Does Hedging Affect Firm Value? Evidence from a Natural Experiment

Erik P. Gilje†
Jérôme P. Taillard‡

September 15, 2014

Abstract

We study how hedging affects firm value and real investment activity. We obtain exogenous variation in basis risk, a measure of hedging effectiveness, from the unexpected breakdown in the correlation of Canadian light oil prices with the WTI benchmark prices used in NYMEX hedging contracts. Using a difference-in-differences framework we compare Canadian light oil producers to their U.S. counterparts. We find that affected firms significantly reduce their capital expenditures. We further show that asset sales, reduced investment and lower firm valuation are driven by firms with higher leverage, as predicted by theory. Overall, our results provide evidence that hedging affects firm value by alleviating the costs of financial distress.

*We thank seminar and conference participants at Boston College, Lehigh University, University of Maryland, University of Massachusetts Amherst, Wharton, the 2014 EFA Conference, the 2014 OSU Alumni Conference and the 2014 SFS Cavalcade conference, as well as Sugato Bhattacharyya, Yeejin Jang, Pedro Matos, Phil Strahan, René Stulz, Mike Weisbach for their comments and Bruno Geremia (CFO of Birchcliff Energy) and Peter Scott (CFO of Lightstream Resources) for their insights on hedging practices among Canadian energy firms. We also thank Max Chou, Sam Gervase, Saeid Hoseinzade, and Xuechuan Ni for their research assistance. All remaining errors are our own.
†The Wharton School, University of Pennsylvania, 3620 Locust Walk Suite, 2400, Philadelphia, PA 19104. Email: gilje@wharton.upenn.edu
‡Carroll School of Management, Boston College, 140 Commonwealth Ave., Chestnut Hill, MA 02467. Email: taillard@bc.edu
1 Introduction

The use of derivatives for hedging purposes is widespread in the economy.¹ Existing theories provide a number of motivations for hedging, ranging from mitigating underinvestment (Bessembinder (1991); Froot et al. (1993)) to avoiding costs of financial distress (Smith and Stulz (1985); Stulz (1996)). Yet despite empirical studies linking hedging with increases in firm value (Carter et al. (2006); Pérez-González and Yun (2013)), there is limited empirical evidence on the precise channels through which hedging affects firm value.² The goal of this study is to empirically identify the economic importance of the different channels through which hedging affects firm value.

Identifying the impact of hedging on firms presents several empirical challenges. First, there is often insufficient disclosure on hedging positions to understand the exact nature of hedging policies implemented by firms. Second, hedging decisions are made concurrently with other financial and investment policies. This endogeneity makes it difficult to establish the causal effect hedging may have on a firm, as well as the channel through which such an effect occurs. To address the first challenge, we focus on the oil and gas industry where disclosure is very detailed and allows us to fully reconstruct the hedging policies of our sample firms.³ To overcome endogeneity concerns, we focus on a natural experiment setting in which Canadian light oil producers experience a relative loss in their ability to hedge relative to U.S. oil producers due to a shock to the basis risk in their oil hedges in 2012.

While finance theory provides clear motivations for hedging, the value of financial hedging depends on how effective it is at lowering the exposure to a given risk. In particular, basis risk has been shown to be an important consideration in hedging decisions made by firms (Haushalter (2000)). Basis risk is the risk that the price behavior of the asset being hedged

---

¹For example, 94% of Fortune Global 500 companies report using financial derivatives to manage risks. This figure is based on survey data from the International Swaps and Derivatives Association (ISDA).

²Two notable exceptions are Campello et al. (2011) and Cornaggia (2012). The first study relates the use of derivatives with lower loan spreads and better contracting terms (fewer restrictive covenants) in the debt markets. The latter shows a subsequent improvement in productivity for farmers that obtain insurance products on their crops by the United States Department of Agriculture (USDA).

³Several recent studies have exploited the unique disclosure practices of this industry. See for instance Jin and Jorion (2006), and Bakke et al. (2013).
may not be perfectly correlated with the price behavior of the derivatives contract used to hedge. The widespread use of standardized exchange traded derivatives, means that firms are often exposed to changes in basis risk and hedging effectiveness. Yet, despite its prevalence in practice, basis risk has received much less attention in the existing literature.

Our natural experiment exploits a change in basis risk for Canadian light oil producers relative to their U.S. counterparts. Firms in the North American oil industry rely on NYMEX derivatives contracts, which are linked to the benchmark price of West Texas Intermediate (WTI) oil, with a delivery point of Cushing, Oklahoma. However, because oil firms may produce and sell a product geographically far from this delivery point, the effectiveness of their hedging program is based on the correlation between the realized price for their oil and WTI prices. We show that the effectiveness of WTI-based derivative contracts used by Canadian firms exhibits a significant drop as of the first quarter of 2012 due to unexpected infrastructure issues and pipeline capacity constraints. This significant increase in basis risk renders WTI-based hedging instruments significantly less effective for Canadian producers as of 2012. We use this event to identify the effect of hedging effectiveness on firm value and real activities by comparing Canadian light oil producers (treatment firms) to otherwise similar U.S. light oil producers (control firms), both before and after this basis risk shock in a difference-in-differences (DD) framework.

---

4Basis risk is present in many markets. In currency markets, basis risk can occur when the currency risk being hedged stems from a country with capital controls and is hedged instead with more liquid currency contracts from a neighboring country. In bond markets, basis risk can occur when the bond being hedged differs from the reference bond in the derivatives contract, with a credit risk or maturity mismatch for example. In commodities markets, basis risk can occur when the product being hedged by commodity producers differs in quality or location from the reference commodity in the derivatives contract.

5The effectiveness of a hedging instrument is typically measured by the $R^2$ of the regression explaining changes in the prices of the underlying asset being hedged with changes in the prices of the benchmark asset used in the financial hedging contracts (e.g. Johnson (1960) and Ederington (1979)). The benchmark for Canadian light oil prices is given by the Edmonton Par index. The benchmark asset used in North American energy hedging contracts is the WTI index. The $R^2$ of the regression explaining changes in Canadian light oil prices with changes in WTI prices stands at .54 during 2011. The measure exhibits a sudden drop as of the first quarter of 2012. Between the second quarter of 2012 and the end of the first quarter in 2013 (the post-event window), the $R^2$ between Edmonton Par and WTI prices drops by half to 0.26.

6The rapidly growing domestic oil production in North America has led to an unprecedented tightening in takeaway capacity by pipeline and rail, in particular for Canadian oil. The U.S. Energy Information Administration (EIA) expects volatility in prices for Canadian oil and the Bakken relative to WTI prices to persist. See for instance: http://www.eia.gov/todayinenergy/detail.cfm?id=10431. Detailed institutional background on the event is given in Section 2.
In equilibrium, firms may adopt different combinations of leverage and hedging in the presence of effective hedging tools. Financial theory argues that hedging will benefit leveraged firms the most by reducing the risk of costly financial distress (e.g., Smith and Stulz (1985); Stulz (1996)). If the effectiveness of hedging instruments is suddenly reduced, theory would predict that firms with higher ex ante leverage will be relatively more affected by the shock. To directly test this hypothesis, we perform a cross-sectional comparison using a triple difference (DDD) test with an additional split into high and low leverage firms within both the treatment and control subsamples.

Our findings are the following. Confirming theoretical predictions, we find that highly leveraged firms within Canada are significantly more hedged than the low leverage Canadian firms at the onset of the basis risk shock. Furthermore, we find that Canadian firms significantly reduce their hedging activity following the basis risk shock. This result is to be expected given the relative loss in hedging effectiveness of WTI-based contracts for Canadian firms and provides indirect confirmation of the validity of our empirical setting.

In terms of firm value, we do not find a statistically significant average treatment effect following the increase in basis risk. However, when we analyze the effect on high and low leverage firms separately, we find that firm valuation is significantly lower for the subset of highly leveraged treatment firms. Specifically we find that high leverage firms in the treatment group exhibit a stock performance that is 28.3% worse than high leveraged firms that maintain access to effective hedging (control group), while the relative decrease in Tobin’s Q equals 13.7%.

To understand the channels through which firm value is affected, we first turn our attention to the analysis of real effects. We find that the reduction in hedging effectiveness causes treatment (Canadian) firms to lower their capital expenditures in the post-event period. The average treatment effect corresponds to a relative reduction of capital expenditures from the sample mean of 29.6% relative to control (U.S.) firms. As in the case of the firm value result, we find significant heterogeneity within the treatment group. While the low leverage treat-

---

7For instance, De Meza (1986) and Maksimovic and Zechner (1991) develop models where a relatively homogenous set of firms within an industry will adopt significantly different corporate policies in equilibrium.
ment group does not see any statistically significant reduction in capex following the basis
risk shock, the high leverage treatment group implements a reduction in capital expendi-
tures corresponding to 53.9\% of their average quarterly investment intensity relative to their
control group. The economic magnitudes of the real effects are large and can be explained,
at least in part, by the fact that industries where output prices correlate positively with
investment opportunities have a natural hedge provided by investment cutbacks in low price
environments, precisely when the project profitability is lower (see Froot et al. (1993)).

While cutting back investments can be viewed as an operational hedge, the fact that low
leverage treatment firms significantly outperform high leveraged treatment firms is consistent
with the presence of indirect costs of financial distress. Leverage is often associated with
competitive effects (e.g. Bolton and Scharfstein (1990)) and a significant reduction in hedging
effectiveness leads affected firms to be more exposed to financial distress risk; therefore,
we would expect firms with ex ante low leverage to become relatively better positioned
to compete on factor markets such as land, labor and capital. To test this hypothesis,
we analyze asset sales patterns among Canadian oil firms following the shock (see Pulvino
(1998) for a similar exercise in the airline industry). We find that high leverage firms have
on average significantly higher net asset disposition levels than low leverage firms. This
result is consistent with competitive effects having a compounding effect on highly leveraged
Canadian oil producers following their reduced ability to hedge effectively.

A key underlying assumption of the differences-in-differences framework is that, in the
absence of treatment, both treated and control firms exhibit similar patterns of behavior;
this assumption is often referred to as the “parallel trends” assumption. By construction,
our treatment and control firms are similar in many aspects; Haushalter (2000) and Jin and
Jorion (2006) highlight a considerable degree of homogeneity within the oil and gas industry.
Specifically, all producers share a common exposure to oil price risk, and this exposure is the
main source of business risk for this industry. Second, their technology and cost structure
are similar. Third, prior to the shock under study, all producers have access to a common set
of effective financial hedging instruments. As such, we would expect these firms to behave
similarly in the absence of treatment; and we offer compelling evidence that financial markets

5
view treatment firms similarly to control firms prior to the basis risk shock analyzed in this study. Lastly, as suggested by Roberts and Whited (2012), we perform placebo tests to provide further support for the parallel trends assumption in our study.

Standard falsification tests (placebo tests) allow us to tackle unobserved heterogeneity between treatment and control firms (parallel trend assumption). However, they do not rule out confounding explanations specific to the Canadian price dislocation we analyze in this study. For instance, it could be that the drop in valuation and investments is due to the fact that the investment opportunity set is permanently lower for Canadian firms as of Q1 2012. We address this issue in several ways. First, we highlight that there are many time periods between the first quarter of 2012 and the third quarter of 2013 when the differential between Edmonton Par (Canadian light oil crude index) and WTI is reduced down to marginal levels. Investments and valuation do not recover during these periods leading us to believe that the effect is not related specifically to episodes of greater price discounts. Second, we compare the results during our event to those obtained from running the same tests during the biggest price drop in oil over the last decade in 2008, a period during which the correlation between Canadian oil prices and WTI was much higher. During the oil price crash of 2008, we find that highly leveraged Canadian producers do not differ significantly from low leveraged Canadian producers within our treatment group. This result is consistent with the fact that the differences in behavior observed between high and low leverage Canadian firms after the 2012 dislocation is not caused by worse investment opportunities for Canadian firms. Lastly, we run our main DD and DDD tests, whereby we shift the pre-period window by two quarters. In doing so, we closely match the average crude oil prices during the pre-period with the average crude oil prices from the post-period and, as such, we remove the direct price impact between the pre and post period of our main specification. Our results are almost unchanged using this new pre-period window. We conclude that the significant increase in basis risk is a significant driver behind our results.

