).

3. EMPIRICAL FINDINGS

In the first set of tests, we examine the univariate relation between oil price uncertainty and IPOs, and how the dynamics between oil price and oil price uncertainty affect the going-public decision.

Table 3: Univariate differences

Panel A: Low vs. Hi oil VIX

Number of IPOs		ln(Proceeds)	
Low Implied Oil Volatility	4.000	Low Implied Oil Volatility	5.374
Hi Implied Oil Volatility	2.716	Hi Implied Oil Volatility	3.989
Diff.	1.283**	Diff.	1.386***

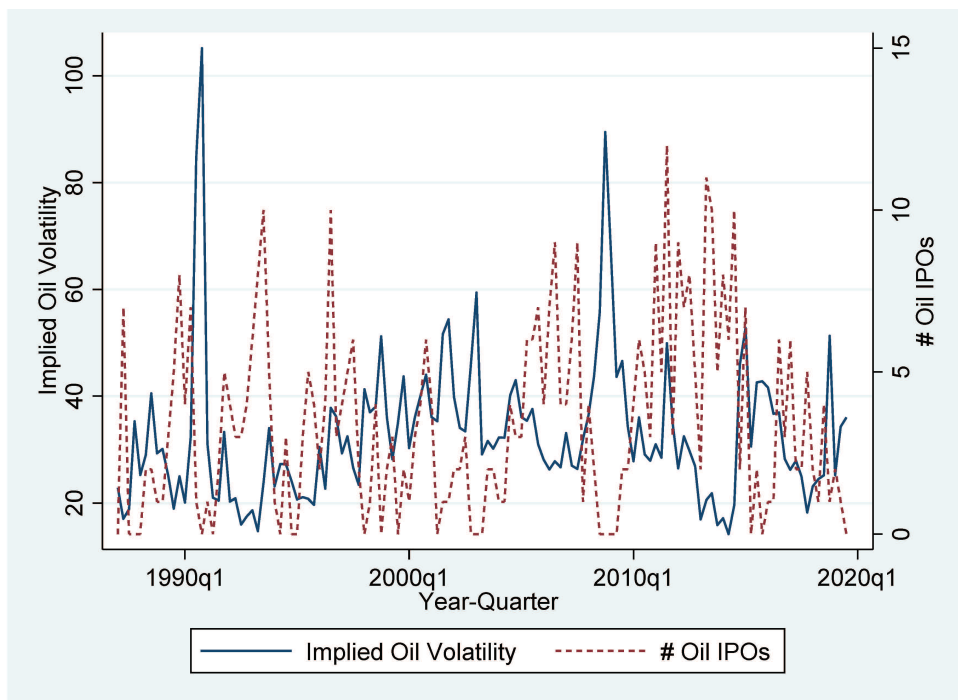
Panel B: split on WTI Price Level

	Lo WTI	Hi WTI	Diff		Lo WTI	Hi WTI	Diff
Low Implied Oil Volatility	3.000	5.233	-2.233***	Low Implied Oil Volatility	4.389	6.590	-2.201***
Hi Implied Oil Volatility	2.433	2.946	-0.513	Hi Implied Oil Volatility	3.954	4.017	-0.063
Diff.	0.566	2.287***		Diff.	0.434	2.573***	

This table shows univariate differences in the IPO volume measures [*# Oil IPOs*; *ln(Proceeds)*]. We split the quarters on the median of the level of Implied Oil Volatility and the level of WTI. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A of Table 3 1 shows univariate differences in IPO volume [*#Oil IPOs* and *ln(Proceeds)*], where we split the sample at the 50th percentile into high and low uncertainty quarters. Our tests reveal that both *#Oil IPOs* and *ln(Proceeds)* are significantly higher during low uncertainty quarters. The magnitudes of the differences are large, the average number of oil IPOs is 4.00 during low compared to 2.716 in high uncertainty quarters ($p < 0.05$), which corresponds to a 68% higher IPO volume. We report similar differences in the amount of proceeds raised ($p < 0.01$), the numbers given in natural logarithms (low uncertainty 5.374; high uncertainty 3.989) correspond to \$215.8 million raised during low compared to \$54.0 million raised during high uncertainty quarters. Our univariate findings suggest that uncertainty is an important factor in determining IPO volume. Figure 2 shows the time-series relation between *Implied Oil Price Volatility* and the number of quarterly IPOs. From the graph, it becomes clear that the two series correlate negatively, i.e. the number of IPOs is higher during low uncertainty quarters. Furthermore, both series appear to be stationary without an evident time trend.

Panel B of Table 3 explores the dynamics between oil price uncertainty, oil price and IPO volume. We double sort quarters at the 50th percentile in terms of the WTI and Oil VIX levels. We

Figure 2: Implied oil volatility and the number of oil and gas IPOs

This figure shows the Implied Oil Volatility and the number of IPOs in the oil and gas sector over time at a quarterly frequency.

examine the differences in IPO volume between the four groups. Our findings suggest that oil price uncertainty has a greater impact on IPO volume during high oil price quarters. This holds for both the number of IPOs and the proceeds raised. We find similar evidence when analyzing differences between high and low oil price quarters, oil price only affects IPO volume during quarters of low oil price uncertainty. Quarters with low uncertainty coupled with high oil prices exhibit the highest IPO volume. Interestingly, all other quarters exhibit similar IPO volume (3; 2.4; 2.9 for *#Oil IPOs*), except the low uncertainty and high oil price quarters where the number of oil IPOs is 5.233. The pattern is similar when examining the proceeds raised in the IPO. Our findings highlight the important dynamics between the oil price and uncertainty in determining the going-public decision.

Next, we test our baseline models (1a) and (1b) to evaluate Hypothesis (1), which states that higher oil price uncertainty is linked to lower IPO volume. Columns (1) to (3) of Table 4 explore the link between oil price uncertainty and the number of quarterly oil IPOs (*#Oil IPOs*). In line with our expectations, all three models show a negative relation between *Implied Oil Price Volatility* and *#Oil IPOs* ($p < 0.01$). The economic magnitude is large in all three specifications, a one standard deviation decrease in the *Implied Oil Price Volatility* (13.59) results in an increase in the number of quarterly Oil IPOs between 0.88 and 0.98. This corresponds to a 26% to 29% increase in the number of quarterly IPOs relative to the quarterly average (3.39). In columns (4) to (6) we instead test for the impact of oil price uncertainty on quarterly proceeds. Similarly, we report a strong negative relation between *Oil VIX* and $\ln(\text{Proceeds})$. The economic magnitude is again substantial, a one standard deviation decrease in the *Implied Oil Price Volatility* represents a 0.94 to 1.05 increase in log proceeds, corresponding to 20% to 22% relative to the mean $\ln(\text{Proceeds})$. This corresponds to \$22.2—\$24.8 million raised during the quarter in dollar values. Only Equity Uncertainty and Δ Political Uncer-

