Do Nonfinancial Firms Use Financial Assets to Risk-Shift?

Evidence from the 2014 Oil Price Crisis

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Abstract

Using hand-collected data on financial portfolios of firms in the oil industry, we investigate risk-shifting around the 2014 oil crisis. Following the crisis, firms with high leverage, particularly short-term, uncollateralized, and unhedged, substantially increase their investments in risky financial assets, including corporate debt, equity, and mortgage-backed securities. In contrast, they do not invest in riskier real assets, which are more visible, restricted by debt covenants, and carry higher transaction costs and delayed payoffs. Overall, we provide first evidence that distressed firms risk-shift using financial assets camouflaged as cash reserves, highlighting the role of debt maturity, collateral, and hedging in risk-shifting.

1. Introduction

A vast body of theoretical work predicts that firms will invest in riskier projects as they become distressed (Modigliani and Miller (1958), Fama and Miller (1972), Jensen and Meckling (1976), Stiglitz and Weiss (1981), Acharya and Viswanathan (2011), and Della Seta, Morellec, and Zucchi (2019)). Despite the prominence of these theories, the empirical evidence on risk-shifting is mixed. On the one hand, Andrade and Kaplan (1998), Rauh (2009), and Gilje (2016), among others, find that firms do not undertake riskier investments as they become distressed. On the other hand, studies such as Eisdorfer (2008), Becker and Stromberg (2012), and Pryshchepa, Aretz, and Banerjee (2013) identify settings in which distressed firms may increase their risk-taking. Recently, Denes (2018) shows that government leverage in VC funding results in risk-shifting by distressed portfolio firms.

We attempt to shed new light on this topic by extending the literature on risk-shifting in several important ways. First, contrary to prior empirical studies that focus exclusively on real investments, this paper investigates firms' financial investments as a novel conduit for risk-shifting. We argue that financial assets can be better conduits for risk-shifting than real assets. Compared with traditional real assets, financial assets are more liquid, easier to access, and carry substantially lower transaction costs. Furthermore, trading in risky financial assets is less visible, does not require an upfront investment in physical or human capital, and can generate immediate/accelerated payoffs.[1] Finally, financing contracts such as debt covenants that are used to counter managerial agency typically restrict real investment and payout (Chava et al. (2010)); however, they do not restrict nor consider financial investments. In fact, financial assets are typically reported on the balance sheet as corporate cash holdings, and consequently, allow firms to camouflage their risk-shifting as investments in seemingly safe asset classes.

[1] The merit of liquidity and accelerated payoffs is well demonstrated by the actions of Fred Smith, the founder of FedEx, who saved his company in 1971 by gambling its last $5,000 in Las Vegas. The immediate payoffs from his speculative positions, which came at the expense of the company's creditors, allowed FedEx to operate for another week and consequently to this very day.

Second, we highlight the importance of debt maturity in risk-shifting. While prior studies argue that short-term debt can mitigate agency problems by disciplining management (e.g., Calomiris and Kahn (1991) and Leland and Toft (1996)), the roll-over risk of short-term debt also introduces incentives to take risk to improve interim debt repricing and avoid inefficient liquidation (Della Seta, Morellec, and Zucchi (2018)). Short-term debt likely plays a particularly important role in the context of a transitory oil price crisis since it is more likely to become due before the crisis ends.

Third, we investigate the role of collateral in risk-shifting. We argue that collateralized financial leverage is less likely to trigger risk-shifting behavior because collateral prevents wealth transfers from debtholders to equity holders. Specifically, collateral guarantees the value of the debt claims, mitigates information asymmetry between equity holders and debtholders (Besanko and Thakor (1987) and Boot, Thakor and Udell (1991)), and reduces costly monitoring by lenders (Rajan and Winton, 1995). Thus, risk-shifting should occur primarily in highly levered firms with low levels of collateral.

Finally, we provide novel evidence on the role of hedging in weakening risk-shifting incentives. Theory suggests that corporate hedging can effectively mitigate risk and enhance firm value (e.g., Froot et al. (1993), Leland (1998), Chidambaran et al. (2001)). Prior empirical studies, however, do not offer conclusive evidence that hedging matters for firm policies and value (e.g., Guay and Kothari (2003), Jin and Jorion, (2006), Bartram et al. (2011)). In contrast, this paper shows that risk-shifting is an important channel through which hedging can affect corporate policies and outcomes.

The identification strategy exploits the 2014 oil price crisis as a natural quasi experiment. The 2014 oil price drop was an exogenous, market-wide shock that affected the entire oil and gas

industry.[2] As Figure 1 shows, the downward oil price pressure persisted through 2016. In fact, Figure 1 shows that oil prices decreased dramatically by the end of 2016. The rationale for using the crisis is that the substantial drop in oil price reduced operating income across all oil and gas firms. The cash flow squeeze, coupled with high short-term leverage, triggered financial distress at affected firms and created an incentive to risk-shift.

To study the role of financial assets in risk-shifting, we collect information on financial investments following the method of Duchin, Gilbert, Harford, and Hrdlicka (DGHH, 2017). DGHH find that U.S. industrial firms invest heavily in non-cash, risky financial assets (e.g., corporate debt, equity, mortgage-backed securities). We hand-collect data on financial investments for firms in the oil and gas industry from 2012 to 2016. The data are collected by exploiting the 2009 Statement of Financial Accounting Standards (SFAS) No. 157 that requires all firms to report the fair value of major asset classes on their balance sheets. The empirical analyses examine whether levered firms increased their risky financial investments in response to the 2014 oil price crisis.

The empirical setting has two important advantages. First, the relative risk of financial assets can be assessed more precisely ex-ante than the risk of real assets. For instance, it is clear that corporate debt, equity, and mortgage-backed securities are riskier than treasury bonds and notes. In contrast, it is difficult to determine which well exploration is riskier ex-ante. Consequently, most previous studies relied on measures of realized ex-post cash flow volatility (e.g., Eisdorfer (2008),

[2] By the end of 2008, the price of oil had bottomed out at $40. The economic recovery that began the following year sent the price of oil back over $100; it hovered between $100 and $125 until 2014, when it experienced another steep drop to $37. Numerous factors contributed to the 2014 drop in oil prices. On the one hand, overproduction caused an excess supply of oil. Countries such as the U.S. and Canada increased their efforts to produce oil. In the U.S., private companies began extracting oil from shale formations in North Dakota using a process known as fracking. Meanwhile, Canada went to work extracting from Alberta's oil sands, the world's third-largest crude oil reserve. As a result of this local production, the two North American countries were able to cut their oil imports sharply, which put further downward pressure on worldwide oil prices. Moreover, faced with a decision between letting prices continue to drop and ceding market share by cutting production in an effort to send prices upward again, Saudi Arabia kept its production stable, deciding that low oil prices offered more of a long-term benefit than giving up market share. By supporting low oil prices, Saudi Arabia hoped that countries such as the U.S. and Canada would be forced to abandon their costlier production methods, such as fracking, due to a lack of profitability. On the other hand, the demand has declined since 2010. Economies such as China, whose rapid growth and expansion greatly increased demand for oil in the 2000's, began to slow after 2010. Other large emerging economies such as Russia, India and Brazil experienced a similar decline after 2010.

Becker and Stromberg (2012), Pryshchepa, Aretz, and Banerjee (2013), Chen, Strebulaev, Zhang and Xing (2018), and Chen and Strebulaev (2018)). These measures, however, suffer from a look-ahead bias, are not necessarily attributable to risk-taking, and can be driven by omitted variables.

Second, the empirical design mitigates concerns about reverse causality. While losses from risky financial investments have no direct effect on operating performance, losses from risky real investments do affect operating performance. Consequently, studies of real investment struggle to identify the direction of causality, that is, whether deteriorating operating performance results in risky investments or whether risky investments result in deteriorating operating performance. Since financial investments are operating-performance-neutral, this setting is less subject to reverse causality critique.

