

A Service of

ZBW

Leibniz-Informationszentrum Wirtschaft Leibniz Information Centre for Economics

Batabyal, Sourav; Killins, Robert

Article

The influence of oil prices on equity returns of Canadian energy firms

Journal of Risk and Financial Management

Provided in Cooperation with: MDPI – Multidisciplinary Digital Publishing Institute, Basel

Suggested Citation: Batabyal, Sourav; Killins, Robert (2021) : The influence of oil prices on equity returns of Canadian energy firms, Journal of Risk and Financial Management, ISSN 1911-8074, MDPI, Basel, Vol. 14, Iss. 5, pp. 1-16, https://doi.org/10.3390/jrfm14050226

This Version is available at: https://hdl.handle.net/10419/239642

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.



https://creativecommons.org/licenses/by/4.0/

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.









Article The Influence of Oil Prices on Equity Returns of Canadian Energy Firms

Sourav Batabyal ^{1,2} and Robert Killins ^{2,*}

- ¹ Grant Center for Real Estate and Economics, E. Craig Wall Sr. College of Business Administration, Coastal Carolina University, 119 Chanticleer Drive West, Conway, SC 29526, USA; sbatabyal@coastal.edu
- ² Department of Finance and Economics, E. Craig Wall Sr. College of Business Administration,
- Coastal Carolina University, 119 Chanticleer Drive West, Conway, SC 29526, USA
 * Correspondence: rkillins@coastal.edu; Tel.: +1-843-349-2519

Abstract: Using monthly data from January 2000 to August 2018, this paper examines how the Canadian oil and gas industry and individual firms' equity prices react to oil price fluctuations, which are measured by the traditional West Texas Intermediate (WTI) benchmark and the Canada-specific Western Canadian Select (WCS) benchmark. The findings provide support for the view that oil price movements are an important factor in explaining the equity returns of the overall industry and for many individual oil and gas firms in Canada. Both WTI and WCS measures provide statistically significant evidence, but the results support that WTI may still be the more relevant measure for Canadian-based firms. We also find that the spread between WTI and WCS has a minimal impact on the firms' equity returns have provided little evidence, whereas time-varying impacts are found for a handful of firms. The empirical findings predicated on the holistic view of the impacts of oil price fluctuations on equity market returns will enhance investor confidence and strengthen the Canadian economy.

Keywords: oil; equity returns; Canada

JEL Classification: E44; G12; L71; Q40

1. Introduction

The impact that energy prices have on the economy has received widespread attention from academics and practitioners (e.g., Hamilton 1983; Hamilton 2003; Lee et al. 2017). Academic researchers have also focused on how energy prices impact the equity market. For example, Jones and Kaul (1996), Ramos and Veiga (2011), and Diaz et al. (2016) take a global perspective, Kilian and Park (2009) and Broadstock and Filis (2014) focus on the U.S. market, Bagirov and Mateus (2019) on the European markets, and Basher and Sadorsky (2006) and Gupta (2016) on the emerging markets. Overall, the majority of studies focusing on the impact energy prices have on the aggregate equity indices have found a negative relationship. This general finding can vary on a number of different factors. One of them is the geographic factor, specifically on whether the country is an oil-importing or oil-exporting country (Park and Ratti 2008; Filis et al. 2011). Secondly, the nature of the underlying oil shock (demand or supply) can influence the reaction that equity markets and firms have on oil fluctuations (Kilian and Park 2009). Finally, additional research has focused on individual sectors of the equity market (e.g., Elyasiani et al. 2011; Lee et al. 2012; Waheed et al. 2018). Empirical findings for industry sectors have suggested that individual industry reactions to oil shocks can vary. Generally, oil-dependent industries have a negative relationship to oil price shocks, whereas oil-producing industries can have positive reactions (Phan et al. 2015).¹



Citation: Batabyal, Sourav, and Robert Killins. 2021. The Influence of Oil Prices on Equity Returns of Canadian Energy Firms. *Journal of Risk and Financial Management* 14: 226. https://doi.org/10.3390/ jrfm14050226

Academic Editor: Michael Polemis

Received: 7 April 2021 Accepted: 9 May 2021 Published: 18 May 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). In recent times, the oil and gas industry has received considerable recognition regarding its reaction to oil shocks. The general findings suggest that oil shocks are positively related to the energy firm's profits (e.g., Dayanandan and Donker 2011) and equity returns (e.g., Nandha and Faff 2008; Mohanty and Nandha 2011; Gupta 2016). There can be varying degrees of impact depending upon the geographic region of the sample. For example, Hall and Kenjegaliev (2017) find that while oil price changes affect stock prices of American and European oil companies as expected, the most atypical behavior is observed for equities of Chinese and Russian companies.

Canada has been one country that has attracted significant consideration from academics in regard to the impact oil has on the economy (e.g., Bashar et al. 2013). Specific assets such as housing (Killins et al. (2017)) and equity (e.g., Lee et al. 2012) have also been explored and have found that oil is a significant factor in explaining the variation of prices and returns. More focused studies on the oil and gas industry in Canada have also provided the literature with important contributions. For example, Sadorsky (2001) find that an increase in the market for oil price increases the return to Canadian oil and gas stock prices and that the oil and gas sector is less risky than the market and its moves are procyclical. Additionally, Boyer and Filion (2007) find that the return of Canadian energy stock is positively associated with the Canadian stock market return and with appreciations of crude oil and gas firms react to changing energy prices by applying a panel data regression on two subsets of energy firms, producers, and integrated firms. They find that the producers are more impacted by oil price fluctuations than the integrated firms.²

Recently, renewed scrutiny on the oil and gas sector in Canada has focused on the impacts the Canadian oil sands (both positive and negative) bring to the Canadian economy.³ This 'heavier' crude oil is often benchmarked by the measure called Western Canadian Select (WCS). Recent developments surrounding pipeline approvals and transportation of Canadian oil have developed uncertainty among international investors in regard to the long-term viability of the western Canadian energy market.⁴ This has caused WCS to trade at a steep discount to the North American benchmark, WTI. Figure 1 provides a visual of the price of both WTI and WCS. The discounted price of WCS has prompted federal and provincial governments in Canada to take action to help bolster the energy market in western Canada.⁵ To the best of our knowledge, the previous literature that has focused on the impact oil shocks have on equity markets in Canada has used only the WTI measure and not the WCS measure. Thus, this research will add to the literature focused on the impact energy prices have on the Canadian oil and gas sector by incorporating the traditional measure of oil in North America, WTI, Canada-specific measure, WCS, and the spread between WTI and WCS. Additionally, this research follows the methodological approach of Baur and Todorova (2018) and empirically tests the impacts oil fluctuations have on individual firms but also on a wide industry basis. Finally, this research tests for asymmetric impacts of energy shocks on Canadian oil and gas equity returns and for time-varying effects.

Using data spanning from January 2000 to August 2018, this research implements individual Fama and French (1993) regressions on a Canadian energy index and the major Canadian energy firms. The findings indicate that, on an industry basis, fluctuations in both WTI and WCS have statistically significant positive relationships with the Canadian energy sector equity returns. When incorporating the spread in WTI and WCS (WTI-WCS), this spread also indicates a positive and significant (at 10% level) relationship with equity returns in the Canadian energy sector. On a firm-by-firm basis, in the WTI regression, seven out of the fourteen firms show significant positive relationships. The WCS regressions provide four firms with significant positive coefficients and in the WTI-WCS regressions, only one firm (Suncor Energy) has a statistically significant coefficient. An empirical test of asymmetry indicates little evidence of asymmetric impacts of oil on the Canadian energy sector equity returns.



in Canada has not been altered significantly since the global financial crisis, but individual firms tend to have time-varying results.

Figure 1. West Texas Intermediate (WTI) and Western Canadian Select (WCS) prices.