Table 4: Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)
		# IPOs			ln(Proceeds)	
Implied Oil Volatility	−0.0653*** (−3.957)	−0.0675*** (−2.767)	−0.0728*** (−2.983)	−0.0774*** (−5.564)	−0.0694*** (−3.739)	−0.0715*** (−3.804)
WTI Return		0.0074 (0.352)	0.0076 (0.339)		0.0288* (1.865)	0.0304* (1.950)
Δ Fed Funds Rate		0.1028 (0.156)	0.1397 (0.218)		0.0974 (0.145)	0.0808 (0.116)
GDP Growth		−0.9023 (−1.627)	−0.9968 (−1.599)		−0.3036 (−0.740)	−0.2590 (−0.567)
Equity Uncertainty		−0.0055*** (−2.830)	−0.0056*** (−2.877)		−0.0041** (−2.233)	−0.0041** (−2.062)
Δ Political Uncertainty		0.0163** (2.109)	0.0121* (1.692)		0.0135** (2.104)	0.0125** (2.052)
Hot IPO market		−0.0497 (−0.061)	0.0610 (0.074)		−0.3719 (−0.603)	−0.4200 (−0.696)
WTI Roll Yield		−0.0134 (−0.084)	−0.0373 (−0.232)		−0.0960 (−0.808)	−0.1122 (−0.927)
Constant	5.5377*** (7.774)	6.8205*** (5.440)	7.1345*** (5.093)	7.2528*** (12.035)	7.7012*** (8.910)	7.7451*** (7.118)
Observations	132	132	132	132	132	132
Newey-West Lags	4	4	4	4	4	4
Quarter Dummies	N	N	Y	N	N	Y

This table shows time-series regression at the quarterly level. The dependent variables are the number of IPOs in the oil and gas sector during the given quarter (#Oil IPOs) in columns (1) to (3) and the total quarterly proceeds raised by IPO firms in the oil and gas [ln(proceeds)] in columns (4) to (6). All independent variables enter the model with one lag. The t-stats are based on Newey-West standard errors using four lags. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

tainty exhibit consistent negative and positive relations to IPO volume among the control variables. In models (5) and (6), the WTI return affects the IPO volume positively. Our findings confirm Hypothesis (1) that oil price uncertainty negatively impacts IPO volume.

Next, we aim to ensure that we identify an oil and gas sector effect. Since oil price uncertainty is correlated with other macro-economic factors that potentially can drive market-wide IPO volume, we create *#Oil IPO Share* and *\$Oil IPO Share*. By scaling our dependent variables, we distinguish oil and gas sector-specific IPO volume variation from market-wide IPO volume. If IPO volume in the oil and gas sector is more affected by oil price uncertainty relative to market IPOs, we expect a negative *Implied Oil Price Volatility* coefficient.

Columns (1) to (3) in Table 5 report the impact of *Implied Oil Price Volatility* on *#Oil IPO Share*. The estimation in column (1) do not show any distinct impact of *Implied Oil Price Volatility* on *#Oil IPO Share*. This suggests that without accurate controls, the oil and gas sector IPOs follow the same pattern as market-wide IPOs. After including standard controls in column (2), we observe a distinct negative relation of oil price uncertainty on the proportion of oil IPOs ($p < 0.01$). When further adjusting for the seasonality of listings, the effect becomes even more pronounced ($p < 0.01$). Models (4) to (6) all show a significant negative impact of *Implied Oil Price Volatility* on the oil and gas sector share of total proceeds raised in IPOs during the given quarter. Our controls reveal that the share of oil and gas IPOs are more affected by *WTI return* and *Equity Market Uncertainty* compared to normal IPOs. Furthermore, oil IPOs are less sensitive to *GDP Growth* compared to overall IPOs and are less likely to be clustered within hot issue markets. Overall, our findings in Table 5 further confirm Hypothesis (1), highlighting a significant negative impact of oil price uncertainty on IPO volume in the oil and gas sector.

Table 5: Oil IPOs relative to all IPOs

	(1)	(2) #IPO share	(3)	(4)	(5) \$IPO share	(6)
Implied Oil Volatility	-0.0318 (-1.568)	-0.0526*** (-2.658)	-0.0570*** (-2.835)	-0.0932** (-2.488)	-0.1355*** (-2.901)	-0.1414*** (-2.969)
WTI Return		0.0508* (1.737)	0.0525* (1.754)		0.0986** (2.159)	0.1025** (2.168)
Δ Fed Funds Rate		-0.8359 (-0.929)	-0.7710 (-0.833)		-0.2719 (-0.161)	-0.2731 (-0.151)
GDP Growth		-0.9251* (-1.681)	-1.0217 (-1.645)		-2.6392** (-2.328)	-2.5970** (-2.039)
Equity Uncertainty		-0.0055** (-2.063)	-0.0060** (-2.033)		-0.0098* (-1.785)	-0.0101* (-1.793)
Δ Political Uncertainty		0.0221** (1.993)	0.0205* (1.818)		0.0271 (1.458)	0.0245 (1.411)
Hot IPO market		-2.5638*** (-4.250)	-2.5185*** (-3.883)		-4.6571*** (-3.938)	-4.7327*** (-3.846)
WTI Roll Yield		-0.1544 (-0.889)	-0.1633 (-0.924)		-0.3549 (-0.948)	-0.3893 (-1.027)
Constant	4.9661*** (5.656)	7.3169*** (6.890)	7.8888*** (5.270)	9.4242*** (5.378)	14.4768*** (5.303)	14.8322*** (4.288)
Observations	132	132	132	132	132	132
Newey-West Lags	4	4	4	4	4	4
Quarter Dummies	N	N	Y	N	N	Y

This table shows time-series regression at the quarterly level. The dependent variables are the number of Oil IPOs during the given quarter scaled by the total number of IPOs (#IPO share) in columns (1) to (3) and the total proceeds raised by oil IPOs in relation to total proceeds raised during the given quarter (\$IPO share) in columns (4) to (6). All independent variables enter the model with one lag. The t-stats are based on Newey-West standard errors using four lags. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

We construct a placebo test to ensure that our findings are not driven by factors correlated with oil price uncertainty. In our tests we have chosen a sector that by definition should have a lower exposure to oil price uncertainty compared to the oil and gas sector—the Hi-tech sector. We identify Hi-tech companies following Loughran and Ritter (2004). To observe if Hi-tech IPOs are affected by *Implied Oil Price Volatility* we aggregate both the number of Hi-tech IPOs scaled by the market-wide IPOs (#Hi-tech IPO share) and Hi-tech proceeds scaled by total proceeds (\$Hi-tech IPO share). Our findings in Appendix A3 do not show any direct link between *Implied Oil Price Volatility* and the share of Hi-tech IPOs. Both the coefficients of *Implied Oil Price Volatility* and the corresponding t-stat is close to zero in all specifications except in column (4).