Overall, our analysis highlights evidence supportive of different economically important channels through which corporate hedging policies affect firm value. First, we find that hedging only effects firm value of firms that had high leverage prior to the loss of effective
hedging instruments. This result provides some support for how hedging may mitigate the
impact of financial distress. We show that some of the indirect costs of financial distress are
casted by asset sales that high leverage firms undertake, which may adversely affect firm
value over the long term. We also observe that high leverage firms reduce investment relative
to low leverage firms, suggesting that the mitigation of underinvestment is an important
channel through which hedging affects firm value.

The paper proceeds as follows. In Section 2, we discuss our empirical methodology. In
Section 3, we provide details on our data. In Section 4, we present our main results. Section
5 provides evidence on the validity of our empirical design and Section 6 concludes.

2 Methodology

In this section, we first provide some background on hedging, basis risk and several
institutional details behind our empirical setup. In doing so, we outline the hypothesis we
test in our data. We then describe our natural experiment and the corresponding difference-
in-differences (DD) framework we implement. We close this section by describing our triple
differences (DDD) specifications.

2.1 Hedging and Basis Risk

Oil producers face significant volatility in the price they get for their main output. Risk
management theories argue that managing risk is valuable if it reduces the deadweight costs
associated with bad outcomes (see Stulz (1996)). For oil producers, risk management can
take several forms; the most common of which is entering into financial derivatives contracts
to hedge the price of oil they expect to sell in the future. By using financial instruments such
as puts, forwards and collars, oil producers can guarantee a minimum price (floor) for their
output and hence reduce the risk of a negative cash flow shock.

One of the channels through which hedging can improve firm value is through its impact
on investments. By lowering the risk of financial distress, hedging allows oil firms to sustain
internal cash flows and reduce the cost of external capital, which in turn will improve the
likelihood of maintaining a given investment program (see Bessembinder (1991) and Campello et al. (2011)).

Financial derivatives contracts used in hedging are based on the price of an underlying asset. In the case of oil, NYMEX financial contracts are based on the Western Texas Intermediate (WTI) price, which is the price of oil obtained in Cushing, OK. If the prices obtained by Canadian firms are not perfectly correlated with WTI prices, then Canadian producers that hedge with WTI-based contracts will suffer from what is known as basis risk. Johnson (1960) and Ederington (1979) show that the weaker the correlation is between the reference price in hedging contracts and the price the producers actually get for their product, the less efficient hedging is; and hence the less likely the producers will hedge. Haushalter (2000) shows empirically that basis risk is a key factor in the decision to hedge in the U.S. oil market. Firms that face a greater disconnect between the price underlying their financial hedges and the actual prices of their output are significantly less likely to hedge. As such, our study’s empirical design builds on Haushalter’s work as we make use of an exogenous shock to basis risk in order to analyze how oil producers react to a withdrawal of effective hedging instruments for oil price risk.

2.2 Outcome variables and Hypotheses

Theoretical work such as Stulz (1984) and Stulz (1996) offer several explanations as to why risk management policies would be value increasing. Part of the empirical analysis will focus on the mechanisms at work when trying to understand the link between hedging practices and firm value.\(^8\)

\(^8\)Tax optimization and the reduction of risk borne by key stakeholders in the firm (e.g., management) are often cited as other channels through which risk management can add value (see Stulz (1996)).

\(^9\)Several recent papers aim at understanding the channels through which hedging affect firm value. For instance, Cornaggia (2013) shows that agricultural firms that obtain access to new insurance products for their crop improve their productivity; while Campello et al. (2011) argue that hedging reduces the cost of debt which in turn spurs investments.
2.2.1 Investment policies

Hedging can affect firm value through its impact on investment policies. If hedging lowers the probability of financial distress and if financial distress can lead to costly curtailments in capital expenditures, we would expect the ability to hedge (or lack thereof) to influence a firm’s investment policies. Campello et al. (2011) show evidence consistent with a specific channel through which hedging affects investment programs. They show empirically that hedging lowers the cost of debt and reduces the number of restrictive covenants put in place. This in turn improves the firm’s ability to invest (see Bessembinder (1991)). As such, our first hypothesis is the following:

- Hypothesis 1a: We expect firms to reduce their capital expenditures in the face of increased basis risk.

The literature has shown that hedging can alleviate financial distress costs, the underinvestment problem and restrictive debt covenants. As a consequence, we would expect that the more leveraged a firm is, the more severe these debt-related distortions to investment become if access to efficient hedging instruments is suddenly curtailed.

- Hypothesis 1b: We expect highly leveraged firms to reduce their capital expenditures significantly more than low leveraged firms in the face of increased basis risk.

2.2.2 Valuation impact

As a direct extension to Modigliani-Miller (MM) irrelevance propositions, hedging does not impact firm value in a frictionless world. The presence of market frictions will, however, make hedging value relevant. One of the most significant costs hedging instruments can help alleviate is related to the negative spillover effects associated with financial distress. If deadweight or indirect costs are associated with financial distress and a firm can reduce the probability of financial distress in an efficient manner through risk management, then

---

10One channel through which financial distress can cause costly curtailments in capital expenditures is through the underinvestment problem whereby management, acting in the interest of shareholders, will forgo positive NPV projects if most of the benefits accrue to debt holders (see Myers (1977)).
putting in place a hedging program will add value to the firm by making the scenario of costly financial distress less likely to occur (see Stulz (1996)).

- Hypothesis 2a: We expect firm value to decrease for producers that face an increase in basis risk.

The hedging benefits described above relate to alleviating the negative impact of financial distress on firms. By reducing the probability of financial distress, hedging can create value by allowing the hedged firm to leverage more and extract more of the benefits of debt, such as tax shields. Conversely, we would expect a withdrawal of effective hedging instruments to have a more detrimental effect on firm value for a highly leverage firm given that the likelihood of financial distress will be greater for the more leveraged firm.

- Hypothesis 2b: We expect to see a more significant drop in firm value for high leverage firms relative to low leverage firms in the face of increased basis risk.

2.2.3 Factor market competition

One of the main benefits of hedging is to reduce the risk of financial distress. As such, when hedging effectiveness is significantly reduced, we expect all affected oil producers to be relatively more exposed to financial distress risk. There are well established theories that link financial strength and predation in product markets (e.g. Bolton and Scharfstein (1990), Brander and Lewis (1986), Maksimovic (1990)). In our context, product market predation effects are unlikely given that firms are price takers. However, oil producers compete for the same production factors; namely land, labor and capital. According to these theories, we would expect that any impact related to debt capacity constraints issues might be exacerbated by factor market competition. This reasoning leads us to our third hypothesis:

- Hypothesis 3: Following an industry-wide reduction in hedging effectiveness, we expect low leverage firms to benefit relative to high leverage firms in terms of factor market competition.
2.3 Natural experiment

Our natural experiment is based on unexpected events in the North American oil industry that lead to a significant increase in basis risk for Canadian oil producers relative to U.S. oil producers. Specifically, in the first quarter of 2012 the price movements of Edmonton Par and WTI decoupled due to (1) a lack of refining capacity in Canada, (2) limited takeaway capacity on the four main pipelines taking Canadian oil to the U.S. and (3) a lack of other means to transport the oil to other markets. In the two years prior to the first quarter of 2012 production from new shale discoveries in North Dakota doubled, capturing pipeline capacity that would have otherwise been used for Canadian oil. The limits on pipeline capacity first became apparent when a primary consumer of Canadian light oil, the BP refinery in Whiting, IL, undertook unplanned maintenance in February 2012, thereby reducing demand for Canadian light oil. As it became clear that producers had limited ability to re-route oil to other end-users, the Canadian market suffered a major price dislocation. Compounding these events was the decision by the Obama administration to reject the permit for the Keystone XL pipeline in Q1 of 2012, which would have provided some visibility to easing pipeline constraints. The lack of adequate and consistent takeaway capacity for Canadian oil has meant that there has been a significant change in hedging effectiveness for Canadian firms with Canadian oil prices being significantly more volatile and less correlated with the WTI benchmark prices on which most hedging contracts are written.\footnote{Although we observe a handful of our sample firms enter differential swaps in 2013 to reduce the basis risk going forward. Conversations with CFOs of our sample firm reveal a very limited OTC market for these contracts with wide bid-ask spreads and overall unfavorable terms. Transportation by rail offers an operational hedge for Canadian firms. Despite a doubling of transportation costs, transportation from oil tanks increased ten folds between Q1 2012 and Q1 2014, representing approximately 5\% of all oil exports out of Canada in 2013.}

Hedging effectiveness can be defined as the reduction in variance of the hedged position relative to the unhedged position. Johnson (1960) and Ederington (1979) show that this measure of hedging effectiveness can be measured by computing the $R^2$ of the regression explaining changes in the prices of the underlying asset being hedged with changes in the prices of the benchmark asset used in the financial hedging contracts. In the North American oil markets, most financial contracts used in hedging are based on WTI benchmark prices.
As such, the relative effectiveness of WTI-based hedging tools for Canadian oil producers relative to their U.S. counterparts is measured by the $R^2$ of the regression explaining changes in Canadian light oil prices, as proxied by Edmonton Par prices, with changes in WTI prices. The $R^2$ stands at 0.54 during the pre-event window.

This resulting increase in basis risk is significant and clearly shown in Figure 1, whereby the correlation between Canadian light oil prices, as proxied by the Edmonton Par reference prices, and WTI prices breaks down after the first quarter of 2012. The lower correlation between Edmonton Par prices and prices for the underlying oil derivative contracts renders WTI-based hedging instruments significantly less effective for Canadian producers after Q1 2012. We use this event to identify the effect of hedging on firm value and real activities by comparing Canadian light oil producers (treatment firms) to otherwise similar U.S. oil producers (control firms), both before and after this basis risk shock in a difference-in-differences (DD) framework.

2.4 Difference-in-differences (DD)

Firms typically determine their hedging policy jointly with other financial and operating policies. Hence in a non-experimental setting, causal links between hedging and firm value are difficult to establish. In this section, we describe how we make use of the natural experiment described above to test whether the withdrawal of effective hedging instruments has a significant impact on firm value and real activities.

2.4.1 Implementation of DD

The implementation of our causal tests relies on a quasi-experimental setting whereby we obtain a plausible exogenous variation in the availability of effective hedging instruments for a subset of firms (treatment group) relative to a comparable set of control firms. The treatment group is comprised of Canadian light oil producers while the control group is comprised of their U.S. counterparts. We compare both sets of oil producers before and after the event in a difference-in-differences (DD) framework.
In our baseline difference-in-differences regressions, we explain an outcome variable \( y_{i,t} \) with a post-event dummy variable (\( Post_t \)), a treatment dummy (\( CADummy_i \)) and the post-event dummy interacted with the treatment dummy (\( Post_t \ast CADummy_i \)):

\[
y_{i,t} = \alpha + \beta_1 CADummy_i + \beta_2 Post_t + \beta_3 Post_t \ast CADummy_i + FirmFE_i + \epsilon_{i,t}
\]

The key coefficient of interest in determining whether treated firms respond differently after the sharp increase in basis risk is \( \beta_3 \), the coefficient on the interaction term \( Post_t \ast CADummy_i \). The magnitude and sign on the coefficient of this term is an indication of how treated firms respond relative to control firms once their ability to hedge effectively has been curtailed. We also include firm fixed effects to account for time invariant heterogeneity of firm investment policies across firms. With the post-event dummy, the DD framework has the advantage of also controlling for time-invariant differences such as differences in access to capital markets between Canadian and U.S. oil firms.