This research and its findings add to the existing literature in several ways. First, this research contributes to the overall energy literature by using a unique Canadian oil benchmark (WCS) that has grown in importance in the North American energy markets over the past two decades. Secondly, the general perception amongst Canadian energy media contributors is that the spread between WTI and WCS is negatively impacting the Canadian energy firms' equity returns. The empirical evidence in the study does not support that view. This is not to say that the spread between WTI and WCS does not have general economic impacts or that this spread does not impact other accounting-based measures or firm operations, but these findings call for further research on how the spread between WTI and WCS are filtered into the general Canadian economy and equity markets. Finally, using industry and firm-specific data, we are able to provide substantial evidence of how energy shocks can be unique to each individual firm, which can be lost when using portfolio or simple industry returns.

The remainder of this paper is structured as follows. Section 2 provides an understanding of the data and the methodological approach. Section 3 discusses the results. Finally, Section 4 provides the conclusion and implications.

2. Data and Methodology

This paper estimates the oil price sensitivity of Canadian oil and gas firms at the industry level as well as at the firm level. This approach is followed for several reasons. First, following the spirit of Fama and French (1997), we argue that all oil and gas industries across countries are not homogeneous. Second, the oil and gas industry plays a significant role in the Canadian economy. For example, Canada's energy sector accounts for almost 11% of the nominal Gross Domestic Product (GDP) and approximately 17% of the TSX

Composite index.⁶ Third, the previous literature on the Canadian oil and gas sector does not explicitly analyze the relationship between changes in oil prices and the equity returns at the firm level. The analysis at the firm level is crucial as the aggregate or industry-level analysis may not reveal an individual firm's risk exposure to changes in oil prices.

2.1. Data

This study uses the iShares S&P/TSX Capped Energy Index ETF to capture the industry level equity returns of the oil and gas sector in Canada.⁷ For the firm-level data, this study uses the fourteen oil and gas firms that are included in the primary equity index in Canada (TSX60).⁸ Appendix A provides a list of the industry ETF and the fourteen energy firms used in this study. Monthly price data for these securities are obtained via the Datastream database from January 2000 to August 2018.

With regard to oil prices, our primary measure is the monthly returns on the West Texas Intermediate (WTI), expressed in USD/barrel. This paper uses the price of WTI for two reasons. First, prices of the WTI are the most widely used indices in North America. Second, when firms use hedging instruments, the vast majority of firms use futures, forward, and other over-the-counter derivatives based on the WTI. The monthly price data for WTI is obtained via the Federal Reserve Economic Database (https://fred.stlouisfed.org accessed on 9 January 2020). As previously noted, to the best of our knowledge, studies that have examined the impact oil prices have on the equity or oil and gas sector in Canada have yet to use the Canadian crude oil blend, Western Canadian Select (WCS). WCS has been of importance to the energy markets in Canada since the early 2000s, when EnCana (Cenovus), Canadian Natural Resources Limited, Petro-Canada (Suncor), and Talisman Energy Inc. joined together to create and market the new blend at the Husky Energy terminal in Hardisty, Alberta, Canada. WCS monthly price data are obtained via the Alberta Government website (https://economicdashboard.alberta.ca/OilPrice accessed on 9 January 2020).⁹ Finally, the Fama–French factors specifically for Canada are obtained via the AQR website.¹⁰ Observations are winsorized at the 1 and 99 percentiles to eliminate outliers and to avoid spurious inferences due to extreme values. Additionally, the oil variables used in the empirical estimations are tested for unit root using the Augmented Dickey–Fuller (ADF) and Philips Perron (PP) tests and are found to be stationary.¹¹

Summary statistics of the variables are provided in Table 1. The average monthly return for the Canadian oil and gas industry during the sample period is approximately 0.0026 percent. In regards to the oil measures, WCS tends to have a higher monthly return at 0.0145 compared to WTI's monthly return of 0.0087. WCS also tend to be more volatile with a 0.1473 standard deviation versus WTI's standard deviation of 0.0912.

Table 1. Summary statistics of m	onthly log returns,	, Fama–French and	oil variables
----------------------------------	---------------------	-------------------	---------------

Index	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
iShares S&P/TSX Energy ETF	209	0.0026	0.0630	-0.2296	0.1646	-0.5047	4.0470
Firm							
Imperial Oil Ltd.	223	0.0066	0.0616	-0.2612	0.1617	-0.1866	4.3774
Enbridge Inc.	223	0.0022	0.0786	-0.6417	0.1697	-4.9143	41.0854
TC Energy Corp.	223	0.0070	0.0443	-0.1671	0.2266	0.3712	6.0626
Encana Corp.	223	-0.0012	0.1087	-0.6160	0.3029	-1.4874	9.9876
Husky Energy	223	0.0021	0.0869	-0.7308	0.1922	-2.7026	24.4205
Fortis Inc.	223	0.0080	0.0441	-0.1017	0.1367	0.1526	3.0272
Canadian Natural Resources	223	0.0013	0.1165	-0.7420	0.2472	-2.5403	16.9563
Suncor Energy	223	-0.0006	0.1093	-0.7083	0.2419	-2.8018	17.3664
Emera Inc.	223	0.0050	0.0394	-0.1070	0.1217	-0.1432	3.2658
Inter Pipeline Inc.	223	0.0076	0.0507	-0.1720	0.1263	-0.3885	3.3662
ARC Resources	223	0.0019	0.0694	-0.2683	0.1535	-0.5137	3.9763
Pembina Pipeline Corp.	223	0.0087	0.0463	-0.1825	0.1128	-0.7567	4.5170
Crescent Point Energy Corp.	200	0.0079	0.0948	-0.2576	0.4321	0.3009	4.8090
Cenovus Energy	104	-0.0075	0.0754	-0.2315	0.2472	0.0825	4.3676

Index	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Fama—French and Oil							
Variables:							
MRK	224	0.0061	0.0563	0.2802	0.2039	-0.6516	5.8591
SMB	224	0.0008	0.0299	-0.0972	0.1458	0.5554	6.2599
HML	224	0.0070	0.0413	-0.1849	0.2194	0.2536	8.0827
ΔWTI	223	0.0087	0.0912	-0.3237	0.3170	-0.1552	3.7197
ΔWCS	223	0.0145	0.1473	-0.3680	0.4393	0.0218	3.2558

Table 1. Cont.

Note: Monthly log returns are from January 2000 to August 2018. The iShares S&P/TSX Energy ETF data are available from March 2001, Crescent Point Energy from October 2002 and Cenovus Energy data from November 2009. MRK is the excess market return, small minus big (SMB) is the size factor, and high minus low (HML) is the value factor. MRK, SMB, and HML are all obtained via the AQR website for Canada. Δ WTI is the monthly return for West Texas Intermediate. Δ WCS is the monthly return of Western Canadian Select.

2.2. Regression Models

This research follows the regression approach of Baur and Todorova (2018) and estimates the following four-factor regression model of the excess returns R_t of the overall oil and gas industry and each Canadian oil firm as:

$$R_t = \alpha_0 + \beta_1 \left(R_{m,t} - R_{f,t} \right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 OIL_t + \varepsilon_t \tag{1}$$

The excess return on a Canadian oil firm is regressed on the three Fama–French factors (the market risk premium, $R_m - R_f$; a capitalization factor of small to big firms, *SMB*; a stock valuation factor of high to low book value stocks, *HML*; and changes in the oil price). The OIL factor measures the change in WTI, WCS, or the spread between WTI and WCS. The regression coefficients β_1 through β_4 measure the sensitivity of the dependent variable to each of the four factors, respectively.

Additionally, as in Baur and Todorova's work (2018), which is motivated by the previous literature regarding significant asymmetric effects of oil price shocks on financial markets (e.g., Arouri 2011; Broadstock et al. 2016), we adapt Equation (1) to test for the potential of asymmetric effects by means of a threshold model as:

$$R_t = \alpha_0 + \beta_1 \left(R_{m,t} - R_{f,t} \right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 OIL_t + \beta_{\blacklozenge} OIL_t D_t + \varepsilon_t$$
(2)

where the dummy variable D_t is equal to one if the price of oil is above a certain threshold and zero if otherwise. This paper considers different thresholds to analyze this effect, such as the average WTI price over the whole sample period (USD 63.26), the median price (USD 60.85), as well as the 1-year and 5-year moving averages. Equation (2) statistically tests for asymmetry based on the coefficient β_{\bullet} .