In the next set of tests we examine Hypothesis (2), stating that upstream IPOs should be more sensitive to oil price uncertainty. We create two additional dependent variables #Upstream and #Other (#Other includes IPOs by midstream and downstream firms) to test the hypothesis. The rationale behind our tests is that downstream and midstream firms do not face the same oil price sensitivity since they can pass on price fluctuations to their customers (i.e. through the crack spread), while upstream producers' cash flows are more sensitive to oil price fluctuations (Doshi et al, 2018; Kumar and Rabinovitch, 2013).

Columns (1) to (3) of Table 6 show that upstream IPO volume is highly sensitive to oil price uncertainty. *Implied Oil Price Volatility* is negative and statistically significant at the 1% level in all three specifications. In line with our expectations, other oil and gas IPO firms in columns (4) to (6) experience low sensitivity to oil price uncertainty. We only find a weak negative effect in the univariate setting of column (4). As predicted by Hypothesis (2), we find that upstream producers' going-public decision is more sensitive to oil price uncertainty relative to downstream and midstream firms.

Table 6: Upstream and Downstream

	(1)	(2) #Upstream	(3)	(4)	(5) #Other	(6)
Implied Oil Volatility	−0.0537*** (−3.679)	−0.0560*** (−2.861)	−0.0607*** (−3.141)	−0.0116* (−1.896)	−0.0115 (−1.298)	−0.0122 (−1.310)
WTI Return		0.0053 (0.407)	0.0051 (0.373)		0.0022 (0.189)	0.0026 (0.220)
Δ Fed Funds Rate		0.0755 (0.145)	0.1435 (0.289)		0.0273 (0.106)	−0.0039 (−0.014)
GDP Growth		−0.9259** (−2.367)	−1.0723** (−2.498)		0.0236 (0.090)	0.0755 (0.259)
Equity Uncertainty		−0.0044*** (−3.397)	−0.0047*** (−3.382)		−0.0011 (−1.205)	−0.0010 (−1.025)
Δ Political Uncertainty		0.0095 (1.347)	0.0062 (0.931)		0.0067* (1.841)	0.0059 (1.636)
Hot IPO market		0.2112 (0.321)	0.3512 (0.529)		−0.2609 (−0.875)	−0.2902 (−0.936)
WTI Roll Yield		0.0283 (0.264)	0.0166 (0.150)		−0.0417 (−0.625)	−0.0538 (−0.816)
Constant	4.0901*** (7.048)	5.2103*** (5.580)	5.6717*** (5.489)	1.4476*** (5.422)	1.6102*** (3.340)	1.4628** (2.531)
Observations	132	132	132	132	132	132
Newey-West Lags	4	4	4	4	4	4
Quarter Dummies	N	N	Y	N	N	Y

This table shows time-series regression at the quarterly level. The dependent variables are the number of upstream Oil IPOs during the given quarter (#Upstream) in columns (1) to (3) and the number of other Oil IPOs during the given quarter (#Other) in columns (4) to (6). All independent variables enter the model with one lag. The t-stats are based on Newey-West standard errors using four lags. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Next we test Hypothesis (3a), stating that high levels of uncertainty increase the value of the real option to postpone the listing. To test our hypothesis we create a variable (*Window Length*), which is the number of days between the filing date and issue date averaged across firms at the quarterly level. *Oil VIX* is measured with one lag prior to the filing date to capture uncertainty at the time of the filing. Hence, if managers take into account uncertainty we expect that an elevated *Implied Oil Price Volatility* prolongs the time-window between filing and listing.

Column (1) of Table 7 reports no effect of *Implied Oil Price Volatility* on the *Window Length* in a univariate setting. However, after including standard controls in column (2) and quarter fixed effects in column (3), we find positive and significant relationships between *Implied Oil Price Volatility* and *Window Length*. Our results indicate that elevated uncertainty causes managers to postpone the listing. This result is in line with real options models [see, e.g., Pastor and Veronesi, (2005)], where higher uncertainty increases the value of the waiting option, causing managers to defer listing in anticipation of better market conditions.

Next we test Hypothesis (3b), stating that a higher level of oil price uncertainty increases the likelihood of a withdrawn oil and gas IPO. We test Hypothesis (3b) at the firm level and collect a sample of all withdrawn IPOs in the U.S. during 1/1/1987–12/31/2019. Our dependent variable is an indicator taking the value of one if the withdrawn IPO is in the oil and gas sector and zero for withdrawn IPOs in other sectors. Since, our control group consists of all other withdrawn IPOs, we effectively control for macro-economic factors causing firms to withdraw their IPOs. The main independent variable is the difference in the *Implied Oil Price Volatility* between the filing date and the withdrawal date (*Implied Oil Volatility Diff.*). We expect oil and gas sector withdrawals to be positively related to *Implied Oil Volatility Diff.*, indicating that changes in oil price uncertainty impacts the listing completion.

Table 7: Time between the filing and issue of the IPO

	(1)	(2) Window Length	(3)
Implied Oil Volatility	0.2249 (0.968)	0.4302** (2.327)	0.4095** (2.209)
WTI Return		0.4627*** (2.767)	0.5020*** (2.893)
Δ Fed Funds Rate		-3.4988 (-0.392)	-3.0476 (-0.312)
GDP Growth		741.8428* (1.791)	742.9432 (1.640)
Equity Uncertainty		0.0038 (0.266)	-0.0030 (-0.183)
Δ Political Uncertainty		-0.0918 (-1.047)	-0.0727 (-0.777)
Hot IPO market		-0.8696 (-0.152)	-1.9642 (-0.330)
WTI Roll Yield		-2.3948 (-1.572)	-2.3649 (-1.545)
Constant	73.7671*** (9.560)	61.6113*** (7.810)	67.3049*** (6.384)
Observations	132	132	132
Newey-West Lags	4	4	4
Quarter Dummies	N	N	Y

This table shows how oil price uncertainty affects the time between the filing and issue date (Window Length). The oil price uncertainty is measured at the beginning of the filing quarter. All independent variables enter the model with one lag. The t-stats are based on Newey-West standard errors using four lags. All variables are defined in Appendix A1.