We estimate the model on three different outcome variables \( y_{i,t} \). The first model uses the average quarterly investment intensity over the year prior to the event quarter for the pre-event observation, and the average quarterly investment intensity over the year that follows the event quarter for the post-event observation. Averaging all quarterly observations in the pre and post period alleviates potential econometric issues related to time dependence in the outcome variable within each firm (see Bertrand et al. (2004)).

The second model takes the average quarterly Tobin’s Q over the year prior to the event quarter for the pre-event observation and the average quarterly Tobin’s Q over the year that follows the event quarter for the post-event observation. Tobin’s Q is often used as a proxy for firm value in the literature (e.g. Jin and Jorion (2006)).

The third model extends the valuation tests by taking the cumulative stock returns from January 1st 2012, the beginning of the event quarter, up to September 30th 2012 and March 31st 2013, respectively six months and one year after the event quarter. The specifications based on cumulative stock returns can be viewed as a DD model on the market value of equity.
Lastly, to ensure the validity of our empirical design, the dislocation between Canadian and U.S. oil prices should not have been anticipated by Canadian producers. To verify the unanticipated nature of the price dislocation, we read the financial statements and in particular the management discussion and analysis (MD&A) section in Q3 2011 and year-end 2011 of every treated Canadian firm. None of them mention any specific anticipation of a dislocation between realized light oil prices in Canada and WTI prices. Given the regulatory need to disclose any event that could materially impact their results, we take this lack of disclosure as evidence that the event was not anticipated by Canadian oil producers. Our market-value tests further suggest that market participants were also not aware of the impending dislocation.

2.5 Triple differences (DDD)

Finance theory predicts that hedging is particularly important for reducing the probability of distress and for accessing external capital. Therefore, if the effectiveness of hedging instruments is reduced, we would expect firms that have higher leverage at the onset to be relatively more affected by the shock (see hypotheses 1b and 2b in Section 2.2 above).

To directly test these hypotheses, we perform a triple difference (DDD) test. We implement this test by splitting both our treatment and control sample into high and low leverage firms, defined as above and below their respective median group leverage in the quarter prior to the shock.

In our baseline DDD regressions, we explain an outcome variable \( y_{i,t} \) with a post-event dummy variable \( \text{Post}_t \), a treatment dummy \( \text{CADummy}_i \), a high leverage dummy \( \text{HighLev}_i \), the double interaction terms \( \text{Post}_t \times \text{CADummy}_i; \text{Post}_t \times \text{HighLev}_i; \text{CADummy}_i \times \text{HighLev}_i \), and the triple interaction term \( \text{Post}_t \times \text{CADummy}_i \times \text{HighLev}_i \) :

\[
y_{i,t} = \alpha + \beta_1 \text{CADummy}_i + \beta_2 \text{Post}_t + \beta_3 \text{Post}_t \times \text{CADummy}_i + \\
+ \beta_4 \text{HighLev}_i + \beta_5 \text{Post}_t \times \text{HighLev}_i + \beta_6 \text{CADummy}_i \times \text{HighLev}_i + \\
+ \beta_7 \text{Post}_t \times \text{CADummy}_i \times \text{HighLev}_i + \text{FirmFE}_i + \varepsilon_{i,t}
\]
The coefficient of interest in determining whether the difference between the differential response of the highly levered treated firms relative to their highly levered control group and the differential response of the low leverage treated firms relative to their low leverage control group after the sharp increase in basis risk is $\beta_7$, the coefficient on the triple interaction term. We also include firm fixed effects to account for time invariant heterogeneity of firm investment policies across firms.

3 Data

In this section, we first detail how we construct our dataset of both treatment (Canadian) and control (U.S.) oil producers. Second, we provide descriptive statistics on the final sample of treatment and control firms used in this study.

3.1 Data Construction

Our empirical design requires us to construct a dataset of Canadian oil producers and a corresponding dataset of U.S. oil producers. In terms of sample size, a key advantage is the fact that the Canadian and U.S. oil industries are among the largest in the world.\textsuperscript{12}

The first significant increase in basis risk occurs during the first quarter of 2012; we define this quarter as our event quarter. We use the four quarters from Q1 2011 to Q4 2011 as our pre-event window; and the four quarters after the event from Q2 2012 to Q1 2013 as our post-event window. All quarterly accounting data comes from Worldscope for Canadian firms and Compustat for U.S. firms.

We complement this data with hand-collected measures of light oil production relative to total production for both Canadian and U.S. firms as of Q4 2011. Detailed disclosure on production and hedging policies allows us to carefully construct a treatment (Canadian) and control (U.S.) group for our study. This data is necessary in order to determine which Canadian firms are exposed to the basis risk jump in light oil prices that occurs in Q1

\textsuperscript{12}As of 2011, Canada’s oil industry produced over 2.1 million barrels of oil per day and is currently the sixth largest producer of oil in the world (source: http://www.capp.ca/canadaIndustry/oil/Pages/default.aspx).
2012 and which U.S. firms can serve as an appropriate control group within the oil and gas Exploration and Production (E&P) universe of firms.

3.1.1 Treatment (Canadian) sample

We describe in this subsection how we obtain our sample of Canadian firms. We first download the universe of Canadian oil and gas exploration firms from Worldscope. We then sort the list of firms by total assets at the end of the fourth quarter 2011 (pre-event quarter). From that list, we hand-collect information on the 150 largest firms.

The Canadian Oil and Gas industry is somewhat heterogeneous with regards to the goods they produce and sell on the market. In particular, while most of the oil produced in the U.S. is light to medium grade oil, Canada has a broader variety of oil extracted. For instance, the oil sands of Alberta produce bitumen and heavy oil, which are harder to transport and refine and hence always trade at a discount relative to WTI prices. The differential in prices between light oil (WTI benchmark) and heavy oil (WCS benchmark) can actually be hedged and is commonly hedged by heavy oil producers in Canada. As such, our major task in terms of defining our treatment sample of Canadian firms is to screen the sample based on the amount of light oil produced. To do so, we compute the percentage of light oil revenues relative to total revenues for each firm in the sample. We require a minimum of 30% of all 2011 revenues to be derived from light oil sales in order to be included in the final sample. Furthermore, a very small number of Canadian producers operate in the Labrador region (East Coast) and in Alaska; both of which obtain Brent pricing and as such were not affected by the price dislocation, and hence are also excluded from the final sample. These firms are also excluded from the final sample. The other exclusion criteria include the removal of (1) all firms with major midstream (pipelines) and downstream (refining) operations, such as Suncor; (2) all firms with significant international operations; (3) all firms that have significant exposure to industries outside of oil (conglomerates) and lastly, (4) all firms with less than $50M in total assets at the end of 2011. We obtain a final treatment sample of 46 Canadian light oil producers.
3.1.2 Control (U.S.) sample

We describe in this subsection how we obtain our sample of control (U.S.) firms. We first download the universe of American oil and gas exploration and production (E&P) firms from Compustat (SIC 1311). We obtain 109 firms. This exclusion criterion based on industry already screens out several conglomerates such as ExxonMobil. However, we still need to hand-collect information on all 109 firms to gauge whether these firms are appropriate matches to their Canadian counterparts; in particular we need to screen out firms that are not E&P firms and also those that do not have a significant percentage of their production derived from oil.

There has been a significant rise in the number of studies using propensity score matching (PSM) techniques in order to define a control group (e.g. Almeida et al. (2012)). We do undertake PSM as a robustness check throughout the study, however, we believe our industry focus allows us to perform a reasonable match using a broader sample based on business characteristics and exposure to similar risks and investment opportunities. To do so, we impose the same list of criteria that we applied to the universe of Canadian oil and gas producers.

Specifically, in terms of type of production, we require at least 30% of total revenues to be derived from oil. We exclude every firm with significant operations outside of the U.S. (for instance Apache) and we remove firms that are not focused on exploration and production (E&P). The restriction to SIC 1311 firms automatically removes oil conglomerates such as ExxonMobil but we still have a handful of midstream operators (pipelines) in the sample. All of them are removed. Lastly, given that our sample of Canadian firms focuses on onshore operations, we also remove every U.S. firm that has a majority of its operations in the Gulf of Mexico. Offshore drilling has very different characteristics from onshore drilling; namely its capital projects require significantly greater capital outlays and take much longer to complete. We are left with a final control sample of 38 U.S. oil producers.
3.2 Descriptive statistics

In this subsection, we describe our sample along several accounting-based measures of size, leverage, profitability and production characteristics. The variable definitions follow the literature. Namely, Tobin’s Q is defined as the ratio of total assets plus market capitalization minus common equity minus deferred taxes and investment tax credit \((\text{atq} + \text{prccq} \times \text{cshoq} - \text{ceqq} - \text{txditcq})\) to total assets \((\text{atq})\). Firm size is measured by total assets \((\text{atq})\). Investment intensity is defined as capital expenditures \((\text{capxq})\) normalized by total assets \((\text{atq})\). Market leverage is defined as the ratio of total debt \((\text{dlcq} + \text{dlttq})\) to total capitalization \((\text{dlcq} + \text{dlttq} + \text{cshoq} \times \text{prccq})\). Profitability is defined as operating profits \((\text{oan cfq})\) normalized by total assets \((\text{atq})\). Lastly, we compute the share of light oil sales for each firm \((\text{Light Oil Percentage})\) by computing the proportion of light oil revenues to total revenues for the fiscal year ending on December 31st 2011.

Panel A of Table 1 contains the information for the treatment sample of Canadian light oil producers and control sample of U.S. producers as of Q4 2011. A significant portion of production is comprised of light oil production for both treatment and control firms which both generate, on average, more than 60% of their revenues from light oil production in 2011. This level of exposure to light oil production is a desired feature of our research design: It guarantees a significant exposure to the surge in basis risk that occurs as of Q1 2012 for Canadian firms while providing a good match in terms of business characteristics for the control group of U.S. firms.

While Panel A of Table 1 shows similar firm characteristics across treatment and control, it also highlights some heterogeneity across treatment and control firms in terms of firm size, hedging, and leverage. To address these differences, we create a matched sample using propensity score matching (PSM) techniques, whereby we match with replacement in order to obtain the best possible match. As can be seen from Panel B of Table 1, the sample of treatment and matched control firms are similar across all observable dimensions.

Panel A and Panel B of Table 2 compare the characteristics of high and low leverage firms within the treatment (Canada) and control (U.S.) sample as of December 31, 2011. Within
the treatment group we see in Panel A of Table 2 that high and low leverage Canadian firms match on many firm characteristics. As theory would suggest, we do observe significant differences in hedging activity, whereby high leverage firms hedge more of their future production at the onset of the basis risk shock.