Finally, the previous literature suggests the existence of structural breaks in the relationship between stock and oil markets (e.g., Apergis and Miller 2009). Research by Salisu and Fasanya (2013), Mollick and Assefa (2013), Baur and Todorova (2018), and Yun and Yoon (2019) indicate that the impacts that oil prices have on financial markets may have been altered during the time of the global financial crisis. Since the sample of this study covers the period of January 2000 to August 2018, we split the sample period to capture two time-frames: (1) from January 2000 to December 2008 and (2) from January 2009 to August 2018. We re-estimated Equation (1) to identify if Canadian oil firms' reactions to oil price fluctuations have been altered in the post-global financial crisis period.¹²

3. Results

3.1. Main Estimation Results

Table 2 provides the results of Equation (1), with WTI as the measure for the oil price. The market beta (MRK) is 0.60 for the industry-wide regression (iShares ETF). Thirteen of the fourteen individual firm regressions indicate that the market beta is significant, in which values range from 0.1176 to 0.6744. These results align with Sadorsky's (2001) findings of an estimated market beta of 0.78 for the Canadian oil and gas industry, suggesting it has been less risky than the market. The size factor (SMB) indicates little statistically significant evidence. The value factor (HML) is generally positive and is significant in eight of the fourteen firm-specific regressions. There is empirical evidence that oil (WTI) does positively impact the equity returns of the oil and gas sector in Canada. Specifically, the coefficient for the industry-wide regression is 0.29 and the OIL coefficient is positive and significant for seven of the fourteen firms, ranging from 0.1267 to 0.3437. These results support the findings of Sadorsky (2001) and Boyer and Filion (2007), who find positive associations between Canadian energy firms and oil prices. The last and second-last columns of Table 2 present the adjusted R^2 values of the full model (Equation (1)) and a constrained model (with only the OIL factor). It is clear that oil price changes make a significant contribution to explaining the monthly returns at an industry and firm levels.

	С	MRK	SMB	HML	OIL	R ²	R ² (OIL)
iShares S&P/TSX Energy ETF	-0.0063 **	0.6046 ***	-0.0716	0.0898	0.2947 ***	0.6863	0.4969
. 85	(0.0025)	(0.0595)	(0.0990)	(0.0719)	(0.0352)		
Imperial Oil	0.0004	0.3591 ***	-0.4539 ***	0.1371	0.2023 ***	0.2668	0.1628
1	(0.0037)	(0.0919)	(0.1305)	(0.1069)	(0.0428)		
Enbridge Inc.	-0.0026	0.1716 **	-0.1458	0.2962 ***	0.0116	0.0329	0.0040
0	(0.0053)	(0.0753)	(0.1416)	(0.0970)	(0.0605)		
TC Energy Corp.	0.0016	0.2462 ***	-0.1561	0.3585 ***	-0.0230	0.1518	0.0079
	(0.0029)	(0.0553)	(0.1308)	(0.0976)	(0.0446)		
Encana Corp.	-0.0127 *	0.5099 ***	-0.5052 **	0.5998 ***	0.3437 ***	0.2386	0.1498
-	(0.0065)	(0.1256)	(0.2175)	(0.1535)	(0.0749)		
Husky Energy Inc.	-0.0069	0.6491 ***	-0.1808	0.4105 ***	0.0600	0.2014	0.0707
	(0.0054)	(0.1102)	(0.1700)	(0.1296)	(0.0909)		
Fortis Inc.	0.0056 *	0.1151	-0.0110	0.0551	-0.0358	0.0151	0.0000
	(0.0031)	(0.0704)	(0.0995)	(0.0715)	(0.0406)		
Canadian Natural Resources	-0.0103	0.7643 ***	-0.0148	0.4173 ***	0.2784 ***	0.2677	0.1698
	(0.0072)	(0.1144)	(0.2488)	(0.1434)	(0.0802)		
Suncor Energy Inc.	-0.0086	0.6744 ***	-0.4975	0.0803	0.2381 *	0.2048	0.1134
	(0.0061)	(0.1724)	(0.3690)	(0.2587)	(0.1347)		
Emera Inc.	0.0027	0.1176 *	-0.0741	0.0537	-0.0542	0.0238	0.0030
	(0.0028)	(0.0618)	(0.0964)	(0.0703)	(0.0366)		
Inter Pipeline Ltd.	0.0024	0.3422 ***	0.0805	0.1687 **	0.0210	0.1710	0.0639
	(0.0033)	(0.0566)	(0.1354)	(0.0842)	(0.0454)		
ARC Resources Ltd.	-0.0067 *	0.5873 ***	-0.3158 *	0.3645 ***	0.1267 **	0.3143	0.1411
	(0.0041)	(0.0909)	(0.1689)	(0.0839)	(0.0495)		
Pembina Pipeline Corp.	0.0038	0.2167 ***	-0.1070	0.2018 ***	0.0612	0.1216	0.0575
	(0.0032)	(0.0675)	(0.1074)	(0.0722)	(0.0453)		
Crescent Point Energy Corp.	-0.0027	0.5376 ***	0.1080	0.3736 **	0.2806 ***	0.3004	0.2189
	(0.0058)	(0.1251)	(0.2561)	(0.1835)	(0.0947)		
Cenovus Energy Inc.	-0.0106	0.4913 ***	-0.4078	0.0178	0.2856 ***	0.2627	0.2030
	(0.0065)	(0.1773)	(0.2703)	(0.1777)	(0.1000)		

Table 2. Regression results-with WTI.

Note: The table presents the Fama–French factor estimates and an oil price factor as per model (1) with robust standard errors (in parentheses). *** p < 0.01, ** p < 0.05, * p < 0.1. R² present the goodness of fit for the full model. R²(OIL) denotes the fit of a model with the oil price factor only.

Table 3 provides the results of Equation (1) with WCS as the measure for the price of oil. In regard to the Fama–French factors, there is not much difference in the reported values from Table 2, only that the market beta (MRK) is slightly higher in Table 3. The OIL coefficient is still positive and significant for the overall industry and for four of the fourteen firm regressions. The OIL coefficient of note is much smaller when using WCS than WTI (e.g., 0.0613 versus 0.2947 for the industry-wide regression). Evidence from the R^2 metrics also suggests that the models with WTI better explained the monthly returns of the Canadian oil and gas industry. Note that, in the constrained model (with only the OIL factor), the R^2 has dropped from 0.4969 with WTI to 0.1093 with WCS. Similar evidence is found in the R^2 metrics for individual firm regressions.