In the main analyses, we find that risky financial assets increased by $244.65 million, or 51%, on average, among firms with high levels of short-term debt. Consequently, the ratio of risky financial assets to total financial assets increased from 21% in 2013 to 33% in 2016 among firms with high short-term debt, and the ratio of risky financial assets to total book assets increased from 2.2% in 2013 to 4.8% in 2016. The significant economic increase in risky financial assets is also highly statistically significant at conventional levels and continues to hold in difference-in-difference panel regressions that include year and firm fixed effects as well as time-varying firm-level attributes such as expenditures and sales. The results also hold robustly across alternative measures of short-term debt and in subsamples of oil producers.

Overall, these estimates imply that highly levered oil firms gravitated considerably toward riskier financial investments following the oil price crisis. By the end of 2016, their risky financial investments accounted for a nontrivial fraction of both their financial and total operations.

To further address the endogeneity problem associated with risk-taking, we estimate a first-stage regression that identifies exogenous changes in profitability from 2013 to 2016 based on the 2014 oil price shock and use the fitted changes in profitability from the first stage regressions to

explain changes in risk-taking from 2013 to 2016 in the second stage regressions. The estimates suggest that the decline in profitability following the oil price crisis was accompanied by an increase in financial risk-taking at highly levered firms. These results hold across different measures of risky financial assets and are highly statistically significant. They suggest that declines in firm profitability around the oil price crisis played an important role in risk-taking at firms with high short-term debt.

We further confirm the role of distress in financial risk-taking by hand-collecting data on bankruptcy filings in the oil and gas industry following the 2014 oil price crisis. The estimates suggest a significant increase of 25.1% in the ratio of risky financial assets to total financial assets in the year before filing for bankruptcy.

In the second set of analyses, we investigate the role of collateral in corporate risk-shifting. First, we double-sort firms on short-term liabilities and collateral. The estimates suggest that the increase in financial risk-taking at highly levered firms is concentrated in firms with low collateral. At highly levered firms with low levels of collateral, the ratio of risky financial assets to total financial assets increases from 27% in 2013 to 46% in 2016 and the difference is statistically significant at the 1% level. In contrast, at highly levered firms with high levels of collateral, the ratio of risky financial assets to total financial assets only increases from 16% in 2013 to 21% in 2016, and the difference is statistically insignificant at conventional levels.

We obtain similar results in triple difference-in-differences regressions where the key explanatory variable is the triple interaction *Low Collateral x High short-term liabilities x Crisis.* In this setting, which includes year and firm fixed effects, the above term is economically large and has a positive sign, suggesting that risky financial investments increase considerably more at levered firms with low collateral.

We also investigate the role of oil price hedging in risk-shifting by hand-collecting data on firms' derivative hedging positions at the onset of the oil price crisis. In univariate and regression

analyses, we find that the increase in financial risk-taking at highly levered firms is concentrated in unhedged firms. At highly levered unhedged firms, the ratio of risky financial assets to total financial assets increases from 26% in 2013 to 45% in 2016. We obtain similar results in triple difference-in-differences regressions. These findings provide new evidence on the effect of hedging on corporate policies through its role in risk-shifting incentives.

In the final set of analyses, we compare the changes in financial investments and real investments among oil and gas firms after the onset of the oil price crisis. Following Gilje (2016), we hand-collect data on real investment risk from the 10-K disclosures of all publicly traded U.S. domiciled oil and gas firms from 2012 to 2016. We define risky real investment as investment in exploratory wells. Consistent with prior evidence (Gilje (2016)), we do not find that highly levered firms increased their risky real investments following the crisis. The differences between risky real investments in 2012 and in 2016 (measured in dollars or as a percentage of total assets) are mostly negative and statistically insignificant. We find similar results in difference-in-differences regressions that include firm and year fixed effects. These findings indicate that following the oil price crisis, highly levered firms did not risk-shift using their real assets. In fact, the findings are mostly consistent with a reduction in real investment risk, consistent with the evidence in Gilje (2016).

We also investigate the relation between financial risk taking and real investment risk. The results suggest that at firms with high short-term liabilities at the onset of the crisis, higher financial risk-taking is correlated with lower real investment risk. One interpretation of these findings is that distressed firms substitute risky financial investments for risky real investments when facing short-term debt maturities, possibly due to the accelerated payoffs of financial investments relative to real investments. To the extent that real investment is costlier to adjust, this evidence indicates that firms that face lower real investment risk increase their overall risk by investing in risky financial assets.

Overall, we contribute to the existing literature by providing new evidence on corporate risk-shifting along several dimensions. First, we investigate firms' financial investments as an alternative conduit for risk-shifting. As shown by Ang et al. (2006) and Frazzini and Petersen (2014), investments in financial assets with high systematic risk or high idiosyncratic risk lead to lower (and negative) stock returns or lower alphas, respectively. Second, we highlight the importance of collateral and hedging in the incentives to risk-shift. Third, our identification strategy exploits the 2014 oil price crisis as an unexpected exogenous shock to firms' operating performance, thus mitigating concerns about the endogeneity of risk-shifting.

2. Empirical Strategy, Data and Variables

A. Sample

To study risk-shifting around the oil price crisis, the sample period spans a six years window around the onset of the oil price crisis in 2014. The sample period starts in 2011, three years before the onset of the crisis, and ends in 2016, three years after the onset of the crisis. The start of the sample period in 2011 occurs two years after SFAS No. 157 went into effect, requiring all firms to report the fair value of their financial asset classes in their annual 10-K reports.

The empirical analyses focus on the oil and gas industry because it is the only industry that experienced a substantial negative shock since 2009, when SFAS No. 157 went into effect. An additional benefit of studying oil and gas firms is that it also allows us to measure the risk of real investments based on oil wells' risk, as proposed and implemented by Gilje (2016).

To construct the sample, we merge the hand-collected data on financial asset portfolios with both quarterly and annual Compustat data. The quarterly data are used to construct the time-invariant measures of short-term liabilities and collateral as of the onset of the crisis, that is, as of the end of the second quarter of 2014. The annual data are used to construct the time-varying control variables, whose annual frequency matches that of firms' financial asset reporting.

Specifically, we begin constructing the sample with all firms in the oil and gas industry (SIC codes between 1300 and 2999) with nonmissing observations on financial assets and positive total assets from 2011-2016.[3] This procedure yields a sample of 122 distinct oil and gas firms and 732 firm-year observations, which are used in univariate analyses (Tables 1 and 2) to describe the financial asset portfolios around the oil price crisis. For the subsequent multivariate regression analyses, we also require that the other control variables, such as *Market-to-book*, *Profitability*, and *Capital investment*, have nonmissing values. Consequently, we lose 5 firm-year observations, and end up with the final sample that includes 122 distinct oil firms and a total of 727 firm-year observations. We note that detailed variable definitions are given in Appendix A.

B. Empirical Strategy

To analyze the role of financial assets in risk-shifting following the onset of the oil price crisis, we employ a difference-in-differences approach in which we compare the risk of the financial asset portfolio of firms before and after the onset of the crisis as a function of their financial position (short-term debt and collateral), controlling for firm and year fixed effects, as well as observable time-varying firm attributes such as expenditures and sales.

We are mostly interested in studying the role of firms' financial positions (debt and collateral) in risk-shifting during the oil price crisis. Inferences may be confounded, however, if variation in these financial positions as the crisis unfolds is endogenous. To address this concern, we purge our specifications of this variation by using only the firm's financial positions measured at the end of the quarter before the onset of the crisis. Thus, our main framework is akin to an instrumental variables approach. The identifying assumption is that firms did not predict the oil price shock, and therefore, their financial positions before the onset of the crisis are independent of

[3] SIC codes 1300-2999 include the following sub-sectors: oil and gas extraction (1300-1300), crude petroleum and natural gas (1310-1319), natural gas liquids (1320-1329), petroleum and natural gas (1330-1339), petroleum and natural gas (1370-1379), oil and gas field services (1380-1380), drilling oil and gas wells (1381-1381), oil-gas field exploration (1382-1382), oil and gas field services (1389-1389), petroleum refining (2900-2912), and miscellaneous petroleum products (2990-2999).

the ensuing crisis. This empirical design is similar to the empirical design in recent papers such as Almeida, Campello, Laranjeira, and Weisbenner (2012).