4 Results

4.1 Hedging policies

Table 3 reports the estimate of a regression which compares the hedging behavior of Canadian oil producers (treatment) relative to U.S. oil producers (control), before and after the basis risk shock. We use a regression form of difference-in-differences for this comparison. The hedging measure we construct is similar to the one used by Jin and Jorion (2006) and Bakke et al. (2013). In particular, we measure both at the year-end 2011 (pre-period) and at the year-end 2012 (post-period) the percentage of oil production that is hedged for the following year. As for the total hedged position, we treat all hedging instruments equally. That is, we apply a $\Delta = -1$ to all linear hedging instruments such as futures, forwards, fixed-price contracts and receive-fixed swaps, as well as all non-linear hedging instruments such as puts and collars. Although the deltas for puts and collars are typically lower than one, we are assuming that firms select puts and collars with guaranteed price levels (floors) that hedge them as effectively as linear hedging instruments against a negative price outcome for oil. As specification (1) in Table 3 shows, Canadian firms reduce hedging after the basis risk shock. The economic interpretation of the interaction coefficient is that Canadian firms reduce hedging by 31.4% from their average pre-shock level, relative to the U.S. firms. We find similar results when estimating the regression in the matched sample, as shown in specification (2) of Table 3.
4.2 Investment policies

In this section we measure the impact of having access to effective hedging instruments on firm investment policies. Table 4 Panel A reports the results of our difference-in-differences and triple differencing specification. The treatment firms in our sample are Canadian light oil producers as they are exposed to a significant increase in basis risk on their light oil hedges as of Q1 2012. We find that after the effectiveness of hedging has been reduced, Canadian firms reduce investment intensity by 0.024, corresponding to 29.6% of the average quarterly investment intensity or 0.457 of the standard deviation of quarterly investment intensity, relative to the investment intensity of U.S. firms. This figure is both economically and statistically significant, and provides evidence consistent with hypothesis 1a.

However, the loss of effective hedging instruments likely does not affect all treatment firms uniformly. As hypothesis 1b outlines, firms with higher leverage prior to the loss of effective hedging instruments may be more affected. In specifications (2) and (3) of Table 4 Panel A, we subdivide our sample into firms with high leverage (2) and firms with low leverage (3), and find that our main result is being driven by firms with high leverage. The economic interpretation of the -0.042 coefficient in specification (2) implies that high leverage firms experience a relative reduction of 53.9% of their average quarterly investment intensity, or 0.67 of the standard deviation of quarterly investment intensity. Conversely, firms with low leverage have a small negative coefficient which is not statistically significant. To formally test whether firms with high leverage are more affected than firms with low leverage, we undertake a triple differencing specification in (4), and find that the triple interaction term is negative and statistically significant. These results provide direct evidence that the event under study affects real investment decisions by firms. This adverse impact is significantly more pronounced for firms with high leverage relative to firms with low leverage.

We estimate the regressions presented in Panel A of Table 4 on the matched sample in Panel B of Table 4. Coefficients are similar to those of Panel A, and the triple interaction term in Panel B is larger in magnitude and statistically significant. This result suggests that the observable differences in treatment and control firms in our main sample are not a
primary driver of the overall result that we observe.

4.3 Firm valuation

In this section we measure the effect of having access to hedging instruments on firm value. Firm value is proxied by Tobin’s Q as is common in the literature (e.g. Jin and Jorion (2006)). Table 5 reports the results of our specifications which measure the effect of a loss of access to effective hedging instruments on firm value. Specification (1) in Table 5 documents that there is no overall effect on treatment firms, a result not supportive of hypothesis 2a. However, when we subdivide the sample into high and low leverage firms, we find coefficients that are much larger in magnitude. The interaction coefficient in (2) is negative, large in magnitude and statistically significant, while the interaction coefficient in (3) is positive, but not statistically significant. These specifications imply that the firm value of high leverage firms is adversely affected by the withdrawal of effective hedging instruments, while firm value increases for low leveraged firms. To formally test whether these two types of firms are affected differently, we undertake a triple differencing specification. The triple interaction coefficient is -0.234, negative and statistically significant. This implies that high leverage treatment firms are valued less than high leverage control firms, relative to the change in value of low leverage treatment firms versus low leverage control firms. Because we are taking the logarithm of Tobin’s q, the -0.234 coefficient, represents a 23.4% relative decrease in firm value, a result consistent with hypothesis 2b.

We estimate the regressions presented in Panel A of Table 5 on the matched sample in Panel B of Table 5. Coefficients are similar to those of Panel A, and the triple interaction term in Panel B remains statistically significant. This result suggests that observable differences in treatment and control firms are not a primary driver of the overall effect on firm value we observe.
4.4 Stock price performance

In this section, we complement our firm value tests based on Tobin’s Q with tests on cumulative stock price returns over the event window. Figure 2 provides visual evidence of the stock price performance of equal weighted portfolios of treatment (Canadian) and control (U.S.) oil producers. It highlights the close correlation of stock prices throughout 2011, and the sharp effect the reduced correlation of Edmonton Par with WTI has on stock returns. We formally test the magnitude of this difference in Table 6. We measure stock returns over a nine month and a fifteen month window (respectively six months and one year after the event quarter). We find that on average stock prices of treatment firms are lower than stock prices of control firms (specifications (1) and specifications (5)), but not always by a statistically significant amount.

When we subdivide our sample into high leverage and low leverage firms, we observe that high leverage treatment firms have significantly lower stock returns relative to the high leverage control firms. We first provide graphical evidence of changes in stock prices in the pre-event and post-event periods for the high and low leverage subgroups separately in Figure 3A and Figure 3B. The results are striking. While high leverage treatment (Canadian) firms significantly under-perform their high leverage control (U.S.) group in Figure 3A, the low leverage treatment (Canadian) firms maintain a stock performance almost on a par with their low leverage control (U.S.) firms. We formally test whether the impact on stock prices for high leverage firms is larger than the difference we observe for low leverage treatment and control firms in specifications (4) and (8) of Table 6. The coefficients in both (4) and (8) of Table 6 are statistically significant, indicating that high leverage firms are affected relatively more by the loss of effective hedging than low leverage firms.

4.5 Factor Market competition

Our valuation results imply a significant dichotomy: After the shock, firm value is reduced for high leverage firms, while it increases for low leverage firms. One interpretation of the increase in firm value for low leverage firms is that they gain a competitive edge when competing
with high leverage firms for limited resources including land, human capital and external financing from capital markets. As such, our valuation results provide indirect evidence that the impact of the withdrawal of effective hedging instruments can be compounded by strategic interactions among industry players. This result provides a potentially interesting extension to the extensive literature on product market competition and leverage (see Bolton and Scharfstein (1990)).

To test more directly for factor market competition effects, we gauge whether low leverage firms behave differently than high leverage firms in terms of asset sales after the shock. Specifically, we define a commonly used measure of net asset acquisitions as asset acquisitions minus asset dispositions divided by beginning of period total assets. We then test whether this measure differs systematically across highly leveraged and low leveraged Canadian oil producers during the post-event period. We compute the net acquisitions measure over two time periods: (1) 2012 and (2) 2012-Q3 2013 (up to the most recent quarterly filing for all sample firms). The results are shown in Table 7. We find that high leverage firms have significantly more net asset sales than their low leverage counterpart. The difference between the two groups is statistically significant at the 5% level for both sample periods. On average, low leverage firms are net acquirers, while high leverage firms are net sellers of assets during the post-event period. This test provides more direct evidence that factor market competition effects play a significant role in explaining differences between high and low leverage Canadian oil firms after the basis risk shock.

5 Validity of Empirical Design

In this section, we provide further evidence that our empirical design has internal validity. In particular, the difference-in-differences framework relies on the assumption that treated and control firms behave similarly prior to the treatment period (“parallel trend” assumption). We perform a series of falsification tests to assess the validity of this assumption in our data as well as discuss the influence of other potential confounding factors in the context of our study.
5.1 Parallel trend assumption

The key identifying assumption in DD estimators is the “parallel trend” assumption. The control group acts as the counterfactual in our experiment and the parallel trend assumption implies that, in the absence of treatment, the average change in the outcome variable would be no different across treatment and control firms. Although it is not possible to directly test this assumption, the oil and gas industry has the advantage of offering a relatively homogenous group of firms. In particular, the treatment and control firms are similar across many dimensions, including technology, production output, and cost structure. An informal confirmation of this assumption can be found in Figure 2, 3a and 3b. The graphical evidence shown in these figures highlight a very high degree of correlation in daily stock returns between treatment and control firms both overall and within high and low leverage firms prior to the event quarter. This graphical evidence can be construed as evidence that the markets do not view the treatment and control firms as subject to significant differences.

To more formally gauge the validity of the “parallel trend” assumption, we perform several placebo tests to assess whether firms behave similarly in prior years (see Roberts and Whited (2012)). In particular, we test whether U.S. and Canadian oil producers have similar investment trends prior to 2012. For this test, we create a placebo event in Q4 2010, and compare capital expenditures in the four quarters after this placebo event with the four quarters before this placebo event.\textsuperscript{13} The results from these regressions are presented in Table 8. None of the interaction coefficients are statistically significant, indicating that both treatment (Canadian firms) and control (U.S. firms) had parallel trends prior to the treatment event. Additionally, none of the interactions with the high leverage dummy variable are statistically significant, indicating that high leverage and low leverage firms also had similar trends prior to treatment. The coefficient on the placebo post dummy in Table 8 is positive and statistically significant, indicating that there was an overall positive trend in investment by all firms over the placebo period. Oil prices were 19\% higher in 2011 than in 2010, so a positive coefficient on the placebo dummy is not surprising and does not invalidate the parallel trend

\textsuperscript{13}The choice of Q4 2010 as the placebo event quarter is driven by the desire to be as close to the real event quarter as possible without having the placebo post-event window overlap with the real event quarter.
assumption as both treatment and control firms increased their drilling activity during the period.

We conduct a similar set of placebo event tests using Tobin’s Q as the dependent variable of interest in Table 9. Again, none of the interaction coefficients in the specifications are statistically significant. This provides supporting evidence towards treatment and control firms, as well as low and high leverage firms, having similar trends in firm value in the two years leading up to the oil price dislocation event in Q1 2012.

While the graphical evidence and placebo regressions do not offer a definitive test of the parallel trend assumption, the evidence provided by these two exercises supports the identifying assumption of our empirical strategy.

5.2 Comparison to 2008 macro shock

Standard placebo tests described in the previous section allow us to tackle unobserved heterogeneity between treatment and control firms (parallel trend assumption). However, they do not rule out confounding explanations specific to the Canadian dislocation we analyze in this study. For instance, it could be the case that whenever there is a negative shock to investment opportunities (e.g. lower oil prices), firms with more leverage are more adversely affected. If it is the case that real investment and firm valuation of high leverage firms is always lower when there is a negative macro shock to oil prices, then this might be a cause for concern for the interpretation of our results.

To address this issue, we compare the investment decision and firm valuation effects of high leverage and low leverage Canadian firms during the negative commodity price shock of 2008 and subsequent recovery. Table 10 and Table 11 report regression estimates for changes in capital expenditures and firm value around the negative oil price shock in 2008. The specifications used are the same as those found in Table 4 and Table 5. While the direct effect of the shock is to reduce both investment and firm value, we find no differential effects across U.S. and Canadian firms nor across high and low leverage firms during the 2008 oil price shock. While investment opportunities did change during this time period, Edmonton
Par and West Texas Intermediate remained highly correlated, thus hedging effectiveness remained unaffected by the shock for all Canadian firms.

5.3 Hedging changes vs. Investment opportunity changes

A key issue in our study is whether the treatment firm responses we identify are due to the inability to hedge effectively going forward or due to lower investment opportunities, i.e. lower realized Edmonton Par prices. Our comparison with the 2008 price shock already shows that the significant differences observed between high and low leverage firms in our sample are not found during an even more severe price drop episode during the financial crisis. In this section, we perform another falsification test to distinguish between the two potentially confounding explanations of hedging ability vs. lower investment opportunities.