	С	MRK	SMB	HML	OIL	R ²	R ² (OIL)
iShares S&P/TSX Energy ETF	-0.0068 **	0.8163 ***	0.0148	0.1682 **	0.0613 ***	0.5892	0.1093
	(0.0029)	(0.0600)	(0.1245)	(0.0806)	(0.0226)		
Imperial Oil	0.0002	0.4970 ***	-0.3861 ***	0.1839 *	0.0445	0.2153	0.0300
	(0.0038)	(0.0892)	(0.1326)	(0.1028)	(0.0282)		
Enbridge Inc.	-0.0026	0.1824 **	-0.1361	0.3004 ***	-0.0029	0.0328	0.0003
0	(0.0055)	(0.0773)	(0.1346)	(0.0983)	(0.0297)		
TC Energy Corp.	0.0017	0.2370 ***	-0.1509	0.3564 ***	-0.0171	0.1532	0.0000
	(0.0029)	(0.0534)	(0.1258)	(0.0960)	(0.0185)		
Encana Corp.	-0.0136 **	0.7088 ***	-0.4601 **	0.6623 ***	0.1410 ***	0.2141	0.0651
_	(0.0069)	(0.1182)	(0.2138)	(0.1601)	(0.0464)		
Husky Energy Inc.	-0.0063	0.7290 ***	-0.0833	0.4433 ***	-0.0591	0.2076	0.0002
	(0.0053)	(0.0794)	(0.1665)	(0.1232)	(0.0372)		
Fortis Inc.	0.0056 *	0.0943	-0.0158	0.0486	-0.0146	0.0134	0.0004
	(0.0031)	(0.0660)	(0.1004)	(0.0712)	(0.0243)		
Canadian Natural Resources	-0.0109	0.9341 ***	0.0389	0.4721 ***	0.0981 *	0.2489	0.0596
	(0.0073)	(0.1197)	(0.2647)	(0.1415)	(0.0517)		
Suncor Energy Inc.	-0.0088	0.8375 ***	-0.4160	0.1359	0.0507	0.1819	0.0216
	(0.0062)	(0.1381)	(0.3517)	(0.2496)	(0.0490)		
Emera Inc.	0.0030	0.0964 *	-0.0612	0.0488	-0.0409 **	0.0339	0.0169
	(0.0028)	(0.0557)	(0.0957)	(0.0715)	(0.0190)		
Inter Pipeline Ltd.	0.0024	0.3537 ***	0.0821	0.1723 **	0.0097	0.1707	0.0205
	(0.0033)	(0.0504)	(0.1303)	(0.0826)	(0.0239)		
ARC Resources Ltd.	-0.0067	0.6806 ***	-0.2594	0.3972 ***	0.0148	0.2962	0.0211
	(0.0041)	(0.0850)	(0.1721)	(0.0844)	(0.0307)		
Pembina Pipeline Corp.	0.0039	0.2670 ***	-0.0693	0.2201 ***	-0.0025	0.1116	0.0043
	(0.0032)	(0.0579)	(0.1094)	(0.0722)	(0.0226)		
Crescent Point Energy Corp.	-0.0032	0.7294 ***	0.1564	0.4408 **	0.0837 *	0.2687	0.0687
	(0.0061)	(0.1028)	(0.2470)	(0.1873)	(0.0457)		
Cenovus Energy Inc.	-0.0114 *	0.7594 ***	-0.2768	0.1314	0.0175	0.2072	0.0264
	(0.0066)	(0.1353)	(0.2848)	(0.1977)	(0.0484)		

Table 3. Regression results—with WCS.

Note: The table presents the Fama–French factor estimates and an oil price factor as per model (1) with robust standard errors (in parentheses). *** p < 0.01, ** p < 0.05, * p < 0.1. R² present the goodness of fit for the full model. R²(OIL) denotes the fit of a model with the oil price factor only.

Table 4 provides the results for Equation (1) with the spread between WTI and WCS as the oil measure. Again, the Fama–French factors are not altered significantly. In the industry regression, the OIL coefficient is similar to Table 3 results, with a coefficient of 0.0705 and now only significant at the 10% level. The model fit statistics have diminished even further, with the R^2 (OIL) measure at 0.0416 for the industry making a negligible contribution to explaining the return of Canadian oil and gas firms in most cases compared to the traditional asset pricing model.

	С	MRK	SMB	HML	OIL	R ²	R ² (OIL)
iShares S&P/TSX Energy ETF	-0.0247 ***	0.8371 ***	0.0522	0.1818 **	0.0705 *	0.5822	0.0416
	(0.0093)	(0.0598)	(0.1229)	(0.0844)	(0.0368)		
Imperial Oil	-0.0103	0.5159 ***	-0.3547 ***	0.1813 *	0.0415	0.2095	0.0088
*	(0.0108)	(0.0884)	(0.1312)	(0.1050)	(0.0412)		
Enbridge Inc.	0.0131	0.1882 **	-0.1158	0.3202 ***	-0.0601	0.0383	0.0026
0	(0.0191)	(0.0726)	(0.1401)	(0.0953)	(0.0762)		
TC Energy Corp.	0.0000	0.2271 ***	-0.1715	0.3499 ***	0.0058	0.1504	0.0035
	(0.0077)	(0.0552)	(0.1273)	(0.0962)	(0.0283)		
Encana Corp.	-0.0227	0.7800 ***	-0.3246	0.6856 ***	0.0396	0.1828	0.0074
_	(0.0225)	(0.1205)	(0.2108)	(0.1687)	(0.0919)		
Husky Energy Inc.	-0.0215 *	0.6902 ***	-0.1685	0.4086 ***	0.0563	0.2027	0.0128
	(0.0117)	(0.0810)	(0.1640)	(0.1292)	(0.0494)		
Fortis Inc.	0.0071	0.0872	-0.0291	0.0468	-0.0059	0.0115	0.0000
	(0.0089)	(0.0662)	(0.0918)	(0.0704)	(0.0334)		
Canadian Natural Resources	-0.0052	0.9894 ***	0.1513	0.5041 ***	-0.0185	0.2354	0.0021
	(0.0192)	(0.1252)	(0.2493)	(0.1434)	(0.0757)		
Suncor Energy Inc.	-0.0551 **	0.8429 ***	-0.4314	0.0878	0.1790 **	0.2033	0.0335
	(0.0249)	(0.1372)	(0.3418)	(0.2570)	(0.0824)		
Emera Inc.	0.0056	0.0757	-0.1007	0.0419	-0.0111	0.0138	0.0006
	(0.0080)	(0.0547)	(0.0927)	(0.0717)	(0.0284)		
Inter Pipeline Ltd.	0.0120	0.3635 ***	0.1067	0.1873 **	-0.0365	0.1750	0.0002
	(0.0091)	(0.0506)	(0.1325)	(0.0861)	(0.0340)		
ARC Resources Ltd.	-0.0127	0.6858 ***	-0.2527	0.3931 ***	0.0234	0.2964	0.0078
	(0.0113)	(0.0804)	(0.1732)	(0.0871)	(0.0422)		
Pembina Pipeline Corp.	-0.0025	0.2626 ***	-0.0816	0.2110 ***	0.0245	0.1143	0.0085
	(0.0100)	(0.0586)	(0.1056)	(0.0745)	(0.0357)		
Crescent Point Energy Corp.	-0.0114	0.7661 ***	0.2371	0.4621 **	0.0354	0.2549	0.0113
	(0.0168)	(0.1030)	(0.2296)	(0.1877)	(0.0607)		
Cenovus Energy Inc.	-0.0178	0.7699 ***	-0.2650	0.1247	0.0263	0.2075	0.0059
	(0.0181)	(0.1402)	(0.2640)	(0.1886)	(0.0796)		

Table 4. Regression results-with WTI-WCS.

Note: The table presents the Fama–French factor estimates and an oil price factor as per model (1) with robust standard errors (in parentheses). *** p < 0.01, ** p < 0.05, * p < 0.1. R² present the goodness of fit for the full model. R²(OIL) denotes the fit of a model with the oil price factor only.

Table 5 presents the results of Equation (2), which tests for potential asymmetric impacts that oil may have on Canadian oil and gas equity returns. The chosen thresholds (with WTI) do not appear to yield any strong evidence for regime-specific differences and asymmetries in the industry-wide regressions. From examining the firm-specific regression, the empirical evidence suggests that some firms may be more sensitive to changes in oil prices when prices are higher. For example, the regressions with Imperial Oil provide positive and statistically significant coefficients for β_{\bullet} across all four thresholds. Additionally, β_{\bullet} is significant in at least one threshold regression for Enbridge, Cenovus Energy, and Crescent Point Energy. These results suggest that individual firms address fluctuations in oil prices in varying risk management (hedging) strategies. Due to the weak to moderate evidence of asymmetric impacts with the initial thresholds described, we extend the threshold levels to the 75 percentile and 90 percentile. With these higher thresholds, stronger evidence of an asymmetric impact is evident, but results are still moderate. This supports the findings of Narayan and Narayan (2014), who suggest there may be a psychological barrier in equity markets when oil prices reach a certain level, around USD 100 per barrel, and that higher crude oil price may generate inflationary pressures (leading to changing of, as well as negative impacts on, equity returns. Finally, this study also substitutes WCS for WTI in the asymmetric regressions and similar empirical findings are found.¹³