***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

In columns (1) to (3) of Table 8, we estimate the oil and gas IPO withdrawal likelihood using Probit models with standard errors clustered on year. In columns (4) to (6) we further include year indicators to control for additional market-wide factors. Models (3) and (6) also include a control for the filed IPO amount. All *Implied Oil Volatility Diff.* coefficients are positive and statistically significant regardless of the model specification. In support of Hypothesis (3b), our findings show that changes in oil price uncertainty have real effects on the decision to complete an IPO after the filing.

3.1. Discussion and Robustness

This study examines how oil price uncertainty affects IPO volume in the oil and gas sector. In our reduced-form estimations, we make the strong assumptions that implied oil price volatility is exogenous with respect to IPO volume. Since, this is a strong assumption, we take several steps to alleviate this concern. Endogeneity stems from either reverse causality or confounding factors. First, reverse causality is a lesser problem since oil price uncertainty is likely not driven by IPO volume. The determinants of the oil price and oil price uncertainty are vastly discussed in the literature (Kilian, 2009; 2010; 2014; Baumeister and Kilian, 2016; Pierru et al., 2018; Baumeister and Hamilton, 2019). They reveal that other factors such as OPEC decisions (Pierru et al, 2018) and macro-economic indicators (Barsky and Kilian, 2001; 2004) affect oil price uncertainty and are not driven by firm-level financing decisions. As a further step, we use lagged explanatory variables to alleviate concerns about potential simultaneity and reverse causality.

A greater concern relates to omitted variables in our main specifications. We address this problem in three ways. First, as oil price uncertainty can be correlated with macro-economic un-

Table 8: Likelihood of withdrawal

	(1)	(2)	(3)	(4)	(5)	(6)
			Withdrawn Oil IPO			
Implied Oil Volatility Diff.	0.1734** (1.996)	0.1740** (2.144)	0.2035* (1.875)	0.2063*** (2.952)	0.1968*** (2.663)	0.2350** (2.311)
WTI level		0.0067* (1.864)	0.0047 (1.136)		0.0140 (1.335)	0.0126 (1.064)
Fed Funds rate		0.0233 (0.509)	0.0274 (0.488)		-0.1086* (-1.784)	-0.1762*** (-3.239)
GDP growth		-0.0922 (-0.770)	-0.0258 (-0.204)		-0.0531 (-0.362)	-0.0139 (-0.100)
Equity Uncertainty		-0.0001 (-0.146)	0.0001 (0.153)		-0.0006 (-1.135)	-0.0004 (-0.764)
Political uncertainty		0.0014 (0.498)	0.0030 (0.891)		0.0018 (0.372)	0.0006 (0.110)
Hot IPO market		-0.0272 (-0.189)	-0.0238 (-0.147)		0.0869 (0.656)	0.0298 (0.186)
WTI Roll Yield		-0.0036 (-0.089)	-0.0035 (-0.081)		0.0259 (0.675)	0.0329 (0.811)
IPO size			0.1608*** (3.961)			0.1993*** (3.593)
Constant	-1.7681*** (-20.229)	-2.2192*** (-4.710)	-3.0329*** (-5.321)	-1.8967*** (-261.250)	-2.7822** (-2.515)	-2.2199** (-2.123)
Observations	2,720	2,720	2,572	2,359	2,359	2,164
Pseudo R-squared	0.00556	0.0357	0.0656	0.0838	0.0899	0.133
Year FE	N	N	No	Y	Y	Y

This table shows Probit models estimating the likelihood of an IPO withdrawal is conducted by an oil and gas firm in sample including all withdrawals. The main independent variable is Oil VIX difference which is the difference between the Oil VIX at the withdrawn month minus the Oil VIX at the filing month. The t-stats are calculated from heteroscedasticity robust standard errors clustered on year. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

certainty (Barsky and Kilian, 2001; 2004), we include a wide range of controls motivated by prior studies (e.g., Lowry et al., 2003) and add WTI return along with equity and political uncertainty measures. Second, we scale our dependent variable by the market-wide number of IPOs, allowing us to distinguish between oil and gas sector-specific IPO variation from overall IPO activity. This is important since oil price uncertainty is correlated with several factors likely also to impact the going-public decision (e.g. GPD, political uncertainty etc.). Third, even though we do not use excluded instruments in our analysis due to the exogeneity of oil price uncertainty, we test for the severity of the potential omitted variable bias using Oster (2019) methodology of coefficient stability.¹ We conduct the Oster's (2019) partial identification test in our main specification (Column 2 of Table 4). Our results indicate that the beta coefficient estimates stay within negative bounds after using the Oster (2019) proposed of 1.3* as the key input to the formula. The calculated estimations suggest that the observables are at least as informative as the non-observables in our models.

The oil and gas sector has undergone significant changes since the sample began in 1987. One of the major revolutions came with fracking in 2012 (Gilje et al., 2013), which led to a near doubling of oil production in the U.S. As seen in Figure 2, a spike in oil and gas IPOs coincides with the fracking revolution. This motivates us to study if our results are driven by the Post-2012 or Pre-2012 time periods. We replicate our analysis from Table 4 by dividing our sample into two sub-samples (before and after the fracking revolution). The outcome of the analysis (Appendix A4) does not alter our previous interpretation, *Implied Oil Price Volatility* has a negative and robust im-

1. The Oster (2019) test is widely used as a test of the coefficient stability in the economics literature (Acharya et al., 2019; Heimer et al., 2019; Ruhm, 2019)

pact on IPO volume in both sub-samples. The Hot IPO Market indicator falls out from the Post-2012 sample due to low overall IPO activity during this period.

We further acknowledge that several of our dependent variables (*#Oil IPOs*, *#Upstream* and *#Other*) are not continuous variables but instead of count data type. Therefore, we re-estimate all our models using Poisson regressions, allowing for a one lag autocorrelation using the model of Schwartz et al., (2006). Our findings in Appendix A5 confirm previous results, oil price uncertainty has a negative impact on total oil and gas and upstream IPO volume, while downstream and mid-stream IPOs do not exhibit any significant sensitivity to oil price uncertainty.

4. CONCLUSIONS

We examine the impact of oil price uncertainty on IPO volume in the oil and gas sector. Our uncertainty measure (*Implied Oil Volatility*) potentially offers advantages over other measures. The measure is forward-looking and exogenously determined, allowing for a cleaner identification in our tests. The theoretical argument for firms to refrain from their IPO stems from the cost of the capital and real options channels. Even though the two channels are not mutually exclusive, they provide different predictions on how uncertainty affects the likelihood of going-public. The cost of capital channel postulates that increased uncertainty has an adverse impact on the firm's valuation, and a lower valuation makes the cost of going-public outweigh the benefits. The real options channel postulates that the value of postponing the offering increases, given that the decision is not completely reversible.