The idea behind our additional test is straightforward. In order to disentangle the two potential explanations, we select a pre-period window that removes the “lower investment opportunity” explanation from the equation. By selecting a pre-period window during which the average oil prices equates the average post-period prices, investment opportunities are kept constant in the difference-in-differences (DD) framework. Specifically, by shifting the pre-period window by two quarters, we reduce the average price difference across the pre and post-period to only 1.7% instead of 11.7%. We estimate our baseline investment and firm value regressions with this new timeline. The results are shown in Table 12 and 13.

Both for the investment regression results in Table 12 and the firm valuation (Tobin’s Q) results in Table 13, we find strikingly similar results to our baseline results when applying the new pre-period window that removes differences in oil prices between the pre and post-period window. These new tests provide strong support for the fact that hedging ability has significant valuation and real effects in our study.
6 Conclusion

Hedging is ubiquitous, as more than 90% of all Fortune Global 500 companies report using derivatives to manage risks. Moreover, the benefits of hedging are theoretically well understood. Yet empirical evidence showing how changes in hedging effectiveness affects firm value and real investment is limited. The main reason for this lack of evidence is due to the endogenous nature of hedging policies. As such, inferring causality is a delicate exercise in most situations.

The objective of this study is to use a natural experiment to identify the causal impact of hedging on firm investment activity and firm value. We use the unexpected reduction in correlation between Edmonton Par oil prices and the West Texas Intermediate price used in financial contracts to obtain exogenous variation in the effectiveness of hedging instruments for Canadian light oil producers. We find that Canadian firms, our treatment group, reduce investment activity by an economically significant amount following the reduced effectiveness of their financial hedges. Furthermore, we find that investment, firm value, and stock price effects are concentrated among Canadian firms that have high ex ante leverage. The economic magnitudes identified in this study point towards significant value implications for hedging, particularly for firms that have high operational and financial leverage. Our results provide direct empirical evidence that hedging affects firm value by alleviating the costs associated with financial constraints, as predicted by theory.
References


This figure separately plots the benchmark light oil prices for the treatment (Canadian) and control (U.S.) firms in this study. The Canadian benchmark is the Edmonton PAR and the U.S. benchmark is the West Texas Intermediate (WTI). The pre-event year used in the main tests in this study is the year prior to the reduced $R^2$. The first major dislocation and drop in $R^2$ is highlighted in Q1 2012. The post-event period used to measure firm outcomes in this study is the post-event year, running from Q2 2012 to Q1 2013.
Figure 2:
This figure separately plots the cumulative stock returns for the equal weighted portfolio of treatment (Canadian) and control (U.S.) firms used in this study. The pre-event year used in the main tests in this study is the year prior to the reduced correlation of oil prices, running from Q1 2011 to Q4 2011. The first major price dislocation and drop in correlation between Canadian and U.S. benchmark prices is highlighted in Q1 2012. The post-event period used to measure firm outcomes in this study is the post-event year, running from Q2 2012 to Q1 2013.
Figure 3A:
This figure separately plots the cumulative stock returns for the equal weighted portfolio of highly leveraged treatment (Canadian) and control (U.S.) firms used in this study. Highly leveraged firms are defined as firms with leverage above their peer median leverage as of Dec 31, 2011. The pre-event year used in the main tests in this study is the year prior to the reduced correlation of oil prices, running from Q1 2011 to Q4 2011. The first major dislocation and drop in correlation is highlighted in Q1 2012. The post-event period used to measure firm outcomes in this study is the post-event year, running from Q2 2012 to Q1 2013.
Figure 3B:
This figure separately plots the cumulative stock returns for the equal weighted portfolio of low leverage treatment (Canadian) and control (U.S.) firms used in this study. Low leverage firms are defined as firms with leverage below their peer median leverage as of Dec 31, 2011. The pre-event year used in the main tests in this study is the year prior to the reduced correlation of oil prices, running from Q1 2011 to Q4 2011. The first major dislocation and drop in correlation is highlighted in Q1 2012. The post-event period used to measure firm outcomes in this study is the post-event year, running from Q2 2012 to Q1 2013.
Table 1. Descriptive statistics

This table provides summary statistics of firm characteristics for our sample of oil and gas firms. The means are computed as of Q4 2011, the quarter prior to the event under study. Our sample consists of treatment (Canadian) firms and control (U.S.) firms. In Panel A, we include all firms that satisfy our screening criteria detailed in Section 2 of the main text. In Panel B, we provide a one-to-one matched sample by allowing for resampling among control firms. The procedure used is the same as in Almeida et al. (2012). The variable definitions are as follows. Tobin's Q is defined as the ratio of total assets plus market capitalization minus common equity minus deferred taxes and investment tax credit (atq + prccq × cshoq − ceqq − txditcq) to total assets (atq). Firm size is measured by total assets (atq). Investment intensity is defined as quarterly capital expenditures (capxq) normalized by total assets (atq). Market leverage is defined as the ratio of total debt (dltq + dlcq) to total capitalization (dltq + dlcq + cshoq * prccq). Profitability is defined as quarterly operating profits (oancfq) normalized by total assets (atq). Lastly, we compute the share of light oil sales for each firm (Light Oil Percentage) by computing the proportion of light oil revenues to total revenues for the fiscal year ending on December 31st 2011. The p-values of the differences in means (t-tests) between treatment and control are given in the third column.

### Panel A: All Firms

<table>
<thead>
<tr>
<th>Sample</th>
<th>Treatment Firms (Canada)</th>
<th>Control Firms (U.S.)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets ($ Millions)</td>
<td>1466.51</td>
<td>3035.77</td>
<td>0.072</td>
</tr>
<tr>
<td>Light Oil Percentage</td>
<td>0.61</td>
<td>0.65</td>
<td>0.381</td>
</tr>
<tr>
<td>Percent of Oil Production Hedged</td>
<td>0.36</td>
<td>0.49</td>
<td>0.039</td>
</tr>
<tr>
<td>Tobins q</td>
<td>1.33</td>
<td>1.54</td>
<td>0.162</td>
</tr>
<tr>
<td>Market Leverage</td>
<td>0.20</td>
<td>0.27</td>
<td>0.043</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.18</td>
<td>0.23</td>
<td>0.050</td>
</tr>
<tr>
<td>Investment Intensity</td>
<td>0.08</td>
<td>0.10</td>
<td>0.119</td>
</tr>
<tr>
<td>N</td>
<td>46</td>
<td>38</td>
<td></td>
</tr>
</tbody>
</table>

### Panel B: Matched Sample

<table>
<thead>
<tr>
<th>Matched Sample</th>
<th>Treatment Firms (Canada)</th>
<th>Control Firms (U.S.)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets ($ Millions)</td>
<td>1466.51</td>
<td>1534.09</td>
<td>0.92</td>
</tr>
<tr>
<td>Light Oil Percentage</td>
<td>0.61</td>
<td>0.65</td>
<td>0.34</td>
</tr>
<tr>
<td>Percent of Oil Production Hedged</td>
<td>0.36</td>
<td>0.43</td>
<td>0.15</td>
</tr>
<tr>
<td>Tobins q</td>
<td>1.33</td>
<td>1.32</td>
<td>0.93</td>
</tr>
<tr>
<td>Market Leverage</td>
<td>0.20</td>
<td>0.17</td>
<td>0.20</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.18</td>
<td>0.20</td>
<td>0.47</td>
</tr>
<tr>
<td>Investment Intensity</td>
<td>0.08</td>
<td>0.09</td>
<td>0.38</td>
</tr>
<tr>
<td>N</td>
<td>46</td>
<td>46</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. High versus low leverage comparison
This table compares high and low leverage firms within the treatment (Canadian) group in Panel A and within the control (U.S.) group in Panel B. The comparison is made as of Q4 2011, the quarter prior to the event under study. All variables are defined in Table 1. A firm has high (low) leverage if its market leverage is above (resp. below) the median market leverage within the treatment and control group respectively, as of Q4 2011. The p-values of the differences in means (t-tests) between high and low leverage firms are given in the third column.

Panel A: Treatment firms

<table>
<thead>
<tr>
<th></th>
<th>Canadian Firms</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Leverage</td>
<td>Low Leverage</td>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>Assets ($ Millions)</td>
<td>1768.55</td>
<td>1164.47</td>
<td>0.477</td>
<td></td>
</tr>
<tr>
<td>Light Oil Percentage</td>
<td>0.61</td>
<td>0.61</td>
<td>0.951</td>
<td></td>
</tr>
<tr>
<td>Percent of Oil Production Hedged</td>
<td>0.44</td>
<td>0.27</td>
<td>0.074</td>
<td></td>
</tr>
<tr>
<td>Tobins q</td>
<td>1.03</td>
<td>1.63</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>Market Leverage</td>
<td>0.32</td>
<td>0.09</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Profitability</td>
<td>0.18</td>
<td>0.18</td>
<td>0.908</td>
<td></td>
</tr>
<tr>
<td>Investment Intensity</td>
<td>0.08</td>
<td>0.08</td>
<td>0.679</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>23</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Control firms

<table>
<thead>
<tr>
<th></th>
<th>U.S. Firms</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Leverage</td>
<td>Low Leverage</td>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>Assets ($ Millions)</td>
<td>2189.96</td>
<td>3881.57</td>
<td>0.267</td>
<td></td>
</tr>
<tr>
<td>Light Oil Percentage</td>
<td>0.58</td>
<td>0.73</td>
<td>0.044</td>
<td></td>
</tr>
<tr>
<td>Percent of Oil Production Hedged</td>
<td>0.53</td>
<td>0.46</td>
<td>0.405</td>
<td></td>
</tr>
<tr>
<td>Tobins q</td>
<td>1.27</td>
<td>1.80</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Market Leverage</td>
<td>0.41</td>
<td>0.14</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Profitability</td>
<td>0.17</td>
<td>0.29</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Investment Intensity</td>
<td>0.09</td>
<td>0.11</td>
<td>0.284</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>19</td>
<td>19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Changes in hedging activity after basis risk shock

This table reports firm-level regressions that measure the change in hedging activity for treatment (Canadian) firms. The treatment is defined as a loss in hedging effectiveness due to a significant increase in basis risk for Canadian light oil producers as of Q1 2012. U.S. light oil producers serve as the control group. The dependent variable is percentage of future production hedged, where future production is measured as the realized production for the following 12 months. The pre-period observation is taken as of Q4 2011, one quarter prior to the basis risk shock. The post period is taken as of Q4 2012. The resulting dataset has two time periods per firm; one pre-treatment, one post-treatment. The Canada dummy variable takes the value of one for treatment (Canadian) firms. The Post dummy takes a value of one for the time period after the treatment. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[ \text{Production Hedged}_{i,t} = \alpha + \beta_1 \text{CA Dummy}_{i,t} + \beta_2 \text{Post}_{i,t} + \beta_3 \text{CA Dummy}_{i,t} \times \text{Post}_{i,t} + \text{FirmFE}_{i} + \epsilon_{i,t} \]