More specifically, we calculate firms' short-term liabilities and collateral values as of the end of the second quarter of 2014, just before the onset of the crisis. Short-term liabilities are defined as the ratio of total current liabilities (Compustat item LCTQ) to total assets (Compustat item ATQ). Following Vassalou and Xing (2004) and Campbell, Hilscher, and Szilagyi (2008), we use current liabilities rather than current debt because a firm's financial burden comprises its total financial liabilities and not just debt. To measure a firm's collateral value, we follow the capital structure literature (e.g., Rampini and Viswanathan, 2013) and define collateral as the ratio of physical assets (Compustat item PPNETQ) to total book assets (Compustat item ATQ).

C. Measures of Risky Financial Assets

To study the risk of firms' financial investments, we follow DGHH (2017) and collect data on firms' financial portfolios that comprise: (1) the balance sheet accounts "cash and cash equivalents" and "short-term investments," which constitute Compustat's data item CHE, the standard measure of cash holdings in the literature, and (2) any additional financial assets reported as "long-term investments" or "other assets".

We hand-collect detailed information on the asset classes that constitute firms' financial portfolios from the footnotes of annual reports for all oil and gas firms.[4] To classify the riskiness of firms' financial assets, we follow DGHH (2017) and define safe financial assets as those that fall into the following asset classes: cash, cash equivalents, demand deposits, money market securities, treasury bills, treasury notes and treasury bonds. All other financial assets are considered risky. Restricted assets, deferred executive compensation, and derivative hedging are excluded from the analyses.

[4] Firms do not disclose the asset class information in their quarterly report.

Using these data, we construct three measures of firms' risky financial assets. The first measure is the logarithm of the dollar amount (in $ millions) of risky financial assets:

$$Log\ risky\ financial\ assets\ = log(1 + \ risky\ financial\ assets)$$

This measure is unscaled by a firm's investments or assets, and therefore is unaffected by changes in other firm-level attributes unrelated to its risky financial investments.

The second measure is the ratio of risky financial assets to total financial assets, defined as follows:

$$Risky\ financial\ assets/finanical\ assets = \frac{Risky\ financial\ assets}{Safe\ financial\ assets + \ Risky\ financial\ assets}.$$

This measure captures the percentage of financial investments allocated to risky financial assets. It measures the composition of a firm's total financial asset portfolio, reflecting the relative allocation to both safe and risky assets. As such, an increase in financial risk-taking according to this measure can reflect an increase in risky assets or a decrease in safe assets, holding constant the size of the financial asset portfolio.

The third measure is the ratio of risky financial assets to total book assets:

$$Risky\ financial\ assets/book\ assets = \frac{Risky\ financial\ assets}{Total\ book\ assets}.$$

This measure scales a firm's risky financial assets by its size. It therefore captures the importance of a firm's risky financial assets in its overall operations or value. We caution the reader, however, that one possible concern with this measure is that the value of a firm's total book assets likely declines following the onset of the oil price crisis. Consequently, an increase in the ratio of a firm's risky financial assets to total book assets following the crisis might be driven by a decline in its book assets rather than by an active decision to increase its risky financial asset holdings. Nevertheless, we include this measure in our analyses to provide evidence on the economic importance of risky financial asset holdings.

D. Measures of Risky Real Assets

We construct a measure of firms' risky real assets by hand-collecting data on investment risk from the 10-K reports of the Crude Oil & Natural Gas firms (SIC 1311) in the sample. These data are collected from firms' disclosures on "Costs Incurred in Natural Gas and Oil Exploration and Development, Acquisitions and Divestitures," which provide information related to expenditures on exploratory wells and development wells. Exploratory wells are those drilled to find a new field or to find a new reservoir in a field in which another reservoir has previously produced oil or gas. Development wells are those drilled within the proven area of an oil or gas reservoir to the depth of a stratigraphic horizon known to be productive.

Following Gilje (2016), we categorize all activities associated with exploratory drilling as risky investments. This includes both the capital to drill and the capital to acquire unproven acreage in which to drill. All activities associated with development drilling, which include the drilling of development wells and the acquisition of proven/producing acreage for development drilling are classified as safe investments.

Using these data, we construct three measures of risky real assets investments, which are similar to the measures of risky financial assets discussed above. The first measure is the logarithm of the amount (in $ millions) of risky real assets:

$$Log\ risky\ real\ assets\ = log(1 +\ exploratory\ oil\ wells)$$

The second measure is the ratio of investment in exploratory wells to total investment in wells:

$$Risky\ real\ assets/real\ assets = \frac{Exploratory\ oil\ wells}{Exploratory + development\ wells}$$

The third measure is investment in exploratory wells scaled by the total book assets:

$$Risky\ real\ assets/book\ assets = \frac{Exploratory\ wells}{Total\ book\ assets}$$

F. Summary Statistics

Table 1 presents summary statistics for the sample. Based on Panel A, the dollar amount of risky financial assets ranges from 0 to $30,985 million, with a mean value of $683 million and a median value of $16 million. The ratio of risky financial assets to total financial assets is highly right-skewed, with a mean value of 0.32, and a median value of 0.21. Similarly, the ratio of risky financial assets to total book assets is also right-skewed with a mean value of 0.04 and a median value of 0.01. These values are smaller compared to the risky financial assets of S&P 500 firms reported by DGHH (Mean = 0.40 for the ratio of risky financial assets to total financial assets; Mean = 0.06 for the ratio of risky financial assets to total book assets). This is consistent with the findings of DGHH that larger firms invest more in risky financial assets.

Panel A of Table 1 also provides summary statistics for firms' real investments. The dollar amount of risky real assets (exploratory wells) ranges from 0 to $112,591 million, with a mean value of $84 million and a median value of $731 million. The ratio of exploratory wells to total wells is right-skewed, with a mean value of 0.33 and a median value of 0.24. Similarly, the ratio of risky real assets to total book assets is also right- skewed, with a mean value of 0.09 and a median value of 0.04.

Panel B describes the other variables employed in this study. The ratio of short-term liabilities to total assets has mean and median values of 0.13 and 0.11, respectively. Collateral values of oil and gas firms are relatively high (Mean = 0.69), likely because these are manufacturing firms that rely heavily on fixed assets. The logarithm of total sales (firm size) has mean and median values of 6.53 and 6.59, respectively. Further, the oil and gas firms in our sample are on average profitable (Mean profitability = 0.09) and have Market-to-book ratios close to 1. About half of the oil and gas firms in our sample do not pay dividends, consistent with the findings in prior studies (Brav, Graham, Harvey, and Michaely, 2005). Lastly, total liabilities are, on average, 46% of book assets.

Panel C of Table 1 investigates the covariate balance between low- and high-short-term-liabilities firms at the onset of the crisis, that is, at the end of the second quarter of 2014. Since we sort firms on their short-term liabilities at the onset of the crisis, we first verify that there are significant differences between low- and high-short-term-liabilities firms. As Panel C shows, the difference in short-term liabilities economically large (High minus Low = 0.132) and statistically significant at the 1% level (t-statistic = 11.25). In contrast, the differences across other firm observable firm attributes are small and statistically indistinguishable from zero. These findings suggest that the two sets of firms are observationally identical at the onset of the crisis on all dimensions but the treatment variable – short-term liabilities.

4. Empirical Results

This section studies how the variation in financial positions at the onset of the oil price crisis affects firms' risk-taking behavior. We begin with an analysis of short-term liabilities and financial asset portfolios, proceed with an investigation of the effects of collateral, and conclude with an examination of real investments.