We develop three hypotheses. First, we test the general effect of oil price uncertainty on the going-public decision, using four different measures of IPO volume. Second, we study upstream producers in isolation, this set of firms are theoretically more sensitive to changes in uncertainty. Third, we explore how uncertainty affects the time between filing and IPO and how it affects the likelihood of a withdrawn IPO.

We test our predictions using a sample of 450 completed oil and gas IPOs during the time-period 1/1/1987–12/31/2019. We find strong support for our main hypothesis, a one standard deviation decrease in implied volatility corresponds to an increase of 29% (22%) in the number of IPOs (proceeds). Concurring with Hypothesis (2), the negative relation between oil price uncertainty and IPOs is concentrated among the price-sensitive upstream producers. We further report that oil price uncertainty increases the time between filing and issue, and increases the IPO withdrawal likelihood.

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REFERENCES

- Acharya, Viral V., Björn Imbierowicz, Sascha Steffen, and Daniel Teichmann (2020). "Does the lack of financial stability impair the transmission of monetary policy?" *Journal of Financial Economics* 138(2): 342–365. <https://doi.org/10.1016/j.jfineco.2020.06.011>.
- Aye, Goodness C., Vincent Dadam, Rangan Gupta, and Bonginkosi Mamba (2014). "Oil price uncertainty and manufacturing production." *Energy Economics* 43: 41–47. <https://doi.org/10.1016/j.eneco.2014.02.004>.

- Bakanova, Asyl (2010). "The information content of implied volatility in the crude oil market." University Of Lugano And Swiss Finance Institute.
- Barth, Mary E., Wayne R. Landsman, and Daniel J. Taylor (2017). "The JOBS Act and information uncertainty in IPO firms." *The Accounting Review* 92(6): 25–47. <https://doi.org/10.2308/accr-51721>.
- Baker, Scott R., Nicholas Bloom, and Steven J. Davis (2016). "Measuring economic policy uncertainty." *The quarterly journal of economics* 131(4): 1593–1636. <https://doi.org/10.1093/qje/qjw024>.
- Baker, Scott R., Nicholas Bloom, Steven J. Davis, and Kyle J. Kost (2019). Policy news and stock market volatility. No. w25720. National Bureau of Economic Research. <https://doi.org/10.3386/w25720>.
- Baig, Ahmed S. and Mengxi Chen (2022). "Did the COVID-19 pandemic (really) positively impact the IPO Market? An Analysis of information uncertainty." *Finance Research Letters* 46: 102372. <https://doi.org/10.1016/j.frl.2021.102372>.
- Barsky, Robert B. and Lutz Kilian (2001). "Do we really know that oil caused the great stagflation? A monetary alternative." *NBER Macroeconomics annual* 16: 137–183. <https://doi.org/10.3386/w8389>.
- Barsky, Robert B. and Lutz Kilian (2004). "Oil and the macroeconomy since the 1970s." *Journal of Economic Perspectives* 18(4): 115–134. <https://doi.org/10.1257/0895330042632708>.
- Baumeister, Christiane and Lutz Kilian (2016). "Forty years of oil price fluctuations: Why the price of oil may still surprise us." *Journal of Economic Perspectives* 30(1): 139–60. <https://doi.org/10.1257/jep.30.1.139>.
- Baumeister, Christiane and James D. Hamilton (2019). "Structural interpretation of vector autoregressions with incomplete identification: Revisiting the role of oil supply and demand shocks." *American Economic Review* 109(5): 1873–1910. <https://doi.org/10.1257/aer.20151569>.
- Bernanke, Ben S. (1983). "Irreversibility, uncertainty, and cyclical investment." *The quarterly journal of economics* 98(1): 85–106. <https://doi.org/10.2307/1885568>.
- Black, F. and M. Scholes (1973). "The pricing of options and corporate liabilities." *Journal of political economy* 81: 637–654. <https://doi.org/10.1086/260062>.
- Brau, James C. and Stanley E. Fawcett (2006). "Initial public offerings: An analysis of theory and practice." *The Journal of Finance* 61(1): 399–436. <https://doi.org/10.1111/j.1540-6261.2006.00840.x>.
- Brennan, Michael J. and Eduardo S. Schwartz (1985). "Evaluating natural resource investments." *Journal of business* : 135–157. <https://doi.org/10.1086/296288>.
- Busaba, Walid Y. (2006). "Bookbuilding, the option to withdraw, and the timing of IPOs." *Journal of Corporate Finance* 12(2): 159–186. <https://doi.org/10.1016/j.jcorpfin.2004.12.003>.
- Busaba, Walid Y., Lawrence M. Benveniste, and Re-Jin Guo (2001). "The option to withdraw IPOs during the premarket: empirical analysis." *Journal of Financial Economics* 60(1): 73–102. [https://doi.org/10.1016/S0304-405X\(01\)00040-X](https://doi.org/10.1016/S0304-405X(01)00040-X).
- Christoffersen, Peter and Xuhui Nick Pan (2018). "Oil volatility risk and expected stock returns." *Journal of Banking & Finance* 95: 5–26. <https://doi.org/10.1016/j.jbankfin.2017.07.004>.
- Chronopoulos, Michail, Verena Hagspiel, and Stein-Erik Fleten (2016). "Stepwise green investment under policy uncertainty." *The Energy Journal* 37(4). <https://doi.org/10.5547/01956574.37.4.mchr>.
- Çolak, Gönül, Art Durnev, and Yiming Qian (2017). "Political uncertainty and IPO activity: Evidence from US gubernatorial elections." *Journal of Financial and Quantitative Analysis* 52(6): 2523–2564. <https://doi.org/10.1017/S0022109017000862>.
- Crain, N., R. Parrino, and R. Srinivasan (2021). "Uncertainty, prospectus content, and the pricing of initial public offerings." *Journal of Empirical Finance* 64: 160–182. <https://doi.org/10.1016/j.jempfin.2021.08.007>.
- Davis, Graham A. and Robert D. Cairns (2017). "The odd notion of 'reversible investment'." *Journal of Banking & Finance* 81: 172–180. <https://doi.org/10.1016/j.jbankfin.2016.03.019>.
- Dickey, David A. and Wayne A. Fuller (1979). "Distribution of the estimators for autoregressive time series with a unit root." *Journal of the American statistical association* 74(366a): 427–431. <https://doi.org/10.1080/01621459.1979.10482531>.
- Doshi, Hitesh, Praveen Kumar, and Vijay Yerramilli (2018). "Uncertainty, capital investment, and risk management." *Management Science* 64(12): 5769–5786. <https://doi.org/10.1287/mnsc.2017.2815>.
- Dossani, Asad and John Elder (2020). "Uncertainty and energy extraction." *Applied Economics* 52(55): 6031–6044. <https://doi.org/10.1080/00036846.2020.1782337>.
- Dossani, Asad and John Elder (2022). "Uncertainty and Investment: Evidence from Domestic Oil Rigs." Available at SSRN 3855141. <https://doi.org/10.2139/ssrn.3855141>.
- Edelstein, Paul and Lutz Kilian (2007). "The response of business fixed investment to changes in energy prices: a test of some hypotheses about the transmission of energy price shocks." *The BE Journal of Macroeconomics* 7(1). <https://doi.org/10.2202/1935-1690.1607>.
- Edelstein, Paul and Lutz Kilian (2009). "How sensitive are consumer expenditures to retail energy prices?" *Journal of Monetary Economics* 56(6): 766–779. <https://doi.org/10.1016/j.jmoneco.2009.06.001>.