Threshold		Mean			Median		1-Year	Moving Aver	age	5-Year Moving Average		
	OIL	β∢	R ²	OIL	β∢	R ²	OIL	β♦	R ²	OIL	β∢	R ²
iShares S&P/TSX Energy ETF	0.2936 ***	0.0025	0.6863	0.3079 ***	-0.0276	0.6866	0.2691 ***	0.0485	0.6873	0.2611 ***	0.0570	0.6877
	(0.0447)	(0.0607)		(0.0461)	(0.0605)		(0.0495)	(0.0595)		(0.0570)	(0.0614)	
Imperial Oil	0.1395 ***	0.1644 *	0.2805	0.1369 **	0.1589 *	0.2796	0.1518 **	0.0932	0.2709	0.0655	0.2148 **	0.2887
-	(0.0525)	(0.0897)		(0.0541)	(0.0880)		(0.0633)	(0.0978)		(0.0699)	(0.0867)	
Enbridge Inc.	-0.0708	0.2155 *	0.0472	-0.0945	0.2576 **	0.0534	-0.0729	0.1559	0.0399	-0.0201	0.0496	0.0336
-	(0.0680)	(0.1206)		(0.0692)	(0.1172)		(0.0705)	(0.1327)		(0.0734)	(0.1098)	
TC Energy Corp.	-0.0399	0.0442	0.1537	-0.0644	0.1005	0.1617	-0.0621	0.0722	0.1566	-0.0456	0.0355	0.1530
	(0.0643)	(0.0829)		(0.0646)	(0.0825)		(0.0521)	(0.0780)		(0.0593)	(0.0769)	
Encana Corp.	0.3760 ***	-0.0847	0.2397	0.3881 ***	-0.1079	0.2405	0.3161 ***	0.0508	0.2390	0.5053 ***	-0.2537 *	0.2484
	(0.1026)	(0.1333)		(0.1069)	(0.1349)		(0.1063)	(0.1283)		(0.1349)	(0.1525)	
Husky Energy Inc.	-0.0081	0.1783	0.2095	-0.0387	0.2399	0.2160	0.0632	-0.0058	0.2014	0.0306	0.0462	0.2019
	(0.0843)	(0.1612)		(0.0851)	(0.1568)		(0.0880)	(0.1234)		(0.0954)	(0.1220)	
Fortis Inc.	-0.0240	-0.0308	0.0160	-0.0221	-0.0332	0.0162	-0.0234	-0.0227	0.0156	-0.0577	0.0344	0.0162
	(0.0478)	(0.0744)		(0.0490)	(0.0739)		(0.0651)	(0.0761)		(0.0763)	(0.0857)	
Canadian Natural Resources	0.1939 *	0.2210	0.2745	0.1799	0.2393	0.2757	0.2697 **	0.0161	0.2677	0.2446 *	0.0531	0.2680
	(0.1060)	(0.1690)		(0.1091)	(0.1634)		(0.1096)	(0.1452)		(0.1430)	(0.1727)	
Suncor Energy Inc.	0.1619	0.1995	0.2111	0.1512	0.2109	0.2118	0.3191 ***	-0.1496	0.2081	0.2060	0.0504	0.2051
	(0.1592)	(0.1480)		(0.1620)	(0.1471)		(0.1209)	(0.1660)		(0.1288)	(0.1664)	
Emera Inc.	-0.0776	0.0612	0.0284	-0.0845 *	0.0737	0.0305	-0.1160 **	0.1140 *	0.0388	-0.1853 ***	0.2057 ***	0.0728
	(0.0470)	(0.0640)		(0.0488)	(0.0641)		(0.0497)	(0.0633)		(0.0489)	(0.0597)	
Inter Pipeline Ltd.	0.0476	-0.0696	0.1746	0.0306	-0.0233	0.1714	0.0763	-0.1019	0.1782	0.0463	-0.0397	0.1721
	(0.0570)	(0.0818)		(0.0567)	(0.0822)		(0.0692)	(0.0812)		(0.0759)	(0.0842)	
ARC Resources Ltd.	0.1444 ***	-0.0462	0.3151	0.1844 ***	-0.1401 *	0.3221	0.1203 *	0.0119	0.3143	0.0600	0.1046	0.3184
	(0.0527)	(0.0836)		(0.0489)	(0.0806)		(0.0728)	(0.0844)		(0.0770)	(0.0828)	
Pembina Pipeline Corp.	0.0576	0.0094	0.1216	0.0514	0.0239	0.1221	0.0644	-0.0059	0.1216	0.1169	-0.0874	0.1280
	(0.0459)	(0.0798)		(0.0456)	(0.0781)		(0.0706)	(0.0754)		(0.0781)	(0.0825)	
Crescent Point Energy Corp.	0.3687 ***	-0.1960	0.3080	0.4181 ***	-0.2832 **	0.3157	0.2591 *	0.0400	0.3007	0.3774 ***	-0.1633	0.3059
_	(0.1183)	(0.1357)		(0.1191)	(0.1340)		(0.1341)	(0.1388)		(0.1202)	(0.1467)	
Cenovus Energy Inc.	0.3482 **	-0.1154	0.2662	0.3750 **	-0.1568	0.2689	0.0962	0.4447 ***	0.3084	0.3395 ***	-0.1721	0.2696
	(0.1608)	(0.1660)		(0.1683)	(0.1715)		(0.1036)	(0.1415)		(0.1237)	(0.1440)	

Table 5. Regression results—asymmetric model with WTI.

Note: The table presents the Fama–French factor estimates and an oil price factor as per Equation (2) with robust standard errors (in parentheses). *** p < 0.01, ** p < 0.05, * p < 0.1. R² present the goodness of fit for the full model. R²(OIL) denotes the fit of a model with the oil price factor only. Fama–French factors are not shown but are available from the authors upon request.

Tables 6 and 7 provide results for the two different time-frames: 2000–2008 and 2009–2018, respectively. The Fama–French factors tend to be relatively stable across the two subsamples. For example, the market beta (MRK) in the 2000–2008 period is 0.6046 compared to 0.6304 in the 2009–2018 period. The coefficient measuring the impact of changes in WTI (OIL) on equity returns is still positive and significant in both subsamples. The 2000–2009 subsample has a moderately higher OIL coefficient of 0.3417 compared to the 2009–2018 subsample OIL coefficient of 0.2437. Additional evidence of a moderately higher impact of oil in the 2000–2008 period is found in the constrained model (with OIL only) with the $R^2(OIL)$ measure in the 2000–2008 period being 0.5334 versus 0.4606 in the 2009–2018 period. The individual firm regression suggests that Imperial Oil, Enicana, and Canadian Natural Resources equity returns are impacted positively by oil price changes and relatively so in the same magnitude in both subsamples. The results in the 2009-2018 sample suggest that individual firms' equity returns are impacted by the price of oil. Specifically, seven of the fourteen firms indicate a positive influence of oil prices on their equity returns in the 2009–2018 period versus only four in the 2000–2008 period. Overall, the results suggest that oil price exposures of firms in the Canadian oil and gas sector vary across firms and over time. The varying effects of oil shocks on equity returns may be attributed to several factors, such as differences in a firm's revenue structure, cost management, diversification activities, hedging strategies, etc.

Table 6. Regression results for the 2000-2008 period.