A. Univariate Evidence

We begin our analysis by presenting univariate results on the relation between firms' outstanding short-term liabilities at the onset of the oil price crisis and the riskiness of their financial asset portfolios. Table 2 reports annual average risky financial asset holdings in 2011-2016 across firms with low and high short-term liabilities. Specifically, we sort firms into terciles based on their short-term liabilities at the end of the second quarter of 2014, and label firms in the top tercile as high short-term liabilities firms and firms in the bottom two terciles as low short-term liabilities firms. Panel A corresponds to firms with low short-term liabilities and Panel B corresponds to firms with high short-term liabilities.

The results in Panel A of Table 2 show that firms with low short-term liabilities outstanding at the onset of the oil price crisis did not change their holdings of risky financial assets significantly. Across all three measures of risky financial assets, the differences-in-means from 2013 to 2016 are economically small and change signs. For example, the ratio of risky financial assets to total financial assets has decreased by 4% from 2013 to 2016, whereas the ratio of risky financial assets to total book assets has increased by 1.3%. These differences also are statistically insignificant at conventional levels.

In contrast, the results in Panel B show that firms with high short-term liabilities have increased their risky financial asset holdings substantially. The average investment in risky financial assets has increased from $484 million in 2013 to $728 million in 2016. Similarly, the ratio of risky financial assets to total financial assets has increased by 12.1% from 2013 to 2016, and the ratio of risky financial assets to total book assets has increased by 2.6%. These increases are all highly statistically significant at the 1% level.

Taken together, the univariate evidence suggests that firms that entered the oil price crisis with high levels of short-term debt increased their holdings of risky financial assets substantially. This increase persisted throughout 2016, when oil prices reached their lowest point. These findings provide first evidence that financially distressed firms increased their risk by investing in risky financial assets, consistent with theories of risk-shifting.

B. Multivariate Regression Evidence

Table 3 shows multivariate evidence on the effect of short-term liabilities at the onset of the oil price crisis on the riskiness of financial asset portfolios with a full system of controls and fixed effects. The table provides estimates from difference-in-differences regressions explaining the riskiness of firms' financial asset portfolios. In columns 1-3, the dependent variable is the logarithm of the dollar value of firms' risky financial assets. In columns 4-6, the dependent

variable is the ratio of risky of financial asset to total financial assets. Finally, in columns 7-9, the dependent variable is the ratio of risky financial assets to total book assets. For each dependent variable, we report three regression models with different fixed effects. The first model does not include firm or year fixed effects. The second model includes firm fixed effects. The third model includes both firm and year fixed effects.

The main variable of interest it the interaction term *High short-term liabilities x Crisis*, which captures the effect high outstanding short-term liabilities at the onset of the crisis on the risk of firms' financial asset portfolios following the onset of the crisis. The variable *High short-term liabilities* is an indicator variable that equals 1 for firms in the top tercile on short-term liabilities at the onset of the crisis (Average ratio of short-term liabilities to book assets = 0.221) and 0 for firms in the bottom two terciles (Average ratio of short-term liabilities to book assets = 0.089).

Columns 1-3 show that firms with high outstanding short-term liabilities have increased substantially the dollar amount invested in risky financial assets. The coefficient on *High short-term liabilities x Crisis* is positive and highly statistically significant at the 1% level across all three specifications. The economic magnitudes are highly stable across the different regression models and imply that following the onset of the crisis highly levered firms increased their investments in risky financial assets by 49.6% to 53.0% more compared to unlevered firms. These findings hold even after controlling for unobservable time-invariant differences across firms (firm fixed effects) and macroeconomic time trends (year fixed effects).

In columns 4-6, we consider risky financial assets relative to total financial investments. The findings suggest that highly levered firms have increased the fraction of their financial portfolio invested in risky financial assets by 9.0%-9.5% compared to unlevered firms following the onset of the oil price crisis. These findings are highly statically significant at the 5% level and continue to hold after controlling for firm and year fixed effects. Finally, in columns 7-9, we consider the investment in risky financial assets relative to the total assets of the firm. We find that

highly levered firms have increased their risky financial investments relative to their overall book assets by 1.0%-1.3% compared to unlevered firms. These results hold across the different regression models, and are statically significant at the 5% level except for column 9.

Taken together, the regression results are consistent with theories of risk-shifting at highly levered, distressed firms. They uncover a new channel through which firms increase their risk-taking, which is relatively cheap to execute and unmonitored by creditors and investors.

C. Robustness and Extensions

In Table 4 we provide several robustness tests and extensions. First, in columns 1-3, we replace the indicator variable *High short-term liabilities* with the continuous variable *Short-term liabilities*, defined as the ratio of short-term liabilities to total book assets as of the onset of the oil price crisis at the end of the second quarter of 2014. Second, in column 4-6, we scale short-term liabilities by total liabilities rather than total book assets. The purpose of these analyses is to ensure that the results do not depend on the definition of *High short-term liabilities*. As before, we consider three different measures of risky financial assets as the dependent variables, and, for brevity, only report the results from the most conservative regression model that includes year and firm fixed effects. The key independent variable is the interaction term *Short-term liabilities x Crisis*.

The results in columns 1-6 of Table 4 indicate that firms with higher levels of short-term liabilities invested more in risky financial assets. The interaction term *Short-term liabilities x Crisis* is positive, economically meaningful, and mostly statistically significant across the different specifications. Based on columns 1-3, for example, an increase of one standard deviation in short-term liabilities (Standard deviation = 0.094) corresponds to an increase of 3.95% in the ratio of risky financial assets to total financial assets, and an increase of 0.46% in the ratio of risky financial assets to total book assets. Overall, these findings are consistent with the evidence in Table 3 that firms with the highest level of short-term liabilities at the onset of the crisis increased their investments in risky financial assets during the crisis.

In columns 7-9, we re-estimate the regressions in a subsample of 102 oil producers that exclude large oil firms with diversified operations such as oil refinement. The purpose of these analyses is to investigate whether the results continue to hold after excluding large firms that may vary in their exposure to the oil price crisis and consequently have different degrees of risk-shifting incentives. For instance, operating in oil refinement entails a directionally opposite exposure to oil price declines. Despite the lower test power in the smaller sample of focused oil producers, the results are consistent with the full-sample estimates. Highly levered oil producers have increased the fraction of their financial portfolio invested in risky financial assets by 7.6% compared to unlevered firms following the onset of the oil price crisis.

To further address the endogeneity problem associated with risk-taking and identify the channel through which the oil price crisis induced firms to increase risk-taking, we estimate first-stage regressions that identify exogenous changes in *Profitability* and *Profitability x High short-term liabilities* from 2012 to 2016 based on the 2014 oil price shock and use the fitted changes in from the first stage regressions to explain changes in risk-taking from 2012 to 2016 in the second stage regressions.

These results are shown in Table 5. Columns 1 and 2 report estimates from the first stage regressions. In column 1, the dependent variable is *Profitability*, defined as the Return on Assets (ROA), or the ratio of net income to book assets. The coefficient on the indicator variable *Crisis* is negative and highly statistically and economically significant. Following the onset of the oil price crisis, the ROA of oil and gas firms has decreased, on average, by 19%. This result is highly statistically significant at the 1% level. It suggests that the oil price crisis had a material negative impact on firms' cash flows. In column 2, the dependent variable is *Profitability x High short-term liabilities*. Here, too, the coefficient on the indicator variable *Crisis* is negative and highly statistically and economically significant, suggesting that the oil price crisis had a significant negative effect on the profitability of highly levered firms.