<table>
<thead>
<tr>
<th>Dependent Variable = Percentage of Production Hedged</th>
<th>Pre-Period = Q4 2011, Post-Period = [Q4 2012]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>((\beta_1)) Canada Dummy(_t)</td>
<td></td>
</tr>
<tr>
<td>((\beta_2)) Post(_t)</td>
<td>0.093***</td>
</tr>
<tr>
<td></td>
<td>[2.92]</td>
</tr>
<tr>
<td>((\beta_3)) Canada Dummy(_t) * Post(_t)</td>
<td>-0.118**</td>
</tr>
<tr>
<td></td>
<td>[-2.47]</td>
</tr>
<tr>
<td>FirmFE(_i)</td>
<td>Yes</td>
</tr>
<tr>
<td>R(^2) Within</td>
<td>0.081</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>168</td>
</tr>
</tbody>
</table>
Table 4. Hedging and Capital Expenditures

This table reports firm-level regressions that measure the change in investment activity for treatment (Canadian) firms. The treatment is defined as a loss in hedging effectiveness due to a significant increase in basis risk for Canadian light oil producers as of Q1 2012. U.S. light oil producers serve as the control group. The dependent variable is capital expenditures scaled by beginning of quarter assets. Firm quarter level observations are aggregated into two separate time periods, one for the average investments in the four quarters prior to the loss of effective hedging instruments (Q1 2011 to Q4 2011) and one for the four quarters after (Q2 2012 to Q1 2013). The resulting dataset has two time periods per firm; one pre-treatment, one post-treatment. The Canada dummy variable takes the value of one for treatment (Canadian) firms. The Post dummy takes a value of one for the time period after the event. High (respectively low) leverage firms are firms with above (respectively below) median market leverage as of Dec. 31 2011. The High Leverage dummy variable takes the value of one for firms with high leverage. Column 1 shows the results for the difference-in-differences specification. Columns 2 and 3 show the results for the difference-in-difference specification estimated on the subset of low (respectively high) leverage firms. Column 4 presents results for the triple difference specification. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[
I/K_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{Post}_t + \beta_3 \text{Post}_t \times \text{CA Dummy}_i + \text{FirmFE}_i + \epsilon_{i,t}
\]

\[
I/K_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{Post}_t + \beta_3 \text{Post}_t \times \text{CA Dummy}_i + \beta_4 \text{High Leverage}_i + \beta_5 \text{High Leverage}_i \times \text{CA Dummy}_i + \beta_6 \text{High Leverage}_i \times \text{CA Dummy}_i \times \text{Post}_t + \text{FirmFE}_i + \epsilon_{i,t}
\]

### Dependent Variable = Capital Expenditures/Assets

<table>
<thead>
<tr>
<th></th>
<th>Pre-Period = [Q1 2011 to Q4 2011], Post-Period = [Q2 2012 to Q1 2013]</th>
<th>Full Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
<td>High Leverage</td>
</tr>
<tr>
<td>((\beta_1)) Canada Dummy(_i)</td>
<td>Absorbed by FirmFE(_i)</td>
<td>(1)</td>
</tr>
<tr>
<td>((\beta_2)) Post(_t)</td>
<td>-0.001</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>[-0.19]</td>
<td>[0.36]</td>
</tr>
<tr>
<td>((\beta_3)) Canada Dummy(_i) * Post(_t)</td>
<td>-0.024***</td>
<td>-0.042***</td>
</tr>
<tr>
<td></td>
<td>[-2.66]</td>
<td>[-3.00]</td>
</tr>
<tr>
<td>((\beta_4)) High Leverage(_i)</td>
<td>Absorbed by FirmFE(_i)</td>
<td>(5)</td>
</tr>
<tr>
<td>((\beta_5)) High Leverage(_i) * Post(_t)</td>
<td>(6)</td>
<td>0.010</td>
</tr>
<tr>
<td>((\beta_6)) High Leverage(_i) * Canada Dummy(_i)</td>
<td>Absorbed by FirmFE(_i)</td>
<td>(7)</td>
</tr>
<tr>
<td>((\beta_7)) High Leverage(_i) * Canada Dummy(_i) * Post(_t)</td>
<td>-0.036**</td>
<td>[-2.04]</td>
</tr>
<tr>
<td>FirmFE(_i)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R^2 Within</td>
<td>0.171</td>
<td>0.293</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>168</td>
<td>84</td>
</tr>
</tbody>
</table>
Table 4 Panel B. Hedging and Capital Expenditures, Matched Sample

Columns 1-4 in Panel B show the results for the same specifications as in columns 1-4 in Panel A, but estimated on the matched sample. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[
I/K_{it} = \alpha + \beta_1 \text{Canada Dummy}_i + \beta_2 \text{Post}_t + \beta_3 \text{Post}_t \times \text{Canada Dummy}_i + \text{FirmFE}_i + \epsilon_{it}
\]

\[
I/K_{it} = \alpha + \beta_1 \text{Canada Dummy}_i + \beta_2 \text{Post}_t + \beta_3 \text{Post}_t \times \text{Canada Dummy}_i + \beta_4 \text{High Leverage}_i + \beta_5 \text{High Leverage}_i \times \text{Post}_t + \beta_6 \text{High Leverage}_i \times \text{Canada Dummy}_i + \beta_7 \text{High Leverage}_i \times \text{Canada Dummy}_i \times \text{Post}_t + \text{FirmFE}_i + \epsilon_{it}
\]

Dependent Variable = Capital Expenditures/Assets

<table>
<thead>
<tr>
<th>Pre-Period = [Q1 2011 to Q4 2011], Post-Period = [Q2 2012 to Q1 2013]</th>
<th>Matched Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(β1) Canada Dummy&lt;sub&gt;i&lt;/sub&gt;</th>
<th>Absorbed by FirmFE&lt;sub&gt;i&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>(β2) Post&lt;sub&gt;t&lt;/sub&gt;</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>[-1.27]</td>
</tr>
<tr>
<td>(β3) Canada Dummy&lt;sub&gt;i&lt;/sub&gt; * Post&lt;sub&gt;t&lt;/sub&gt;</td>
<td>-0.016*</td>
</tr>
<tr>
<td></td>
<td>[-1.71]</td>
</tr>
<tr>
<td>(β4) High Leverage&lt;sub&gt;i&lt;/sub&gt;</td>
<td>Absorbed by FirmFE&lt;sub&gt;i&lt;/sub&gt;</td>
</tr>
<tr>
<td>(β5) High Leverage&lt;sub&gt;i&lt;/sub&gt; * Post&lt;sub&gt;t&lt;/sub&gt;</td>
<td>0.043***</td>
</tr>
<tr>
<td></td>
<td>[3.03]</td>
</tr>
<tr>
<td>(β6) High Leverage&lt;sub&gt;i&lt;/sub&gt; * Canada Dummy&lt;sub&gt;i&lt;/sub&gt;</td>
<td>Absorbed by FirmFE&lt;sub&gt;i&lt;/sub&gt;</td>
</tr>
<tr>
<td>(β7) High Leverage&lt;sub&gt;i&lt;/sub&gt; * Canada Dummy&lt;sub&gt;i&lt;/sub&gt; * Post&lt;sub&gt;t&lt;/sub&gt;</td>
<td>-0.070***</td>
</tr>
<tr>
<td></td>
<td>[-3.69]</td>
</tr>
<tr>
<td>FirmFE&lt;sub&gt;i&lt;/sub&gt;</td>
<td>Yes</td>
</tr>
<tr>
<td>R² Within</td>
<td>0.149</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>184</td>
</tr>
</tbody>
</table>
Table 5 Panel A. Hedging and Firm Value

This table reports firm-level regressions that measure the change in firm value for treatment (Canadian) firms. The treatment is defined as a loss in hedging effectiveness due to a significant increase in basis risk for Canadian light oil producers as of Q1 2012. U.S. light oil producers serve as the control group. Firm value is proxied by Tobin’s Q. Firm quarter level observations are aggregated into two separate time periods, one for the average Tobin’s Q in the four quarters prior to the loss of effective hedging instruments (Q1 2011 to Q4 2011) and one for after (Q2 2012 to Q1 2013). The resulting dataset has two time periods per firm; one pre-treatment, one post-treatment. All indicator variables are defined in Table 4. All the different specifications in Panel A and Panel B are also described in detail in Table 4. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[
Q_{it} = \alpha + \beta_1 CA \text{Dummy}_{it} + \beta_2 Post_{it} + \beta_3 Post_{it} \times CA \text{Dummy}_{it} + FirmFE_{it} + \epsilon_{it}
\]

\[
Q_{it} = \alpha + \beta_1 CA \text{Dummy}_{it} + \beta_2 Post_{it} + \beta_3 Post_{it} \times CA \text{Dummy}_{it} + \beta_4 \text{High Leverage}_{it} + \beta_5 \text{High Leverage}_{it} \times Post_{it} + \beta_6 \text{High Leverage}_{it} \times CA \text{Dummy}_{it} + \beta_7 \text{High Leverage}_{it} \times CA \text{Dummy}_{it} \times Post_{it} + FirmFE_{it} + \epsilon_{it}
\]

Dependent Variable = Tobin’s Q

<table>
<thead>
<tr>
<th></th>
<th>Pre-Period = [Q1 2011 to Q4 2011], Post-Period = [Q2 2012 to Q1 2013]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>(β₁) Canada Dummy&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>(β₂) Post&lt;sub&gt;i&lt;/sub&gt;</td>
<td>-0.206***</td>
</tr>
<tr>
<td>(β₃) Canada Dummy&lt;sub&gt;i&lt;/sub&gt; * Post&lt;sub&gt;i&lt;/sub&gt;</td>
<td>-0.020</td>
</tr>
<tr>
<td></td>
<td>[-0.43]</td>
</tr>
<tr>
<td>(β₄) High Leverage&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>(β₅) High Leverage&lt;sub&gt;i&lt;/sub&gt; * Post&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>(β₆) High Leverage&lt;sub&gt;i&lt;/sub&gt; * Canada Dummy&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>(β₇) High Leverage&lt;sub&gt;i&lt;/sub&gt; * Canada Dummy&lt;sub&gt;i&lt;/sub&gt; * Post&lt;sub&gt;i&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>FirmFE&lt;sub&gt;i&lt;/sub&gt;</td>
<td>Yes</td>
</tr>
<tr>
<td>R² Within</td>
<td>0.495</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>168</td>
</tr>
</tbody>
</table>
Table 5 Panel B. Hedging and Firm Value, Matched Sample
This Table reports the same regression specifications as Panel A, but estimated on the matched sample. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[ Q_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{Post}_i + \beta_3 \text{Post}_i \times \text{CA Dummy}_i + \beta_4 \text{High Leverage}_i \]
\[ + \beta_5 \text{High Leverage}_i \times \text{Post}_i + \beta_6 \text{High Leverage}_i \times \text{CA Dummy}_i \]
\[ + \beta_7 \text{High Leverage}_i \times \text{Post}_i \times \text{CA Dummy}_i + \text{FirmFE}_i + \epsilon_{i,t} \]