- Elder, John (2019). "Oil price volatility and real options: 35 years of evidence." *Journal of Futures Markets* 39(12): 1549–1564. <https://doi.org/10.1002/fut.22057>.
- Elder, John and Peter E. Kennedy (2001). "Testing for unit roots: what should students be taught?" *The Journal of Economic Education* 32(2): 137–146. <https://doi.org/10.1080/00220480109595179>.
- Elder, John and Apostolos Serletis (2010). "Oil price uncertainty." *Journal of Money, Credit and Banking* 42(6): 1137–1159. <https://doi.org/10.1111/j.1538-4616.2010.00323.x>.
- Gao, Lin, Steffen Hitzemann, Ivan Shaliastovich, and Lai Xu (2022). "Oil volatility risk." *Journal of Financial Economics* 144(2): 456–491. <https://doi.org/10.1016/j.jfineco.2021.08.016>.
- Gilje, Erik, Robert Ready, and Nikolai Roussanov (2016). Fracking, drilling, and asset pricing: Estimating the economic benefits of the shale revolution. No. w22914. National Bureau of Economic Research. <https://doi.org/10.3386/w22914>.
- Heimer, Rawley Z., Kristian Ove R. Myrseth, and Raphael S. Schoenle (2019). "YOLO: Mortality beliefs and household finance puzzles." *The Journal of Finance* 74(6): 2957–2996. <https://doi.org/10.1111/jofi.12828>.
- Henriques, Irene and Perry Sadorsky (2011). "The effect of oil price volatility on strategic investment." *Energy Economics* 33(1): 79–87. <https://doi.org/10.1016/j.eneco.2010.09.001>.
- Jin, Yanbo and Philippe Jorion (2006). "Firm value and hedging: Evidence from US oil and gas producers." *The Journal of Finance* 61(2): 893–919. <https://doi.org/10.1111/j.1540-6261.2006.00858.x>.
- Jo, Soojin (2014). "The effects of oil price uncertainty on global real economic activity." *Journal of Money, Credit and Banking* 46(6): 1113–1135. <https://doi.org/10.1111/jmcb.12135>.
- Kellogg, Ryan (2014). "The effect of uncertainty on investment: evidence from Texas oil drilling." *American Economic Review* 104(6): 1698–1734. <https://doi.org/10.1257/aer.104.6.1698>.
- Kettunen, Janne, Derek W. Bunn, and William Blyth (2011). "Investment propensities under carbon policy uncertainty." *The Energy Journal* 32(1). <https://doi.org/10.5547/ISSN0195-6574-EJ-Vol32-No1-4>.
- Kilian, Lutz (2009). "Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market." *American Economic Review* 99(3): 1053–69. <https://doi.org/10.1257/aer.99.3.1053>.
- Kilian, Lutz (2010). Oil price volatility: Origins and effects. No. ERSD-2010-02. WTO Staff Working Paper.
- Kilian, Lutz (2014). "Oil price shocks: Causes and consequences." *Annu. Rev. Resour. Econ.* 6(1): 133–154. <https://doi.org/10.1146/annurev-resource-083013-114701>.
- Kumar, Praveen and Ramon Rabinovitch (2013). "CEO entrenchment and corporate hedging: Evidence from the oil and gas industry." *Journal of financial and quantitative analysis* 48(3): 887–917. <https://doi.org/10.1017/S0022109013000276>.
- Loughran, Tim and Jay Ritter (2004). "Why has IPO underpricing changed over time?" *Financial management* : 5–37.
- Lowry, Michelle (2003). "Why does IPO volume fluctuate so much?" *Journal of Financial economics* 67(1): 3–40. [https://doi.org/10.1016/S0304-405X\(02\)00230-1](https://doi.org/10.1016/S0304-405X(02)00230-1).
- Luo, Danglun, Naqiong Tong, and Guoman She (2017). "City-level political uncertainty and city-level IPO activities." *Accounting & Finance* 57(5): 1447–1480. <https://doi.org/10.1111/acfi.12341>.
- Majd, Saman and Robert S. Pindyck (1987). "Time to build, option value, and investment decisions." *Journal of financial Economics* 18(1): 7–27. [https://doi.org/10.1016/0304-405X\(87\)90059-6](https://doi.org/10.1016/0304-405X(87)90059-6).
- Maghyereh, Aktham and Hussein Abdoh (2020). "Asymmetric effects of oil price uncertainty on corporate investment." *Energy Economics* 86: 104622. <https://doi.org/10.1016/j.eneco.2019.104622>.
- Newey, Whitney K. and Kenneth D. West (1986). "A simple, positive semi-definite, heteroskedasticity and autocorrelation-consistent covariance matrix." <https://doi.org/10.3386/t0055>.
- Oster, Emily (2019). "Unobservable selection and coefficient stability: Theory and evidence." *Journal of Business & Economic Statistics* 37(2): 187–204. <https://doi.org/10.1080/07350015.2016.1227711>.
- Pagano, Marco, Fabio Panetta, and Luigi Zingales (1998). "Why do companies go public? An empirical analysis." *The Journal of Finance* 53(1): 27–64. <https://doi.org/10.1111/0022-1082.25448>.
- Pástor, Luboš and Pietro Veronesi (2005). "Rational IPO waves." *The Journal of Finance* 60(4): 1713–1757. <https://doi.org/10.1111/j.1540-6261.2005.00778.x>.
- Phan, Dinh Hoang Bach, Vuong Thao Tran, and Dat Thanh Nguyen (2019). "Crude oil price uncertainty and corporate investment: New global evidence." *Energy Economics* 77: 54–65. <https://doi.org/10.1016/j.eneco.2018.08.016>.
- Pierru, Axel, James L. Smith, and Tamim Zamrik (2018). "OPEC's impact on oil price volatility: The role of spare capacity." *The Energy Journal* 39(2). <https://doi.org/10.5547/01956574.39.2.apie>.
- Pindyck, Robert S. (1991). "Irreversibility, Uncertainty, and Investment." *Journal of Economic Literature* 29: 1110–1148. <https://doi.org/10.3386/w3307>.
- Rahman, Sajjadur and Apostolos Serletis (2011). "The asymmetric effects of oil price shocks." *Macroeconomic Dynamics* 15(S3): 437–471. <https://doi.org/10.1017/S1365100511000204>.