In columns 3-8, we investigate the impact of the negative cash flow shock resulting from the oil price crisis on firms' risk-taking. We regress the three measures of firms' risky financial asset portfolios on the fitted profitability from the first stage and the fitted interaction of profitability with the indicator *High short-term liabilities.* The results indicate that highly levered firms with more negative profitability shocks have increased their holdings of risky financial assets following the onset of the crisis. The coefficients on the interaction term *Predicted profitability x High short-term liabilities* are negative and statistically significant at the 5% or 10% levels. A decline of one standard deviation in profitability at highly-levered firms implies an increase of 24.87% in the ratio of risky financial assets to total financial assets, and an increase of 2.41% in the ratio of risky financial asset to total book assets.

These findings collectively show that the oil price crisis had an economically substantial negative effect on the profitability of oil and gas companies. In response to the cash flow squeeze, levered firms with short-term debt positions exposed to rollover and bankruptcy risks, increased the risk of their financial asset portfolios. These findings are consistent with the predications of risk-shifting theories (e.g., Jensen and Meckling (1976)), providing novel evidence on the role of risky financial assets held by industrial firms in risk-shifting, and highlighting the importance of short-maturity liabilities amid transient cash flow shocks.

In Table 6, we provide direct evidence on the role of distress and subsequent bankruptcy in risk-taking by collecting information on bankruptcy filings of oil and gas companies following the onset of the oil price crisis. We obtain these data from the UCLA-LoPucki Bankruptcy Research Database for a total of 5 bankruptcy filings in 2015 and 16 bankruptcy filings in 2016.

To investigate the role of bankruptcy in risky financial asset holdings, we construct an indicator variable *Bankruptcy* that equals 1 for firms that file for bankruptcy in the subsequent one or two years, respectively, and 0 otherwise. As before, we estimate panel regressions explaining risky financial investments that include time-varying controls and firm and year fixed effects.

Table 6 shows that distressed firms, which end up filing for bankruptcy following the oil price crisis, invest more in risky financial assets. The coefficients on *Bankruptcy* are positive across all measures of risky financial assets and statistically significant in 5 out of the 9 cases. The economic magnitudes are also nontrivial. Future bankruptcy filings imply an increase of 22.9% in the ratio of risky financial assets to total financial assets, and an increase of 0.2% in the ratio of risky financial asset to total book assets with frim and time fixed effects. These findings provide direct evidence that distressed firms used their financial asset portfolios to risk-shift following the onset of the oil price crisis.

D. The Role of Collateral

In this subsection, we investigate the role of collateral in corporate risk-shifting. We argue that collateralized debt is less prone to the agency problem of asset substitution or risk-shifting by borrowers (Jensen and Meckling (1976)). Prior work has shown that collateral mitigates information asymmetry between equity holders and debtholders (Besanko and Thakor (1987) and Boot, Thakor and Udell (1991)), and reduces costly monitoring by lenders (Rajan and Winton, 1995). Consequently, risk-shifting should occur primarily in uncollateralized debt.

In Tables 7 and 8, we introduce collateral into the analyses. Table 7 presents univariate evidence on the role of collateral in risk-shifting by double-sorting firms on short-term debt and collateral. Panel A considers firms with low outstanding short-term debt positions at the onset of the oil price crisis, whereas Panel B considers firms with high outstanding short-term debt positions. Next, each subsample is sorted around the median collateral value, defined as the ratio of tangible assets to total book assets, into two subsamples of low and high collateral value. For each subsample, Table 7 reports the average risky financial asset holdings in each sample year from 2011 to 2016. As before, we consider three measures of risky financial asset holdings based on their dollar value, ratio to total financial asset holdings, and ratio to total book assets.

The estimates in Table 7 suggest that the increase in financial risk-taking at highly levered firms is concentrated in firms with low collateral. At highly levered firms with low levels of collateral, the ratio of risky financial assets to total financial assets increases from 26.7% in 2013 to 46.4% in 2016 and the difference is statistically significant at the 1% level (t-statistic = 3.63). In contrast, at highly levered firms with high levels of collateral, the ratio of risky financial assets to total financial assets only increases from 16% in 2013 to 21% in 2016, and the difference is statistically insignificant at conventional levels (t-statistic = 0.73). We obtain similar results for the other two measures of risky financial asset holdings. The average dollar value of risky financial assets increases significantly by 66.26% from 2013 to 2016 (t-statistic =2.165) at high short-term debt, low-collateral firms. The ratio of risky financial assets to total book assets increases from 3.4% in 2013 to 7.9% in 2016 (t-statistic = 3.141) at these firms. In contrast, risky financial asset holdings do not increase significantly at levered firms with high collateral value or at unlevered firms irrespective of their collateral value.

In Table 8, we present regression evidence on the role of collateral values in corporate risk-shifting. The table provides estimates from triple-differences regressions explaining the riskiness of firms' financial asset portfolios. In columns 1, 4, and 7, the dependent variable is the logarithm of the dollar value of firms' risky financial assets. In columns 2, 5, and 8 the dependent variable is the ratio of risky of financial assets to total financial assets. In columns 3, 6, and 9, the dependent variable is the ratio of risky financial assets to total book assets. The regression models include the set of time-varying controls from the previous tables, as well as different combinations of firm and year fixed effects.

The main variable of interest it the interaction term *High short-term liabilities x Low collateral x Crisis*, which captures the effect of high outstanding short-term liabilities and low collateral values at the onset of the crisis on the risk of firms' financial asset portfolios following the onset of the crisis.

The results in Table 8 suggest that the increase in risky financial assets following the onset of the oil price crisis is concentrated in firms with high outstanding short-term positions and low collateral values. In particular, the interaction term *High short-term liabilities x Low collateral x Crisis* is economically large and has a positive sign across all regression specifications. The point estimates imply an increase of 14.2% in the ratio of risky financial assets to total financial assets, and an increase of 4.7% in the ratio of risky financial asset to total book assets at highly levered firms with low collateral values. These estimates are statistically significant at conventional levels in 6 out of the 9 regression models.[5]

E. The Role of Hedging

In this subsection, we investigate the influence of derivative hedging on corporate risk-shifting. While theory on corporate risk management suggests that hedging can effectively mitigate risk and enhance firm value (e.g., Froot et al. (1993), Leland (1998), Chidambaran et al. (2001)), prior empirical studies do not offer conclusive evidence that hedging matters for firm policies and value (e.g., Guay and Kothari (2003), Jin and Jorion, (2006), Bartram et al. (2011)). We seek to provide novel evidence on an unexplored channel through which hedging can influence incentives, policies, and outcomes in firms, namely the risk-shifting channel. We conjecture that derivative hedging can weaken the incentives to risk-shift by reducing the exposure of highly levered firms to adverse shocks.

To investigate the role of derivative hedging in risk-shifting, we hand-collect detailed data on oil and gas firms' use of oil derivative contracts at the onset of the 2014 oil price crisis. Using these data, we classify the sample firms into hedging and non-hedging firms, and estimate the effect of hedging on risky financial investments in Tables 9 and 10.

[5] In unreported analyses, we obtain similar results in Two-Stage Least Squares regressions. The first-stage regressions identify exogenous changes in *Profitability, Profitability x High short-term liabilities*, and *Profitability x High short-term liabilities x Low collateral* from 2012 to 2016 based on the 2014 oil price shock. The second-stage regressions use the fitted changes in from the first stage regressions to explain changes in risk-taking from 2012 to 2016.

Table 9 presents univariate evidence on the role of hedging in risk-shifting by double-sorting firms on short-term debt and hedging. Panel A considers firms with low outstanding short-term debt positions at the onset of the oil price crisis, whereas Panel B considers firms with high outstanding short-term debt positions. Each subsample is then sorted based on whether or not the firm uses derivatives to hedge oil price risk, and the table reports the average risky financial asset holdings in each subsample year from 2011 to 2016.

The estimates in Table 9 suggest that the increase in financial risk-taking at highly levered firms is considerable larger in unhedged firms. At highly levered unhedged firms, the ratio of risky financial assets to total financial assets increases from 25.8% in 2013 to 44.8% in 2016. In contrast, at highly levered hedged firms, the ratio of risky financial assets to total financial assets only increases from 13.5% in 2013 to 22.1% in 2016.