<table>
<thead>
<tr>
<th>Dependent Variable = Tobin's Q</th>
<th>Matched Sample</th>
<th>Pre-Period = [Q1 2011 to Q4 2011], Post-Period = [Q2 2012 to Q1 2013]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
<td>High Leverage</td>
</tr>
<tr>
<td></td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>((\beta_1)) Canada Dummy(_i)</td>
<td>Absorbed by FirmFE(_i)</td>
<td></td>
</tr>
<tr>
<td>((\beta_2)) Post(_i)</td>
<td>-0.269***</td>
<td>-0.219***</td>
</tr>
<tr>
<td>((\beta_3)) Canada Dummy(_i) \times Post(_i)</td>
<td>0.043</td>
<td>-0.053</td>
</tr>
<tr>
<td></td>
<td>[0.99]</td>
<td>[-0.92]</td>
</tr>
<tr>
<td>((\beta_4)) High Leverage(_i)</td>
<td>Absorbed by FirmFE(_i)</td>
<td></td>
</tr>
<tr>
<td>((\beta_5)) High Leverage(_i) \times Post(_i)</td>
<td>0.088*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[1.86]</td>
<td></td>
</tr>
<tr>
<td>((\beta_6)) High Leverage(_i) \times Canada Dummy(_i)</td>
<td>Absorbed by FirmFE(_i)</td>
<td></td>
</tr>
<tr>
<td>((\beta_7)) High Leverage(_i) \times Canada Dummy(_i) \times Post(_i)</td>
<td>-0.180**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-2.12]</td>
<td></td>
</tr>
<tr>
<td>FirmFE(_i)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R(^2) Within</td>
<td>0.593</td>
<td>0.636</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>184</td>
<td>86</td>
</tr>
</tbody>
</table>
Table 6. Hedging and Stock Returns

This table reports firm-level regressions that measure cumulative stock returns for treatment (Canadian) firms. The treatment is defined as a loss in hedging effectiveness due to a significant increase in basis risk for Canadian light oil producers as of Q1 2012. U.S. light oil producers serve as the control group. The dependent variable is the nominal cumulative stock return from January 1, 2012 (onset of event quarter) to September 30, 2012 (short window) and March 31st 2013 (long window). All indicator variables are defined in Table 4. T-statistics are reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[\text{StockReturn}_{it} = \alpha + \beta_1 \text{CA Dummy}_{it} + \beta_2 \text{HighLeverage}_{it} + \beta_3 \text{CA Dummy}_{it} \times \text{HighLeverage}_{it} + \epsilon_{it}\]

### Dependent Variable = Cumulative Stock Returns

<table>
<thead>
<tr>
<th></th>
<th>All Firms (1)</th>
<th>High Leverage (2)</th>
<th>Low Leverage (3)</th>
<th>All Firms (4)</th>
<th>High Leverage (5)</th>
<th>Low Leverage (6)</th>
<th>All Firms (7)</th>
<th>All Firms (8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[-2.51]</td>
<td>[-4.83]</td>
<td>[-0.25]</td>
<td>[-0.31]</td>
<td>[-1.43]</td>
<td>[-3.53]</td>
<td>[0.29]</td>
<td>[0.36]</td>
</tr>
<tr>
<td>(\beta_2) HighLeverage,</td>
<td></td>
<td></td>
<td></td>
<td>4.167</td>
<td></td>
<td></td>
<td></td>
<td>-7.221</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[-0.55]</td>
</tr>
<tr>
<td>(\beta_3) High Leverage, * Canada Dummy(_i)</td>
<td>-28.268**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-36.264**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-2.16]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[-2.03]</td>
</tr>
<tr>
<td>R² Within</td>
<td>0.072</td>
<td>0.368</td>
<td>0.002</td>
<td>0.153</td>
<td>0.024</td>
<td>0.237</td>
<td>0.002</td>
<td>0.164</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>84</td>
<td>42</td>
<td>42</td>
<td>84</td>
<td>84</td>
<td>42</td>
<td>42</td>
<td>84</td>
</tr>
</tbody>
</table>

\[\text{Short Window} = \text{Jan 1, 2012 to Sep 30, 2012}\]
\[\text{Long Window} = \text{Jan 1, 2012 to Mar 31, 2013}\]
Table 7. Asset Acquisitions/Dispositions by Treatment Firms
This table reports acquisition and disposition activity by Canadian light oil producers after the basis risk shock. Specifically, it reports the net acquisitions conducted by Canadian firms, scaled by assets: (Acquisitions_t - Dispositions_t)/Assets_t-1. The reported acquisitions and dispositions activity periods correspond to (1): Q1-Q4 2012 and (2): Q1 2012-Q3 2013 (up to most recent quarterly filing). Mean activity is computed for high and low leverage Canadian oil producers separately. High (low) leverage firms are defined as having market leverage above (below) median market leverage as of Q4 2011, the quarter prior to the event under study. Differences in means (t-tests) are computed where *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

<table>
<thead>
<tr>
<th></th>
<th>High Leverage</th>
<th>Low Leverage</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 2012 Net Acquisitions (Dispositions)</td>
<td>-6.61%</td>
<td>1.54%</td>
<td>-8.15%**</td>
</tr>
<tr>
<td>(2) 2012 and 2013 Net Acquisitions (Dispositions)</td>
<td>-6.91%</td>
<td>3.93%</td>
<td>-10.84%**</td>
</tr>
</tbody>
</table>
Table 8. Placebo Test: Hedging and Capital Expenditures
This table reports firm-level regressions which measure the change in investment activity for treatment (Canadian) firms in response to a placebo event which occurs in Q4 2010. The placebo event quarter Q4 2010 corresponds to the closest placebo time period prior to the basis risk shock in Q1 2012 while avoiding the post-placebo event window to overlap with the true event under study. The dependent variable is capital expenditures scaled by beginning of quarter assets. Firm quarter level observations are aggregated into two separate time periods, one for the average Tobin's Q in the quarters prior to the placebo event (Q4 2009 to Q3 2010) and one for average Tobin's Q in the quarters after the placebo event (Q1 2011 to Q4 2011). The resulting dataset has two time periods for a firm, one for the time period before the placebo treatment and one for the time period after the placebo treatment. U.S. oil producers serve as the control group. High (respectively low) leverage firms are firms with above (respectively below) median market leverage as of Oct 31, 2010. All indicator variables are defined in Table 4. The PostPlacebo indicator variable indicates a post-placebo event observation. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[
I/K_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPlacebo}_i + \beta_3 \text{PostPlacebo}_i \times \text{CA Dummy}_i + \text{FirmFE}_i + \epsilon_{i,t}
\]

\[
I/K_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPlacebo}_i + \beta_3 \text{PostPlacebo}_i \times \text{CA Dummy}_i + \beta_4 \text{High Leverage}_i + \beta_5 \text{High Leverage}_i \times \text{PostPlacebo}_i + \beta_6 \text{High Leverage}_i \times \text{CA Dummy}_i + \beta_7 \text{High Leverage}_i \times \text{PostPlacebo}_i \times \text{CA Dummy}_i + \text{FirmFE}_i + \epsilon_{i,t}
\]

<table>
<thead>
<tr>
<th>Dependent Variable = Capital Expenditures/Assets</th>
<th>Pre-Period = [Q4 2009 to Q3 2010], Post-Period = [Q1 2011 to Q4 2011]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>(\beta_1) Canada Dummy_i</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>(\beta_2) PostPlacebo_i</td>
<td>0.024***</td>
</tr>
<tr>
<td></td>
<td>[3.96]</td>
</tr>
<tr>
<td>(\beta_3) Canada Dummy_i \times PostPlacebo_i</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>[-1.16]</td>
</tr>
<tr>
<td>(\beta_4) High Leverage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>(\beta_5) High Leverage \times PostPlacebo_i</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>[0.10]</td>
</tr>
<tr>
<td>(\beta_6) High Leverage \times Canada Dummy_i</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>(\beta_7) High Leverage \times Canada Dummy_i \times PostPlacebo_i</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>[0.49]</td>
</tr>
<tr>
<td>FirmFE_i</td>
<td>Yes</td>
</tr>
<tr>
<td>R^2 Within</td>
<td>0.144</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>145</td>
</tr>
</tbody>
</table>
### Table 9. Placebo Test: Hedging and Firm Value

This table reports firm-level regressions which measure the change in firm value for treatment (Canadian) firms in response to a placebo event which occurs in Q4 2010. The placebo event quarter Q4 2010 corresponds to the closest placebo time period prior to the basis risk shock in Q1 2012 while avoiding the post-placebo event window to overlap with the true event under study. The dependent variable is Tobin's Q. Firm quarter level observations are aggregated into two separate time periods, one for the average Tobin's Q in the quarters prior to the placebo event (Q4 2009 to Q3 2010) and one for average Tobin's Q in the quarters after the placebo event (Q1 2011 to Q4 2011). The resulting dataset has two time periods for a firm, one for the time period before the placebo treatment and one for the time period after the placebo treatment. U.S. oil producers serve as the control group. High (respectively low) leverage firms are firms with above (respectively below) median market leverage as of Oct 31, 2010. All indicator variables are defined in Table 4. The PostPlacebo indicator variable indicates a post-placebo event observation. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[ Q_{it} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPlacebo}_t + \beta_3 \text{PostPlacebo}_t \times \text{CA Dummy}_i + \beta_4 \text{High Leverage}_i + \beta_5 \text{High Leverage}_i \times \text{PostPlacebo}_t + \beta_6 \text{High Leverage}_i \times \text{CA Dummy}_i + \beta_7 \text{High Leverage}_i \times \text{CA Dummy}_i \times \text{PostPlacebo}_t + \text{FirmFE}_i + \varepsilon_{it} \]

<table>
<thead>
<tr>
<th>Dependent Variable = Tobin's Q</th>
<th>Pre-Period = [Q4 2009 to Q3 2010], Post-Period = [Q1 2011 to Q4 2011]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
</tr>
<tr>
<td>(\beta_1) Canada Dummy_i</td>
<td></td>
</tr>
<tr>
<td>(\beta_2) PostPlacebo_t</td>
<td>0.040</td>
</tr>
<tr>
<td></td>
<td>[0.88]</td>
</tr>
<tr>
<td>(\beta_3) Canada Dummy_i \times PostPlacebo_t</td>
<td>-0.014</td>
</tr>
<tr>
<td></td>
<td>[-0.21]</td>
</tr>
<tr>
<td>(\beta_4) High Leverage_i</td>
<td></td>
</tr>
<tr>
<td>(\beta_5) High Leverage_i \times PostPlacebo_t</td>
<td></td>
</tr>
<tr>
<td>(\beta_6) High Leverage_i \times Canada Dummy_i</td>
<td></td>
</tr>
<tr>
<td>(\beta_7) High Leverage_i \times Canada Dummy_i \times PostPlacebo_t</td>
<td>0.120</td>
</tr>
<tr>
<td>FirmFE_i</td>
<td>Yes</td>
</tr>
<tr>
<td>R^2 Within</td>
<td>0.013</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>146</td>
</tr>
</tbody>
</table>

Absorbed by FirmFE_i
Table 10. Placebo Test: Effect of Negative Macro Oil Price Shock and Capital Expenditures

This table reports firm-level regressions which measure the change in investment activity for treatment (Canadian) firms in response to a negative macro oil price shock that occurs in Q3 and Q4 2008. The dependent variable is capital expenditures scaled by beginning of quarter assets. Firm quarter level observations are aggregated into two separate time periods, one for the average investment in the quarters prior to the negative macro oil price shock (Q3 2007 to Q2 2008) and one for average investment in the quarters after the negative macro oil price shock (Q1 2009 to Q4 2009). The resulting dataset has two time periods for a firm, one for the time period before the negative macro oil price shock and one for the time period after the negative macro oil price shock. U.S. oil producers serve as the control group. High (respectively low) leverage firms are firms with above (respectively below) median market leverage as of June 30, 2008. All indicator variables are defined in Table 4. The PostPriceShock indicator variable indicates a post-macro oil price shock observation. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[
\frac{I}{K}_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPriceShock}_t + \beta_3 \text{PostPriceShock}_t \times \text{CA Dummy}_i + \text{FirmFE}_i + \epsilon_{i,t}
\]

\[
\frac{I}{K}_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPriceShock}_t + \beta_3 \text{PostPriceShock}_t \times \text{CA Dummy}_i + \beta_4 \text{High Leverage}_i + \beta_5 \text{High Leverage}_i \times \text{PostPriceShock}_t + \beta_6 \text{High Leverage}_i \times \text{CA Dummy}_i + \beta_7 \text{High Leverage}_i \times \text{CA Dummy}_i \times \text{PostPriceShock}_t + \text{FirmFE}_i + \epsilon_{i,t}
\]