	С	MRK	SMB	HML	OIL	R ²	R ² (OIL)
iShares S&P/TSX Energy ETF	-0.0053	0.6046 ***	-0.0041	0.2165	0.3417 ***	0.7101	0.5334
	(0.0049)	(0.0945)	(0.1858)	(0.1576)	(0.0509)		
Imperial Oil	0.0001	0.5356 ***	-0.6194 ***	0.4701 ***	0.2406 ***	0.3579	0.1691
-	(0.0066)	(0.1533)	(0.1949)	(0.1545)	(0.0583)		
Enbridge Inc.	-0.0039	0.1640	-0.0667	0.3599 **	-0.0528	0.0335	0.0020
	(0.0077)	(0.1260)	(0.2086)	(0.1525)	(0.0675)		
TC Energy Corp.	-0.0006	0.2918 ***	-0.1869	0.5071 ***	0.0104	0.1879	0.0061
	(0.0046)	(0.0805)	(0.2005)	(0.1382)	(0.0670)		
Encana Corp.	-0.0072	0.5111 ***	-0.2950	0.6840 ***	0.2732 ***	0.1985	0.1071
	(0.0092)	(0.1612)	(0.2561)	(0.1931)	(0.0924)		
Husky Energy Inc.	-0.0080	0.7906 ***	-0.1303	0.7678 ***	0.0414	0.1896	0.0371
	(0.0095)	(0.1656)	(0.2321)	(0.1806)	(0.1354)		
Fortis Inc.	0.0076	0.0871	-0.0510	0.0587	-0.0022	0.0086	0.0008
	(0.0054)	(0.1205)	(0.1445)	(0.1073)	(0.0550)		
Canadian Natural Resources	0.0140	0.7643 ***	0.0997	0.7407 ***	0.3170 ***	0.2345	0.1397
	(0.0110)	(0.1935)	(0.4032)	(0.1954)	(0.1119)		
Suncor Energy Inc.	-0.0252 **	0.8639 ***	-0.9995 *	0.4777	0.3039	0.1922	0.0813
	(0.0105)	(0.2701)	(0.5983)	(0.4323)	(0.2159)		
Emera Inc.	0.0002	0.1264	-0.0831	0.1038	-0.0313	0.0264	0.0007
	(0.0041)	(0.0868)	(0.1271)	(0.0959)	(0.0494)		
Inter Pipeline Ltd.	-0.0031	0.3917 ***	0.1744	0.2905 **	-0.0064	0.2016	0.0414
	(0.0050)	(0.0779)	(0.1902)	(0.1360)	(0.0563)		
ARC Resources Ltd.	-0.0033	0.5453 ***	-0.0220	0.3672 ***	0.1519 **	0.3169	0.1659
	(0.0063)	(0.1252)	(0.2012)	(0.1265)	(0.0583)		
Pembina Pipeline Corp.	0.0013	0.3280 ***	0.0268	0.2508 **	-0.0344	0.1490	0.0112
	(0.0047)	(0.1049)	(0.1451)	(0.1216)	(0.0486)		
Crescent Point Energy Corp.	0.0231 *	0.5795 ***	0.6456	0.0221	0.1866	0.2932	0.1653
	(0.0124)	(0.2106)	(0.5264)	(0.4852)	(0.1506)		

Note: The table presents the Fama–French factor estimates and an oil price factor as per model (1) with robust standard errors (in parentheses). *** p < 0.01, ** p < 0.05, * p < 0.1. R² present the goodness of fit for the full model. R²(OIL) denotes the fit of a model with the oil price factor only.

	С	MRK	SMB	HML	OIL	R ²	R ² (OIL)
iShares S&P/TSX Energy ETF	-0.0078 **	0.6304 ***	-0.1535	0.0473	0.2437 ***	0.6795	0.4606
0,	(0.0031)	(0.0774)	(0.1163)	(0.0848)	(0.0483)		
Imperial Oil	-0.0033	0.3081 **	-0.2714 **	-0.1698	0.1755 ***	0.2533	0.1580
	(0.0041)	(0.1203)	(0.1362)	(0.1243)	(0.0575)		
Enbridge Inc.	-0.0017	0.1803 **	-0.2259	0.1467	0.1073	0.0539	0.0343
0	(0.0076)	(0.0884)	(0.2056)	(0.1665)	(0.1104)		
TC Energy Corp.	0.0019	0.2660 ***	-0.1344	0.2283 **	-0.0587	0.1458	0.0107
	(0.0035)	(0.0874)	(0.1167)	(0.0908)	(0.0506)		
Encana Corp.	-0.0176 *	0.5176 ***	-0.7158 *	0.4042 *	0.4424 ***	0.2788	0.2031
-	(0.0091)	(0.1939)	(0.4121)	(0.2275)	(0.1246)		
Husky Energy Inc.	-0.0089 *	0.6170 ***	-0.2513	0.0167	0.1129	0.3186	0.1576
	(0.0053)	(0.1184)	(0.2030)	(0.1570)	(0.0819)		
Fortis Inc.	0.0031	0.1737 **	0.0537	0.0403	-0.0864	0.0382	0.0012
	(0.0037)	(0.0849)	(0.1387)	(0.1194)	(0.0621)		
Canadian Natural Resources	-0.0102	0.9163 ***	-0.1507	0.0280	0.2417 **	0.3658	0.2179
	(0.0089)	(0.1345)	(0.2406)	(0.1533)	(0.1000)		
Suncor Energy Inc.	0.0005	0.6409 ***	0.0258	-0.2401	0.1934 **	0.4320	0.2489
	(0.0050)	(0.1369)	(0.1775)	(0.1480)	(0.0815)		
Emera Inc.	0.0044	0.1338	-0.0793	0.0274	-0.0819	0.0310	0.0073
	(0.0037)	(0.1006)	(0.1456)	(0.1058)	(0.0559)		
Inter Pipeline Ltd.	0.0070	0.3055 ***	-0.0663	0.0577	0.0728	0.1686	0.0978
	(0.0043)	(0.0861)	(0.2026)	(0.1052)	(0.0752)		
ARC Resources Ltd.	-0.0088 *	0.6370 ***	-0.6686 ***	0.3805 ***	0.0823	0.3514	0.1196
	(0.0053)	(0.1275)	(0.2262)	(0.1410)	(0.0833)		
Pembina Pipeline Corp.	0.0071 *	0.0407	-0.3019 **	0.1702 *	0.2071 ***	0.1845	0.1406
	(0.0042)	(0.0963)	(0.1396)	(0.1012)	(0.0775)		
Crescent Point Energy Corp.	-0.0167 ***	0.4047 ***	-0.1310	0.3851 **	0.3532 ***	0.3597	0.2899
	(0.0063)	(0.1334)	(0.2624)	(0.1842)	(0.1042)		
Cenovus Energy Inc.	-0.0106	0.4913 ***	-0.4078	0.0178	0.2856 ***	0.2627	0.2030
	(0.0065)	(0.1773)	(0.2703)	(0.1777)	(0.1000)		

Table 7. Regression results for the 2009–2018 period.

Note: The table presents the Fama–French factor estimates and an oil price factor as per model (1) with robust standard errors (in parentheses). *** p < 0.01, ** p < 0.05, * p < 0.1. R² present the goodness of fit for the full model. R²(OIL) denotes the fit of a model with the oil price factor only.

3.2. Additional Estimations for Time-Varying Oil Sensitivities

To enable a better understanding of the time-varying and dynamic relevance of the oil factors on the oil firms' equity returns, time-varying oil price sensitivities are presented graphically for a restricted model. Figures 2 and 3 present the time-varying betas based on a monthly return frequency for Δ WTI and Δ WCS, respectively, based on a 3-year forward rolling window. All charts in Figure 3 coincide with a downward movement for changes in WTI in 2009, as the global financial crisis recession ended in June 2009. Less clear are the time-varying WCS sensitivities.



Figure 2. Time varying oil price beta (36-month average (Δ WTI)).



Figure 3. Time varying oil price beta (36-month average (Δ WCS)).

4. Conclusions and Implications

This study addresses how oil prices impact the equity returns of the Canadian oil and gas industry. Although this research question has been explored in previous work by Sadorsky (2001) and Boyer and Filion (2007), this paper extends the previous work in several important ways. First, this study uses both the traditional North American oil benchmark, WTI, but also the specific Western Canadian Select (WCS) oil measure that has become important in the Canadian oil market since the development of the oil sands in the early 2000s. Secondly, this study implements a methodological approach that evaluates the impact of oil prices on equity returns at both the industry and firm-specific levels. Although Boyer and Filion (2007) separate their sample into producers and integrated oil and gas firms in a panel data format, this paper separates the pooling or portfolio approach and applies firm-specific regressions. Finally, updating the previous literature with data from the post-global financial crisis period and commodity supercycle period provides further evidence in regard to the potential of time-sensitive impacts.