In Table 10, we present regression evidence on the role of hedging in corporate risk-shifting. The table provides estimates from triple-differences regressions explaining the riskiness of firms' financial asset portfolios. The main variable of interest it the interaction term *High short-term liabilities x No hedging x Crisis*, which captures the effect of high outstanding short-term liabilities and the absence of oil price hedging at the onset of the crisis on the risk of firms' financial asset portfolios following the onset of the crisis.

The results in Table 10 suggest that the increase in risky financial assets following the onset of the oil price crisis is larger in unhedged firms with high outstanding short-term positions. In particular, the interaction term *High short-term liabilities x No hedging x Crisis* is economically nontrivial and has a positive sign across all regression specifications. For instance, the point estimates imply an increase of 8-9% in the ratio of risky financial assets to total financial assets. Note, however, that the estimates are only statistically significant at conventional levels in 4 out of

the 9 regression models.[6]

5. Real Assets

In this section, we investigate the relation between risky financial investments and risky real investments among oil and gas firms after the onset of the oil price crisis. We start by providing univariate evidence on risky real investments during the sample period 2011-2016. These estimates are shown in Table 11.

We consider three measures of risky real assets that are conceptually similar to the three measures of risky financial assets consider in the previous analyses. The first measure, *Log risky real assets*, is the logarithm of the dollar value of firms' investment in exploratory oil wells. The second measure, *Risky real assets/total real assets* is the ratio of firms' investment in exploratory oil wells to their total investment in both exploratory and established wells. The third measure, *Risky real assets/total book assets* is the ratio of firms' investment in exploratory oil wells to their total book assets.

As before, Table 11 sorts the sample firms based on their outstanding short-term liabilities at the onset of the oil price crisis and reports the average investment in risky real assets in each year from 2011 to 2016. In contrast to risky financial investments, Table 11 shows no increase in risky real investments following the onset of the oil price crisis. The differences between average risky real investments in 2013 and 2016 are economically small, flip signs, and are never statistically significant at conventional levels. These results hold true for both sets of firms – those with low outstanding short-term liabilities at the onset of the crisis and those with high outstanding short-term liabilities.

[6] In unreported analyses, we obtain similar results in Two-Stage Least Squares regressions. The first-stage regressions identify exogenous changes in *Profitability, Profitability x High short-term liabilities*, and *Profitability x High short-term liabilities x No Hedging* from 2012 to 2016 based on the 2014 oil price shock. The second-stage regressions use the fitted changes in from the first stage regressions to explain changes in risk-taking from 2012 to 2016.

Table 12 provides multivariate regression evidence on the riskiness of real investments at oil and gas firms following the onset of the 2014 oil price crisis. The table provides estimates from difference-in-differences regressions explaining the riskiness of firms' investments in risky real assets, measured by their investment in exploratory oil wells. In columns 1-3, the dependent variable is the logarithm of the dollar value of firms' risky real investments. In columns 4-6, the dependent variable is the ratio of risky of real investments to total real investments. Finally, in columns 7-9, the dependent variable is the ratio of risky real investments to total book assets. For each dependent variable, we report three regression models with different fixed effects. The first model does not include firm or year fixed effects. The second model includes firm fixed effects. The third model includes both firm and year fixed effects. As before, the main variable of interest it the interaction term *High short-term liabilities x Crisis*. This variable captures the effect high outstanding short-term liabilities at the onset of the crisis on the risk of firms' real investments following the onset of the crisis.

The results in Table 12 show that firms with high outstanding short-term liabilities have not materially changed their investment in risky real assets following the onset of the oil price crisis. While the coefficients on *High short-term liabilities x Crisis* are always negative, they are never statistically significant at conventional levels.

Collectively, the findings suggest that following the oil price crisis, highly levered oil and gas firms increased their risk primarily through risky financial investments rather than risky real investments. There are several reasons why firms would prefer to risk-shift by investing in risky financial assets rather than risky real asset. First, compared with traditional real assets, financial assets are more liquid, easier to access, and carry substantially lower transaction costs. Second, trading in risky financial assets is less visible, does not require an upfront investment in physical or human capital, and can generate immediate/accelerated payoffs. Third, debt covenants typically restrict real investment and payout (Chava et al. (2010)), but do not restrict financial investments.

We also provide descriptive evidence on the relation between investments in risky financial assets and risky real assets. Table 13 provides estimates from triple-differences regressions explaining the riskiness of firms' investments in risky real assets. In columns 1-3, the dependent variable is the logarithm of the dollar value of firms' risky real investments. In columns 4-6, the dependent variable is the ratio of risky real investments to total real investments. Finally, in columns 7-9, the dependent variable is the ratio of risky real investments to total book assets. For each dependent variable, we include the corresponding measure of risky financial investments, and report three regression models that correspond to three different thresholds of short-term liabilities: tope tercile, top quartile, and top quintile. All regression models include year and firm fixed effects.

The main variable of interest it the interaction term *High short-term liabilities x Crisis x Risky financial assets*. This variable captures the relation between investment in risky real assets and risky financial assets during the oil price crisis at firms with high outstanding short-term liabilities at the onset of the crisis. As mentioned above, the indicator variable, *High short-term liabilities*, equals one if a firm's short term liabilities are classified in the top tercile, top quantile and top quintile at the end of the second quarter of 2014.

The results in Table 13 suggest an inverse relation between investments in risky assets and risky financial assets. Across all 9 columns, the triple interaction term *High short-term liabilities x Crisis x Risky financial assets* is negative. It is also statistically significant in 6 of the 9 regressions. Furthermore, as the threshold defining *High short-term liabilities* increases, the relation between risky real investments and risky financial investments becomes more negative, that is, there is more substitution between the two types of risky investments.

These findings indicate that at highly levered firms, higher financial risk-taking is correlated with lower real investment risk, and more so in more highly levered firms. One interpretation of these findings is that firms substitute risky financial investments for risky real

investments, and increasingly so as they face greater short-term debt pressures that require accelerated payoffs. To the extent that real investment is costlier to adjust, this evidence indicates that firms that face lower real investment risk increase their overall risk by investing in risky financial assets. Furthermore, these findings reconcile the predictions of agency models of risk-shifting (Jensen and Meckling (1976)) with the results in Gilje (2016), who shows that distressed firms did not increase their investment in risky real assets (exploratory oil wells). The findings in this paper suggest that distressed firms do in fact increase their risk - they do so through their financial asset portfolio rather than their real investments studies by prior research.

In the final set of analyses, we investigate the effect of risky financial investments on firms' overall risk. If firms substitute risky financial investments for risky real investments, the overall effect on the firm's risk can go either way because the reduction in the riskiness of the real asset portfolio can offset the increase in the riskiness of the financial asset portfolio. Moreover, risky financial investments can eliminate idiosyncratic risk by diversifying the firm's investment portfolio. Under this scenario, the link between risky financial investments and risk-shifting becomes less clear.

We investigate this possibility by estimating the relation between risky financial investments and the firm's overall risk, as measured by the volatility of the firm's cash flows, profitability, or asset growth rates following the onset of the 2004 oil price crisis. These results are presented in Table 14, which report estimates from regressions in which the dependent variable is one of the above measures of the firm's overall risk.

Table 14 shows that across all measures of volatility, higher risky financial investments following the onset of the crisis lead to higher levels of volatility. This result is evident from the positive coefficient on the interaction term *Risky financial assets x Crisis*. The estimates are statistically significant at conventional levels in 7 of the 9 regressions. The economic magnitudes are nontrivial. For example, an increase of one standard deviation in *Risky financial assets/book*

assets leads to an increase of 39.7% in the annualized of cash flows, 0.8% in the annualized volatility of profits, and 1.0% in the annualized volatility of asset growth. Overall, these results suggest that risky financial investments do not reduce overall risk by substituting for risky real investments or by diversifying a firm's holdings portfolio, consistent with their role in corporate risk-shifting.