<table>
<thead>
<tr>
<th>Dependent Variable = Capital Expenditures/Assets</th>
<th>Pre-Period = [Q3 2007 to Q2 2008], Post-Period = [Q1 2009 to Q4 2009]</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Firms</td>
<td>High Leverage</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>((\beta_1)) Canada Dummy, Absorbed by FirmFE</td>
<td></td>
</tr>
<tr>
<td>((\beta_2)) PostPriceShock, -0.041***</td>
<td>-0.044***</td>
</tr>
<tr>
<td>[ -5.16]</td>
<td>[ -4.42]</td>
</tr>
<tr>
<td>((\beta_3)) Canada Dummyi * PostPriceShock, 0.017*</td>
<td>0.028**</td>
</tr>
<tr>
<td>[1.78]</td>
<td>[2.32]</td>
</tr>
<tr>
<td>((\beta_4)) High Leverage, Absorbed by FirmFE</td>
<td></td>
</tr>
<tr>
<td>((\beta_5)) High Leverage, -0.007</td>
<td></td>
</tr>
<tr>
<td>[ -0.45]</td>
<td></td>
</tr>
<tr>
<td>((\beta_6)) High Leverage, * Canada Dummy, 0.022</td>
<td></td>
</tr>
<tr>
<td>[1.16]</td>
<td></td>
</tr>
<tr>
<td>FirmFE, Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R² Within</td>
<td>0.512</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>106</td>
</tr>
<tr>
<td>High Lev Canadian Firms Post vs. Low Lev Canadian Firms Post ((\beta_3 + \beta_7))</td>
<td>0.014</td>
</tr>
</tbody>
</table>
Table 11. Placebo Test: Effect of Negative Macro Oil Price Shock and Firm Value
This table reports firm-level regressions which measure the change in investment activity for treatment (Canadian) firms in response to a negative macro oil price shock that occurs in Q3 and Q4 2008. The dependent variable is capital expenditures scaled by quarter assets. Firm quarter level observations are aggregated into two separate time periods, one for the average investment in the quarters prior to the negative macro oil price shock (Q3 2007 to Q2 2008) and one for average investment in the quarters after the negative macro oil price shock (Q1 2009 to Q4 2009). The resulting dataset has two time periods for a firm, one for the period before the negative macro oil price shock and one for the period after the negative macro oil price shock. U.S. oil producers serve as the control group. High (respectively low) leverage firms are firms with above (respectively below) median market leverage as of June 30, 2010. All indicator variables are defined in Table 4. The PostPriceShock indicator variable indicates a post-macro oil price shock observation. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[ Q_{i,t} = \alpha + \beta_1 CA\ Dummy_{i,t} + \beta_2 PostPriceShock_{i,t} + \beta_3 PostPriceShock_{i,t} * CA\ Dummy_{i,t} + FirmFE_{i,t} + \epsilon_{i,t} \]

\[ Q_{i,t} = \alpha + \beta_1 CA\ Dummy_{i,t} + \beta_2 PostPriceShock_{i,t} + \beta_3 PostPriceShock_{i,t} * CA\ Dummy_{i,t} + \beta_4 High\ Leverage_{i,t} \\
+ \beta_5 High\ Leverage_{i,t} * PostPriceShock_{i,t} + \beta_6 High\ Leverage_{i,t} * CA\ Dummy_{i,t} + \beta_7 High\ Leverage_{i,t} * CA\ Dummy_{i,t} * PostPriceShock_{i,t} + FirmFE_{i,t} + \epsilon_{i,t} \]

**Dependent Variable = Tobin’s Q**

<table>
<thead>
<tr>
<th></th>
<th>Pre-Period = [Q3 2007 to Q2 2008]</th>
<th>Post-Period = [Q1 2009 to Q4 2009]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
<td>High Leverage</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>( \beta_1 ) Canada Dummy_{i,t}</td>
<td>Absorbed by FirmFE_{i,t}</td>
<td>0.008</td>
</tr>
<tr>
<td>( \beta_2 ) PostPriceShock_{i,t}</td>
<td>-0.363***</td>
<td>-0.371***</td>
</tr>
<tr>
<td></td>
<td>[-6.56]</td>
<td>[-4.87]</td>
</tr>
<tr>
<td>( \beta_3 ) Canada Dummy_{i,t} * PostPriceShock_{i,t}</td>
<td>0.054</td>
<td>0.067</td>
</tr>
<tr>
<td></td>
<td>[0.77]</td>
<td>[0.82]</td>
</tr>
<tr>
<td>( \beta_4 ) High Leverage_{i,t}</td>
<td>-0.017</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FirmFE_{i,t}</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R² Within</td>
<td>0.649</td>
<td>0.765</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>110</td>
<td>54</td>
</tr>
</tbody>
</table>

Absorbed by FirmFE_{i,t}
Table 12. Hedging and Capital Expenditures (Similar Oil Prices in Pre and Post Period)

This table reports firm-level regressions that measure the change in investment activity for treatment (Canadian) firms. The treatment is defined as a loss in hedging effectiveness due to a significant increase in basis risk for Canadian light oil producers as of Q1 2012. U.S. light oil producers serve as the control group. The dependent variable is capital expenditures scaled by beginning of quarter assets. Firm quarter level observations are aggregated into two separate time periods, one for the average investments in the four quarters prior to the loss of effective hedging instruments, (Q3 2010 to Q2 2011) and one for after (Q2 2012 to Q1 2013). The pre-period window is shifted back by two quarters relative to Table 4. This new comparison is made such that oil prices in the pre and post period are similar (1.7% difference). The resulting dataset has two time periods per firm, one for the time period before the loss of hedging instruments by treatment (Canadian) firms and one for the time period after the loss of hedging instruments by treatment (Canadian) firms. All indicator variables are defined in Table 4. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[
\frac{I}{K_i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPlacebo}_i + \beta_3 \text{PostPlacebo}_i \times \text{CA Dummy}_i + \text{FirmFE}_i + \epsilon_{i,t}
\]

\[
\frac{I}{K_i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPlacebo}_i + \beta_3 \text{PostPlacebo}_i \times \text{CA Dummy}_i + \beta_4 \text{High Leverage}_i + \beta_5 \text{High Leverage}_i \times \text{PostPlacebo}_i + \beta_6 \text{High Leverage}_i \times \text{CA Dummy}_i + \beta_7 \text{High Leverage}_i \times \text{CA Dummy}_i \times \text{PostPlacebo}_i + \text{FirmFE}_i + \epsilon_{i,t}
\]

<table>
<thead>
<tr>
<th>Dependent Variable = Capital Expenditures/Assets</th>
<th>Pre-Period = [Q3 2010 to Q2 2011], Post-Period = [Q2 2012 to Q1 2013]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
</tr>
<tr>
<td>((\beta_1)) Canada Dummy_i</td>
<td>Absorbed by FirmFE_i</td>
</tr>
<tr>
<td>((\beta_2)) PostPlacebo_i</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>[0.72]</td>
</tr>
<tr>
<td>((\beta_3)) Canada Dummy_i \times PostPlacebo_i</td>
<td>-0.032***</td>
</tr>
<tr>
<td></td>
<td>[-2.81]</td>
</tr>
<tr>
<td>((\beta_4)) High Leverage_i</td>
<td>Absorbed by FirmFE_i</td>
</tr>
<tr>
<td>((\beta_5)) High Leverage_i \times PostPlacebo_i</td>
<td>0.028*</td>
</tr>
<tr>
<td></td>
<td>[1.67]</td>
</tr>
<tr>
<td>((\beta_6)) High Leverage_i \times Canada Dummy_i</td>
<td>Absorbed by FirmFE_i</td>
</tr>
<tr>
<td>((\beta_7)) High Leverage_i \times Canada Dummy_i \times PostPlacebo_i</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FirmFE_i</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>R^2 Within</td>
<td>0.138</td>
<td>0.287</td>
<td>0.088</td>
<td>0.174</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>158</td>
<td>78</td>
<td>80</td>
<td>158</td>
</tr>
</tbody>
</table>
Table 13. Hedging and Firm Value (Similar Oil Prices in Pre and Post Period)

This table reports firm-level regressions that measure the change in firm value for treatment (Canadian) firms. The treatment is defined as a loss in hedging effectiveness due to a significant increase in basis risk for Canadian light oil producers as of Q1 2012. U.S. light oil producers serve as the control group. Firm value is proxied by Tobin's Q. Firm quarter level observations are aggregated into two separate time periods, one for the average Tobin's Q in the four quarters prior to the loss of effective hedging instruments, (Q3 2010 to Q2 2011) and one for after (Q2 2012 to Q1 2013). The pre-period window is shifted back by two quarters relative to Table 4. This new comparison is made such that oil prices in the pre and post period are similar (1.7% difference). The resulting dataset has two time periods per firm, one for the time period before the loss of hedging instruments by treatment (Canadian) firms and one for the time period after the loss of hedging instruments by treatment (Canadian) firms. All indicator variables are defined in Table 4. Standard errors are clustered by firm, with t-statistics reported in brackets below the coefficient estimates. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively.

\[
Q_{i,t} = \alpha + \beta_1 \text{CA Dummy}_i + \beta_2 \text{PostPlacebo}_i + \beta_3 \text{PostPlacebo}_i \times \text{CA Dummy}_i + \beta_4 \text{High Leverage}_i + \beta_5 \text{High Leverage}_i \times \text{PostPlacebo}_i + \beta_6 \text{High Leverage}_i \times \text{CA Dummy}_i + \beta_7 \text{High Leverage}_i \times \text{CA Dummy}_i \times \text{PostPlacebo}_i + \text{FirmFE}_i + \epsilon_{i,t}
\]

Dependent Variable = Tobin's Q

<table>
<thead>
<tr>
<th></th>
<th>Pre-Period = [Q3 2010 to Q2 2011], Post-Period = [Q2 2012 to Q1 2013]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Firms</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>$\beta_1$ Canada Dummy$_i$</td>
<td></td>
</tr>
<tr>
<td>$\beta_2$ PostPlacebo$_i$</td>
<td>-0.278***</td>
</tr>
<tr>
<td></td>
<td>[-6.34]</td>
</tr>
<tr>
<td>$\beta_3$ Canada Dummy$_i$ * PostPlacebo$_i$</td>
<td>-0.036</td>
</tr>
<tr>
<td></td>
<td>[-0.57]</td>
</tr>
<tr>
<td>$\beta_4$ High Leverage$_i$</td>
<td></td>
</tr>
<tr>
<td>$\beta_5$ High Leverage$_i$ * PostPlacebo$_i$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.226***</td>
</tr>
<tr>
<td></td>
<td>[2.89]</td>
</tr>
<tr>
<td>$\beta_6$ High Leverage$_i$ * Canada Dummy$_i$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_7$ High Leverage$_i$ * Canada Dummy$_i$ * PostPlacebo$_i$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.316**</td>
</tr>
<tr>
<td></td>
<td>[-2.63]</td>
</tr>
<tr>
<td>FirmFE$_i$</td>
<td>Yes</td>
</tr>
<tr>
<td>R² Within</td>
<td>0.530</td>
</tr>
<tr>
<td>N - Total Firm Years</td>
<td>158</td>
</tr>
</tbody>
</table>