- Rajan, Raghuram and Henri Servaes (1997). "Analyst following of initial public offerings." *The Journal of Finance* 52(2): 507–529. <https://doi.org/10.1111/j.1540-6261.1997.tb04811.x>.
- Ritter, Jay R. (1984). "The 'hot issue' market of 1980." *Journal of business* : 215–240. <https://doi.org/10.1086/296260>.
- Ruhm, Christopher J. (2019). "Drivers of the fatal drug epidemic." *Journal of health economics* 64: 25–42. <https://doi.org/10.1016/j.jhealeco.2019.01.001>.
- Schwartz, Joel, C. Spix, G. Touloumi, L. Bacharova, T. Barumamdzadeh, Al Le Tertre, T. Piekarski et al. (1996). "Methodological issues in studies of air pollution and daily counts of deaths or hospital admissions." *Journal of Epidemiology & Community Health* 50(Suppl 1): S3–11. https://doi.org/10.1136/jech.50.Suppl_1.S3.
- Schwert, G. William (1989). "Tests for Unit Roots: A Monte Carlo Investigation." *Journal of Business & Economic Statistics* 7(2): 147–159. <https://doi.org/10.1080/07350015.1989.10509723>.
- Singleton, Kenneth J. (2014). "Investor flows and the 2008 boom/bust in oil prices." *Management Science* 60(2): 300–318. <https://doi.org/10.1287/mnsc.2013.1756>.
- Suenaga, Hiroaki and Aaron Smith (2011). "Volatility dynamics and seasonality in energy prices: implications for crack-spread price risk." *The Energy Journal* 32(3). <https://doi.org/10.5547/ISSN0195-6574-EJ-Vol32-No3-2>.
- Thanh, Binh Nguyen (2020). "Macroeconomic uncertainty, the option to wait and IPO issue cycles." *Finance Research Letters* 32: 101100. <https://doi.org/10.1016/j.frl.2019.01.012>.

APPENDIX A1: VARIABLE DEFINITIONS

Variable	Definition	Source
# Oil IPOs	The quarterly number of IPOs in the oil and gas sector	SDC
ln(Proceeds)	The natural logarithm of proceeds raised by oil and gas sector IPOs during the given quarter	SDC
#IPO Share	The number of oil and gas IPOs scaled by the total number of IPOs	SDC
\$IPO Share	Proceeds raised by oil and gas sector IPOs scaled by the total proceeds raised by IPO firms during the given quarter	SDC
#Hi-Tech Share	The number of hi-tech IPOs scaled by the total number of IPOs	SDC
\$ Hi-Tech Share	Proceeds raised by hi-tech sector IPOs scaled by the total proceeds raised by IPO firms during the given quarter	SDC
# Upstream IPOs	The number of quarterly upstream IPOs according to the classification in appendix A2	SDC
# Other IPOs	The number of quarterly oil and gas IPOs that is not classified as Upstream according to the classification in appendix A2	SDC
Window Length in days	Days between Filing and Issue date of the IPO	SDC
Implied Oil Volatility	The implied volatility of oil options	Commodity Research Group
WTI Level	The price of WTI	Eikon
WTI Return	The return of WTI	Eikon
Fed Funds Rate	The Fed funds rate in %	Federal Reserve
Δ Fed Funds Rate	The first difference of the Fed Funds rate	Federal Reserve
GDP Growth	U.S. GDP growth	World Bank
Equity Uncertainty	The equity uncertainty index by Baker et al. (2019)	http://www.policyuncertainty.com/
Political Uncertainty	The political uncertainty index by Baker et al. (2016)	http://www.policyuncertainty.com/
Δ Political Uncertainty	The first difference of political uncertainty	http://www.policyuncertainty.com/
Withdrawn Oil IPO	An indicator taking the value of one if the withdrawn IPO is in the oil and gas sector	SDC
IPO Size	The natural logarithm of the total proceeds raised in the IPO	SDC
Hot IPO Market	An indicator variable taking the value of one if the quarter is in the top quartile of IPO activity	SDC
WTI Roll Yield	The spread between the 6-month and 1-month WTI contracts	Eikon

APPENDIX A2: UPSTREAM DEFINITION

Industry

Upstream	SIC Codes
Crude petroleum and natural gas	1311
Natural gas liquids	1321
Drilling oil and gas wells	1381
Oil and gas exploration services	1382
Oil and gas field services, nec	1389
Other	
Petroleum refining	2911
Misc. products of petroleum and coal	2990
Lubricating oils and greases	2992
Oil and gas field machinery	3533
Crude petroleum pipelines	4612
Refined petroleum pipelines	4613
Pipelines, nec	4619
Natural gas transmission	4922
Gas transmission and distribution	4923
Natural gas distribution	4924
Gas production and/or distribution	4925
Petroleum bulk stations and terminals	5171
Petroleum products, nec	5172
Gasoline service stations	5541
Fuel oil dealers	5983
Oil royalty traders	6792

This table shows our classification into Upstream and Other oil and gas firms based on their sub-sector SIC codes. Other oil and gas sector firms mainly consists of downstream firms.