The empirical evidence in this paper confirms the previous findings of Sadorsky (2001) and Boyer and Filion (2007), who find that oil prices positively influence the equity returns of the Canadian oil and gas industry. When evaluating the impact of oil prices with the WCS measure, positive statistically significant results are still found, but at a moderately lower level when compared to the WTI results. Since WCS has historically traded with a discount to WTI, further empirical regressions are conducted to determine if this spread impacts equity returns of the oil and gas industry in Canada. The results suggest a minimal impact at an industry level and little to no evidence at the firm level. Little evidence of the asymmetric impact of oil on equity returns in the Canadian oil and gas sector is found. Finally, in the subsample analysis (pre-/post-2009) evidence from firm-specific regressions suggest that some Canadian oil and gas firms have become more sensitive to oil price changes. The varying effects of oil shocks on individual equity returns may be attributed to factors such as differences among firms' revenue structures or hedging strategies (Boyer and Filion 2007) and draw attention to the importance of methodological approaches that provide analysis at the firm level, as aggregate or industry-level analysis may not reveal an individual firm's risk exposure to changes in oil prices.

This research will provide researchers, investors, policymakers, and regulators with additional insight into how energy prices influence equity returns of Canadian oil and gas firms. First, the findings of this study suggest that an increase in oil prices has a statistically significant positive effect on the equity returns of Canadian energy firms, but the sensitivity of each firm varies with oil price fluctuations and can change over time. Secondly, this study indicates that WCS is a relevant alternative measure of oil when assessing the impacts energy prices have on equity returns in Canada. Further research should address how WCS impacts other sectors of the financial markets in Canada (e.g., currency, uncertainty, etc.) and firm-specific decisions (e.g., capital structure, payout policy, etc.). Finally, the empirical findings will guide investors about the effect of oil price changes (both WTI and WCS) on Canadian oil and gas stock returns within the industry, as well as for the managers of these firms who require deeper insight into the effectiveness of hedging policies, which are affected by oil price changes. The results highlighting the flow of firm-specific risks through one of the most critical equity sectors of the Toronto Stock Exchange will ameliorate some aspects of investor uncertainty and provide policymakers with a holistic view of the impact of oil price fluctuations.

Author Contributions: All authors equally contributed to this paper. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The iShares S&P/TSX Capped Energy Index ETF and the fourteen energy firm-level monthly price data are downloaded from the Datastream International accessed on 9 January 2020. The monthly price data for WTI is downloaded from the Federal Reserve Economic Database, https://fred.stlouisfed.org, accessed on 9 January 2020. The WCS monthly price data are downloaded from the Alberta Government website, https://economicdashboard.alberta.ca/OilPrice, accessed on 9 January 2020. Finally, the Fama–French factors for Canada are downloaded from the AQR website, https://www.aqr.com/Insights/Datasets/Betting-Against-Beta-Equity-Factors-Monthly, accessed on 13 January 2020.

Acknowledgments: The authors would like to gratefully acknowledge many useful comments from the Editor and two anonymous reviewers.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

	Index	GVKEY
1	iShares S&P/TSX Capped Energy ETF	142830
	Firm	
2	Imperial Oil Ltd.	005903
3	Enbridge Inc.	006135
4	TC Energy Corp.	010671
5	Encana Corp.	011781
6	Husky Energy	013994
7	Fortis Inc.	014390
8	Canadian Natural Resources	015055
9	Suncor Energy	015070
10	Emera Inc.	025792
11	Inter Pipeline Inc.	066319
12	ARC Resources	105239
13	Pembina Pipeline Corp.	130618
14	Crescent Point Energy Corp.	145812
15	Cenovus Energy	183791

Table A1. List of Canadian Energy Index and Firms.

Note: This study uses the iShares S&P/TSX Capped Energy Index ETF to capture the industry level equity returns of the oil and gas sector in Canada. For the firm level data, this study uses the fourteen oil and gas firms that are included in the primary equity index in Canada (TSX60).

Notes

- ¹ For example, Alfadli and Rjoub (2020) and Esmaeil et al. (2020) find that oil prices are one of the most significant macroeconomic factors of profitability for banks in the Gulf Cooperation Council (GCC). Its positive and significant elasticity is explained via the PCSE interpretation. Hesami et al. (2020) identify a relationship between tourism and oil prices in MENA countries.
- ² Additional sectors in Canada have also been examined (e.g., banking (Killins and Mollick 2020) and the transportation sector (Killins 2020)).
- ³ See https://www.nrcan.gc.ca/energy/publications/18756 (accessed on 19 June 2020) for a discussion on the economic benefits of the oil sands in Canada.
- ⁴ The Trans Mountain Pipeline is a pipeline that carries crude and refined oil from Alberta to the coast of British Columbia, Canada. In 2013, the Canadian National Energy Board has approved a proposal by Kinder Morgan to expand the pipeline. The proposal has attracted controversy due to its potential environmental impact, faced legal challenges, as well as protests from environmentalists and First Nations groups. The disputes have intensified in early 2018 when the provinces of Alberta and B.C. engaged in a trade war over the expansion project. In May 2018, the federal government has announced its intent to buy the pipeline from Kinder Morgan for \$4.5 billion, and seek outside investors to complete the expansion.

- ⁵ See https://www.bnnbloomberg.ca/ottawa-gives-green-light-to-trans-mountain-pipeline-expansion-1.1275007 (accessed on 12 July 2020) & https://www.bnnbloomberg.ca/senate-passes-bill-c-69-c-48-in-blow-to-canada-senergy-industry-1.1276452 (accessed on 12 July 2020).
- ⁶ See https://www.nrcan.gc.ca/science-and-data/data-and-analysis/energy-data-and-analysis/energy-facts/20061 (accessed on 19 June 2020) and https://us.spindices.com/indices/equity/sp-tsx-composite-index (accessed on 19 June 2020).
- ⁷ See https://www.blackrock.com/ca/individual/en/products/239839/ish-ares-sptsx-capped-energy-index-etf (accessed on 12 July 2020) for details of the iShares index. Please note the inception of this index was March 2001 and thus the data for the industry analysis is from March 2001 to August 2018.
- ⁸ See https://ca.spindices.com/indices/equity/sp-tsx-60-index (accessed on 13 January 2020) for details and breakdown of the TSX60 index. These fourteen firms are the largest and most actively traded energy firms in Canada.
- ⁹ WCS is the reference price for heavy crude oil from the oil sands delivered at Hardisty, Alberta, Canada. It is Canada's largest commercial heavy oil stream, comprised of bitumen, conventional oil, synthetic crude, and diluent. For further details about WCS please see https://www.oilsandsmagazine.com/technical/western-canadian-select-wcs (accessed on 13 January 2020). Data for the WCS series before 2004 is supplement with the oil price at Hardisty and is obtained via the Petroleum Services Association of Canada https://www.psac.ca/ (accessed on 13 January 2020).
- See https://www.aqr.com/Insights/Datasets/Betting-Against-Beta-Equity-Factors-Monthly (accessed on 13 January 2020). This paper uses the AQR dataset due to the fact that Kenneth French's website does not have a specific factor for Canada (only North America).
- ¹¹ Please note the unit root results are not included but available from the authors upon request.
- ¹² Further, several articles have focused on oil prices empirically suggest a breakpoint in and around 2010 (e.g., Chen et al. 2015 and Scheitrum et al. 2018).
- ¹³ Results with alternative thresholds and with the WCS oil price are not reported but are available from the authors upon request.