6. Conclusion

We study how nonfinancial distressed firms use financial securities to increase their risk. Exploiting the 2014 oil price shock as an exogenous negative shock to firm profitability, and hand-collecting detailed data on firms' financial asset portfolios, we find that firms with large outstanding positions of short-term debt, primarily uncollateralized and unhedged, at the onset of the crisis substantially increased their investments in risky financial assets such as corporate bonds, stocks, and mortgage backed securities. In contrast, these firms did not increase their investment in risky real assets such as exploratory oil wells. Thus, while most empirical research on agency problems at distressed firms focused on real investments, often with no or mixed results, our evidence shows that distressed firms take on more risk through their financial asset portfolios.

We put forth several reasons why firms would prefer to risk-shift by investing in risky financial assets rather than risky real assets. First, compared with traditional real assets, financial assets are more liquid, easier to access, and carry substantially lower transaction costs. Second, trading in risky financial assets is less visible, does not require an upfront investment in physical or human capital, and can generate immediate/accelerated payoffs. Third, debt covenants typically restrict real investment and payout, but do not restrict financial investments. Fourth, financial assets are typically reported on the balance sheet as corporate cash holdings, and consequently, camouflage risk-shifting as investments in seemingly safe asset classes.

Our findings have important implications because the financial asset portfolios of nonfinancial firms are large in size, typically opaque, with poor disclosure requirements and little monitoring, and therefore can be used to risk-shift, with the expected detrimental consequences of the agency/moral hazard problem of asset substitution. Our findings suggest that increased disclosure standards and monitoring of corporate financial investments, including through debt covenants, may alleviate concerns about risk-shifting.

Overall, our paper highlights several key factors in corporate risk-shifting. First, it demonstrates that investment in risky financial securities rather than risky real assets can be a preferred conduit for risk-shifting. Second, it highlights the importance of debt maturity in risk-shifting by showing that outstanding, time-pressing short-term obligations rather than long-term obligations trigger risk-shifting behavior. Third, it shows that collateralized debt is significantly less likely to result in risk-shifting at distressed firms. Fourth, it provides one of the first evidence on the role of derivative hedging in curbing risk-shifting. We believe that future empirical work should continue to investigate the role of these three crucial ingredients – financial asset portfolios, debt maturity, collateral value, and derivative hedging – in corporate risk-shifting in other settings.

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Appendix A: Variable Definitions

A.1. Measures of Risky Financial Assets

log(1 + Risky financial assets) = the logarithm of the dollar amount (in millions) of risky financial assets.

Risky financial assets/financial assets = risky financial assets divided by total financial assets (the sum of safe financial assets and risky financial assets).

Risky financial assets/ book assets = risky financial assets divided by total book assets.

A.2. Measures of Risky Real Assets

log(1 + Risky real assets) = the logarithm of the dollar amount (in millions) invested in risky exploratory wells.

Risky real assets/ real assets = investment in risky exploratory wells divided by the total investment in exploratory and development wells.

Risky real assets/book assets = investment in exploratory wells divided by total book assets.

A.3. Other Regression Variables

Short-term liabilities/book assets = current short-term liabilities (Compustat item LCTQ) divided by total book assets (Compustat item ATQ), calculated as of the onset of the oil price crisis in the second quarter of 2014.

High short-term liabilities = an indicator that equals 1 for firms in the top tercile of *Short-term liabilities/book assets* and 0 otherwise.

Crisis = an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016.

Collateral/book assets = physical assets (Compustat item PPNETQ) divided by total book assets (Compustat item ATQ), calculated as of the onset of the oil price crisis in the second quarter of 2014.

Log(sale) = proxy for firm size, calculated as the logarithm of sales (Compustat item Sale).

Profitability = operating income before depreciation (Compustat item OIBDP) divided by lagged total book assets (Compustat item AT).

Market-to-book = the sum of the equity (Compustat items PRCC_F*CSHO) and total debt (Compustat items DLTT + DLC) divided by total book assets (Compustat item AT).

Dividend ratio = cash dividends (Compustat item DVC) divided by total book assets (Compustat item AT).

Capital investment = capital expenditure (Compustat item CAPEX) divided by total book assets (Compustat item AT).

Total liabilities/book assets = total liabilities (Compustat items DLTT + LCT) divided by total book assets (Compustat item AT).

Bankruptcy = an indicator that equals 1 if a firm will go bankrupt in the next two years.

Hedging = an indicator that equals 1 for firms that have oil derivatives contracts in 2014 in SEC 10-K filing (Item 7A in 10-K reports).

Volatility of cash flow = the annualized standard deviation of quarterly operating income percentage growth rates, measured over the 12 quarters (Compustat item OIBDPQ).

Volatility of profitability = the annualized standard deviation of quarterly profits, measured over the 12 quarters.

Volatility of asset growth rates = the annualized standard deviation of quarterly asset percentage growth rates, measured over the 12 quarters (Compustat item ATQ).

Figure 1. Brent Crude Oil Price

This figure plots the Brent crude oil price (USD per barrel) from Jan 2012 to Jan 2017.
(Source: https://www.focus-economics.com/commodities/energy/brent-crude-oil.)

Table 1. Summary Statistics

This table reports summary statistics. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. All variable definitions appear in Appendix A.

Panel A: Risky Assets

Variable	N	Mean	Standard deviation	Min	25th Percentile	Median	75th Percentile	Max
Risky financial assets ($millions)	732	683	3217	0	0.014	16	144	30985
Risky financial assets/financial assets	732	0.320	0.324	0.000	0.003	0.210	0.573	1.000
Risky financial assets/book assets	732	0.037	0.105	0.000	0.000	0.010	0.033	1.000
Risky real assets ($millions)	492	731	5188	0	5	84	412	112591
Risky real assets/real assets	492	0.327	0.307	0.000	0.059	0.237	0.550	1.000
Risky real assets/book assets	492	0.094	0.160	0.000	0.010	0.040	0.112	1.000

Panel B: Firm-level Variables

Variable	N	Mean	Standard deviation	Min	25th Percentile	Median	75th Percentile	Max
Short-term liabilities/book assets	727	0.134	0.087	0.000	0.081	0.113	0.163	0.604
Total liabilities/book assets	727	0.464	1.080	0.000	0.252	0.346	0.435	10.000
Collateral/book assets	727	0.687	0.225	0.000	0.583	0.754	0.868	0.952
Log(sale)	727	6.525	2.567	0.001	5.022	6.594	8.174	12.980
Profitability	727	0.091	0.232	-1.500	0.063	0.134	0.205	0.566
Market-to-book	727	1.328	1.249	0.090	0.768	1.001	1.388	10.000
Capital investment	727	0.164	0.116	0.000	0.065	0.140	0.234	0.432
Dividend ratio	727	0.018	0.036	0.000	0.000	0.000	0.020	0.299
Volatility of cash flow growth	627	5.829	6.176	0.221	1.131	3.908	8.417	31.97
Volatility of profitability	632	0.140	0.160	0.006	0.037	0.076	0.188	0.860
Volatility of asset growth rates	633	0.367	0.296	0.014	0.1465	0.279	0.494	1.588

Panel C: Covariate Balance (2nd Quarter of 2014)

	High short-term liabilities firms		Low short-term liabilities firms			
Variable	Mean	Standard deviation	Mean	Standard deviation	Difference	t-statistics
Short-term liabilities/book assets	0.221	0.094	0.089	0.033	0.132	11.250
Total Liabilities/book assets	0.504	3.016	0.383	2.457	0.121	3.365
Log(sale)	5.652	0.031	5.151	0.028	0.501	0.974
Profitability	0.033	1.512	0.034	0.694	-0.001	-0.178
Market-to-book	1.661	0.013	1.385	0.019	0.276	1.369
Capital investment	0.072	0.062	0.091	0.059	-0.019	-1.635
Dividend ratio	0.008	0.189	0.012	0.184	-0.004	-1.199

Table 2. Univariate Evidence on Short-term Liabilities and Risky Financial Investments

This table presents evidence on the relation between a firm's outstanding short-term liabilities at the onset of the oil price crisis (the second quarter of 2014) and its investments in risky financial assets. Firms in the bottom two terciles of short-term liabilities (measured in the second quarter of 2014) are classified as *Low short-term liabilities* (Panel A) and those in the top tercile are classified as *High short-term liabilities* (Panel B). The table reports annual average investments in risky financial assets for the sample period 2011-2016 as well as a difference-in-means test between 2013 and 2016. T-statistics are reported in brackets. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. All variable definitions appear in Appendix A.