APPENDIX A3: HI-TECH FIRMS AND OIL PRICE UNCERTAINTY

	(1)	(2)	(3)	(4)	(5)	(6)
	#Hi-Tech IPO Share			\$Hi-Tech IPO Share		
Implied Oil Volatility	-0.0004 (-0.516)	0.0000 (0.060)	-0.0001 (-0.149)	-0.0009* (-1.698)	-0.0001 (-0.094)	-0.0001 (-0.175)
WTI Return		-0.0023*** (-4.926)	-0.0021*** (-4.692)		-0.0008 (-1.278)	-0.0007 (-1.210)
Δ Fed Funds Rate		0.0174 (0.789)	0.0224 (1.065)		0.0130 (0.563)	0.0151 (0.653)
GDP Growth		-0.3599 (-0.236)	-0.9600 (-0.624)		0.1099 (0.090)	-0.1975 (-0.150)
Equity Uncertainty		-0.0002*** (-2.710)	-0.0003*** (-2.984)		-0.0002*** (-3.545)	-0.0002*** (-3.598)
Δ Political Uncertainty		-0.0002 (-0.907)	-0.0002 (-0.659)		-0.0001 (-0.486)	-0.0001 (-0.397)
Hot IPO market		-0.0076 (-0.379)	-0.0074 (-0.373)		-0.0092 (-0.540)	-0.0081 (-0.461)
WTI Roll Yield		0.0137*** (3.193)	0.0143*** (3.323)		0.0111** (2.267)	0.0113** (2.263)
Constant	0.1978*** (8.601)	0.2143*** (7.755)	0.2561*** (7.378)	0.1438*** (7.215)	0.1425*** (5.974)	0.1587*** (5.037)
Observations	132	132	132	132	132	132
Newey-West Lags	4	4	4	4	4	4
Quarter Dummies	N	N	Y	N	N	Y

This table shows time-series regression at the quarterly level. The dependent variables are the number of hi-tech IPOs during the given quarter scaled by the total number of IPOs (#Hi-Tech IPO share) in columns (1) to (3) and the total proceeds raised by hi-tech IPOs in relation to total proceeds raised during the given quarter (\$Hi-Tech IPO share) in columns (4) to (6). All independent variables enter the model with one lag. The t-stats are based on Newey-West standard errors using four lags. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

APPENDIX A4: BEFORE AND AFTER THE FRACKING REVOLUTION

	(1)	(2)	(3)	(4)	(5)	(6)
		Pre-2012			Post-2012	
	# IPOs					
Implied Oil Volatility	-0.0536*** (-3.380)	-0.0466* (-1.846)	-0.0564** (-2.231)	-0.1209*** (-2.765)	-0.2027** (-2.511)	-0.2343*** (-3.410)
WTI Return		0.0208 (1.000)	0.0219 (1.013)		-0.0427 (-0.796)	-0.0679 (-1.188)
Δ Fed Funds Rate		0.1185 (0.179)	0.2640 (0.424)		-0.4924 (-0.094)	0.2957 (0.067)
GDP Growth		-0.6805 (-1.346)	-1.0302* (-1.878)		-0.8764 (-0.413)	-0.9259 (-0.463)
Equity Uncertainty		-0.0054*** (-2.782)	-0.0060*** (-3.028)		-0.0089 (-1.169)	0.0095 (1.026)
Δ Political Uncertainty		0.0245** (2.509)	0.0192* (1.958)		0.0113 (0.486)	0.0103 (0.536)
WTI Roll Yield		-0.1461 (-0.935)	-0.1367 (-0.851)		-0.1298 (-0.334)	-0.1715 (-0.532)
Hot IPO market		0.2784 (0.355)	0.4438 (0.542)			
Constant	5.0089*** (7.194)	5.8216*** (4.897)	6.9796*** (4.726)	7.5935*** (4.646)	10.9008*** (3.870)	8.7627*** (3.565)
Observations	100	100	100	32	32	32
Newey-West Lags	4	4	4	4	4	4
Quarter Dummies	N	N	Y	N	N	Y

This table shows time-series regression at the quarterly level. The dependent variable is the number of IPOs in the oil and gas sector during the given quarter (#Oil IPOs). The sample is partitioned based on the fracking revolution; pre-2012 includes the years 1987-2011, and Post-2012 contains 2012-2019. All independent variables enter the model with one lag. The t-stats are based on Newey-West standard errors using four lags. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

APPENDIX A5: ROBUSTNESS TEST USING POISSON TIME-SERIES REGRESSIONS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		#Oil IPOs			#Upstream			#Other	
Implied Oil Volatility	-0.0262*** (-3.669)	-0.0244*** (-3.030)	-0.0260*** (-3.367)	-0.0344*** (-3.979)	-0.0296*** (-3.217)	-0.0316*** (-3.666)	-0.0123 (-1.386)	-0.0146 (-1.242)	-0.0159 (-1.382)
WTI Return		0.0045 (0.729)	0.0049 (0.796)		0.0046 (0.653)	0.0053 (0.778)		0.0038 (0.410)	0.0050 (0.539)
Δ Fed Funds Rate		0.0529 (0.287)	0.0720 (0.396)		-0.0119 (-0.059)	0.0383 (0.191)		0.0598 (0.210)	0.0461 (0.164)
GDP Growth		-0.0299* (-1.863)	-0.0340** (-2.067)		-0.0399** (-2.263)	-0.0543*** (-2.962)		0.0260 (0.107)	0.0748 (0.306)
Equity Uncertainty		-0.0028*** (-3.345)	-0.0024*** (-2.956)		-0.0036*** (-3.599)	-0.0033*** (-3.301)		-0.0014 (-1.330)	-0.0012 (-1.093)
Δ Political Uncertainty		0.0063** (2.331)	0.0049* (1.865)		0.0053* (1.707)	0.0031 (1.054)		0.0080** (1.993)	0.0081** (1.991)
Hot IPO market		0.1089 (0.622)	0.1238 (0.727)		0.1642 (0.883)	0.2099 (1.169)		-0.1319 (-0.445)	-0.1293 (-0.446)
WTI Roll Yield		-0.0049 (-0.146)	-0.0152 (-0.466)		0.0056 (0.152)	0.0059 (0.167)		-0.0422 (-0.818)	-0.0577 (-1.126)
Constant	2.0382*** (9.198)	2.4027*** (8.559)	2.7025*** (9.209)	1.9011*** (7.282)	2.2944*** (7.359)	2.6781*** (8.347)	0.4633 (1.583)	0.6647 (1.521)	0.8755* (1.896)
R1	0.2520*** (3.126)	0.3125*** (3.559)	0.3276*** (3.857)	0.2273*** (2.877)	0.3026*** (3.542)	0.3178*** (3.771)	0.1516* (1.751)	0.1313 (1.466)	0.1874** (2.093)
Observations	131	131	131	131	131	131	131	131	131
R-squared	0.160	0.274	0.332	0.162	0.294	0.356	0.040	0.078	0.121
AR lags	1	1	1	1	1	1	1	1	1
Quarter dummies	N	N	Y	N	N	Y	N	N	Y

This table re-estimate our main results using Poisson models to take into account of that our dependent variables are of count data type. The dependent variable in columns (1) to (3) is the number of IPOs in the oil and gas sector during the given quarter. In columns (4) to (6) the dependent variable is the number of upstream IPOs and in columns (7) to (9) the number of other IPOs according to our classification in Appendix A2. The t-stats are reported in parentheses. All variables are defined in Appendix A1. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.