References

- Alfadli, Abduallah, and Husam Rjoub. 2020. The impacts of bank-specific, industry-specific and macroeconomic variables on commercial bank financial performance: Evidence from the Gulf cooperation council countries. *Applied Economics Letters* 27: 1284–88. [CrossRef]
- Apergis, Nicholas, and Stephen M. Miller. 2009. Do structural oil-market shocks affect stock prices? *Energy Economics* 31: 569–75. [CrossRef]
- Arouri, Mohamed El Hedi. 2011. Does crude oil move stock markets in Europe? A sector investigation. *Economic Modelling* 28: 1716–25. [CrossRef]
- Bagirov, Miramir, and Cesario Mateus. 2019. Oil prices, stock markets and firm performance: Evidence from Europe. International Review of Economics and Finance 61: 270–88. [CrossRef]
- Bashar, Omar H. M. N., I. K. M. Mokhtarul Wadud, and Huson Joher Ali Ahmed. 2013. Oil price uncertainty, monetary policy and the macroeconomy: The Canadian perspective. *Economic Modelling* 35: 249–59. [CrossRef]
- Basher, Syed A., and Perry Sadorsky. 2006. Oil price risk and emerging stock markets. Global Finance Journal 17: 224-51. [CrossRef]
- Baur, Dirk G., and Neda Todorova. 2018. Automobile manufacturers, electric vehicles and the price of oil. *Energy Economics* 74: 252–62. [CrossRef]
- Boyer, M. Martin, and Didier Filion. 2007. Common and fundamental factors in stock returns of Canadian oil and gas companies. *Energy Economics* 29: 428–53. [CrossRef]
- Broadstock, David C., and George Filis. 2014. Oil price shocks and stock market returns: New evidence from the United States and China. *Journal of International Financial Markets, Institutions and Money* 33: 417–33. [CrossRef]
- Broadstock, David C., Ying Fan, Qiang Ji, and Dayong Zhang. 2016. Shocks and stocks: A bottom-up assessment of the relationship between oil prices, gasoline prices and the returns of Chinese firms. *The Energy Journal* 37: 55–86. [CrossRef]
- Chen, Wei, Zhuo Huang, and Yanping Yi. 2015. Is there a structural change in the persistence of WTI–Brent oil price spreads in the post-2010 period? *Economic Modelling* 50: 64–71. [CrossRef]
- Dayanandan, Ajit, and Han Donker. 2011. Oil prices and accounting profits of oil and gas companies. *International Review of Financial Analysis* 20: 252–57. [CrossRef]
- Diaz, Elena Maria, Juan Carlos Molero, and Fernando Perez de Gracia. 2016. Oil price volatility and stock returns in the G7 economies. *Energy Economics* 54: 417–30. [CrossRef]
- Elyasiani, Elyas, Iqbal Mansur, and Babatunde Odusami. 2011. Oil price shocks and industry stock returns. *Energy Economics* 33: 966–74. [CrossRef]
- Esmaeil, Jabir, Husam Rjoub, and Wing-Keung Wong. 2020. Do oil price shocks and other factors create bigger impacts on Islamic Banks than conventional Banks? *Energies* 13: 3106. [CrossRef]

- Fama, Eugene F., and Kenneth R. French. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33: 3–56. [CrossRef]
- Fama, Eugene F., and Kenneth R. French. 1997. Industry costs of equity. Journal of Financial Economics 43: 153–93. [CrossRef]
- Filis, George, Stavros Degiannakis, and Christos Floros. 2011. Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries. *International Review of Financial Analysis* 20: 152–64. [CrossRef]
- Gupta, Kartick. 2016. Oil price shocks, competition, and oil and gas stock returns—Global evidence. *Energy Economics* 57: 140–53. [CrossRef] Hall, Stephen G., and Amangeldi Kenjegaliev. 2017. The effect of oil price changes on the price of Russian and Chinese oil shares.

Empirical Economics 53: 1639–56. [CrossRef]

- Hamilton, James D. 1983. Oil and the macroeconomy since World War II. Journal of Political Economy 91: 228-48. [CrossRef]
- Hamilton, James D. 2003. What is an oil shock? Journal of Econometrics 113: 363–98. [CrossRef]
- Hesami, Siamand, Bezhan Rustamov, Husam Rjoub, and Wing-Keung Wong. 2020. Implications of oil price fluctuations for tourism receipts: The case of oil exporting countries. *Energies* 13: 4349. [CrossRef]
- Jones, Charles M., and Gautam Kaul. 1996. Oil and the stock markets. The Journal of Finance 51: 463–91. [CrossRef]
- Kilian, Lutz, and Cheolbeom Park. 2009. The impact of oil price shocks on the US stock market. *International Economic Review* 50: 1267–87. [CrossRef]
- Killins, Robert N. 2020. The impact of oil on equity returns of Canadian and US railways and airlines. *The North American Journal of Economics and Finance* 52: 101178. [CrossRef]
- Killins, Robert N., and Andre V. Mollick. 2020. Performance of Canadian banks and oil price movements. *Research in International Business and Finance* 54: 101258. [CrossRef]
- Killins, Robert N., Peter V. Egly, and Diego Escobari. 2017. The impact of oil shocks on the housing market: Evidence from Canada and U.S. *Journal of Economics and Business* 93: 15–28. [CrossRef]
- Lee, Bi-Juan, Chin Wei Yang, and Bwo-Nung Huang. 2012. Oil price movements and stock markets revisited: A case of sector stock price indexes in the G-7 countries. *Energy Economics* 34: 1284–300. [CrossRef]
- Lee, Chi-Chuan, Chien-Chiang Lee, and Shao-Lin Ning. 2017. Dynamic relationship of oil price shocks and country risks. *Energy Economics* 66: 571–81. [CrossRef]
- Mohanty, Sunil K., and Mohan Nandha. 2011. Oil risk exposure: The case of the US oil and gas sector. *Financial Review* 46: 165–91. [CrossRef]
- Mollick, André Varella, and Tibebe Abebe Assefa. 2013. US stock returns and oil prices: The tale from daily data and the 2008–2009 financial crisis. *Energy Economics* 36: 1–18. [CrossRef]
- Nandha, Mohan, and Robert Faff. 2008. Does oil move equity prices? A global view. Energy Economics 30: 986–97. [CrossRef]
- Narayan, Paresh Kumar, and Seema Narayan. 2014. Psychological oil price barrier and firm returns. *Journal of Behavioral Finance* 15: 318–33. [CrossRef]
- Park, Jungwook, and Ronald A. Ratti. 2008. Oil price shocks and stock markets in the US and 13 European countries. *Energy Economics* 30: 2587–608. [CrossRef]
- Phan, Dinh Hoang Bach, Susan Sunila Sharma, and Paresh Kumar Narayan. 2015. Oil price and stock returns of consumers and producers of crude oil. *Journal of International Financial Markets, Institutions and Money* 34: 245–62. [CrossRef]
- Ramos, Sofia B., and Helena Veiga. 2011. Risk factors in oil and gas industry returns: International evidence. *Energy Economics* 33: 525–42. [CrossRef]
- Sadorsky, Perry. 2001. Risk factors in stock returns of Canadian oil and gas companies. Energy Economics 23: 17–28. [CrossRef]
- Salisu, Afees A., and Ismail O. Fasanya. 2013. Modelling oil price volatility with structural breaks. *Energy Policy* 52: 554–62. [CrossRef] Scheitrum, Daniel P., Colin A. Carter, and Cesar Revoredo-Giha. 2018. WTI and Brent futures pricing structure. *Energy Economics* 72: 462–69. [CrossRef]
- Waheed, Rida, Chen Wei, Suleman Sarwar, and Yulan Lv. 2018. Impact of oil prices on firm stock return: Industry-wise analysis. *Empirical Economics* 55: 765–80. [CrossRef]
- Yun, Xiao, and Seong-Min Yoon. 2019. Impact of oil price change on airline's stock price and volatility: Evidence from China and South Korea. Energy Economics 78: 668–79. [CrossRef]

Short Biography of Authors

Dr. Sourav Batabyal is an Assistant Professor of Economics in the E. Craig Wall Sr. College of Business Administration at Coastal Carolina University. Dr. Batabyal received his Ph.D. from the University of Wisconsin-Milwaukee. He has varied research interests in real estate, financial institutions, corporate finance, urban and regional economics, development/international economics, and applied econometrics. His research articles are published in *Economic Modelling, The Quarterly Review of Economics and Finance, Progress in Development Studies*, and *Atlantic Economic Journal*.

Dr. Robert Killins is an Associate Professor of Finance in the E. Craig Wall Sr. College of Business Administration at Coastal Carolina University. Dr. Killins received his Ph.D. from the University of Texas Rio Grande Valley. He is an expert on the Canadian economy. His research articles are published in the *Journal of Economics and Business, The North American Journal of Economics and Finance, Research in International Business and Finance, Journal of Behavioral and Experimental Finance, The Journal of Investing, Applied Economics Letters, etc.*