Panel A. Low Short-term Liabilities

Year	2011	2012	2013	2014	2015	2016	2016 - 2013
Risky financial assets($millions)	838 [1.773]	781 [1.942]	755 [1.797]	812 [1.858]	733 [1.780]	565 [1.510]	-190 [-0.648]
Risky financial assets/financial assets	0.344 [9.107]	0.384 [10.239]	0.369 [9.641]	0.394 [9.893]	0.333 [8.524]	0.329 [9.157]	-0.04 [-0.892]
Risky financial assets/book assets	0.041 [3.038]	0.042 [3.077]	0.038 [2.874]	0.041 [3.085]	0.039 [2.949]	0.051 [3.028]	0.013 [1.043]
N of Firms	81	81	81	81	81	81	81

Panel B. High Short-term Liabilities

Year	2011	2012	2013	2014	2015	2016	2016 - 2013
Risky financial assets($millions)	421 [2.678]	441 [2.272]	484 [2.109]	519 [2.286]	734 [1.946]	729 [2.345]	245 [1.966]
Risky financial assets/financial Assets	0.221 [5.211]	0.184 [4.546]	0.212 [5.605]	0.241 [5.789]	0.269 [5.887]	0.334 [7.659]	0.121 [2.705]
Risky financial assets/book assets	0.025 [4.250]	0.022 [3.838]	0.022 [4.665]	0.024 [4.717]	0.032 [3.595]	0.048 [5.506]	0.026 [3.397]
N of Firms	41	41	41	41	41	41	41

Table 3. Regression Evidence on Short-term Liabilities and Risky Financial Investments

This table reports estimates from difference-in-differences regressions on the relation between short-term liabilities and investments in risky financial assets around the 2014 oil price crisis. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. *High short-term liabilities* is an indicator that equals 1 for firms in the top tercile of Short-term liabilities/book assets and 0 otherwise. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

Dependent Variable	Log risky financial assets			Risky financial assets/ financial assets			Risky financial assets/ book assets		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-1.460*** [-2.910]			0.160** [2.180]			0.080* [1.730]		
High short-term liabilities	-0.730* [-1.930]			-0.160*** [-3.410]			<0.001 [-0.470]		
Crisis	-0.380*** [-3.520]	-0.037 [-0.400]		-0.040 [-1.270]	-0.006 [-0.189]		-0.010 [-1.130]	<0.001 [-0.005]	
High short-term liabilities × Crisis	0.530*** [2.850]	0.526*** [2.895]	0.496*** [2.852]	0.090** [2.260]	0.093** [2.223]	0.095** [2.565]	0.010 [1.260]	0.013* [1.814]	0.010 [1.577]
Log(sale)	0.760*** [10.520]	0.237** [2.355]	0.243*** [2.627]	0.030*** [3.490]	-0.001 [-0.054]	-0.001 [-0.031]	<0.001 [-0.870]	-0.001 [-0.229]	-0.001 [-0.278]
Profitability	-1.500*** [-3.730]	-0.157 [-0.659]	0.104 [0.386]	-0.070 [-1.020]	-0.036 [-0.661]	-0.017 [-0.296]	0.030 [1.390]	-0.003 [-0.388]	0.004 [0.567]
Market-to-book	0.070 [0.850]	0.031 [0.595]	0.037 [0.578]	-0.010 [-0.330]	-0.012 [-1.092]	-0.012 [-1.092]	-0.010 [-1.190]	<0.001 [0.201]	0.001 [0.686]
Dividend ratio	8.250* [1.900]	0.306 [0.179]	0.144 [0.078]	2.050** [2.390]	-0.002 [-0.007]	-0.018 [-0.052]	1.270 [1.580]	-0.019 [-0.458]	-0.024 [-0.546]
Capital investment	-1.570 [-1.520]	0.316 [0.581]	0.749 [1.402]	0.030 [0.190]	0.350** [1.993]	0.379** [2.098]	-0.130** [-1.990]	0.004 [0.238]	0.017 [1.162]
Total liabilities	-0.120 [-1.270]	-0.046 [-0.948]	-0.059 [-1.225]	<0.001 [-0.360]	-0.019* [-1.771]	-0.019* [-1.868]	<0.001 [0.170]	-0.001 [-1.219]	-0.001* [-1.811]
N_obs	727	727	727	727	727	727	727	727	727
R^2	0.500	0.904	0.906	0.135	0.667	0.668	0.242	0.936	0.936
Firm FE	N	Y	Y	N	Y	Y	N	Y	Y
Year FE	N	N	Y	N	N	Y	N	N	Y

Table 4. Robustness and Extensions

This table reports robustness tests from panel regressions on the relation between short-term liabilities and investments in risky financial assets around the 2014 oil price crisis. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. In columns 1-3, *Short-term liabilities* are measured as a continuous variable. In columns 4-6, *Short-term liabilities* are scaled by total liabilities rather than total book assets. In columns 7-9, the sample is restricted to a subset of 102 oil and gas producers (sic code from 1300 to 1399). In columns 1, 4, and 7, the dependent variable is *Log risky financial assets*. In columns 2, 5, and 8, the dependent variable is *Risky financial assets/ financial assets*. In columns 3, 6, and 9, the dependent variable is *Risky financial assets/ book assets*. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. All regressions include year and firm fixed effects. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

	Continuous measure of short-term liabilities			Alternative measure of short-term liabilities			Subsample of oil and gas producers		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Short-term liabilities × Crisis	2.456***	0.420***	0.049	0.412**	0.111**	0.009	0.503*	0.076*	0.015
	[2.692]	[3.263]	[1.485]	[2.314]	[2.584]	[1.211]	[1.959]	[1.811]	[1.614]
Log(sale)	0.215*	-0.003	-0.001	0.289***	0.009	0.000	0.301***	0.010	0.001
	[1.946]	[-0.225]	[-0.302]	[3.147]	[0.474]	[-0.017]	[2.868]	[0.464]	[0.331]
Profitability	0.191	0.005	0.005	0.144	-0.008	0.005	0.012	-0.045	0.006
	[0.672]	[0.131]	[0.763]	[0.510]	[-0.130]	[0.645]	[0.043]	[-0.763]	[0.763]
Market-to-book	0.052	-0.007	0.001	0.063	-0.005	0.001	0.037	-0.012	0.001
	[0.789]	[-0.933]	[0.888]	[1.001]	[-0.434]	[1.105]	[0.584]	[-1.085]	[1.082]
Dividend ratio	-0.167	-0.090	-0.021	-0.218	-0.144	-0.031	-1.582	0.042	-0.042
	[-0.097]	[-0.353]	[-0.600]	[-0.141]	[-0.433]	[-0.795]	[-1.355]	[0.087]	[-0.924]
Capital investment	0.645	0.238*	0.015	0.610	0.338**	0.014	0.702	0.333*	0.021
	[1.230]	[1.907]	[1.132]	[1.181]	[1.989]	[1.015]	[1.313]	[1.750]	[1.394]
Total liabilities	-0.055	-0.014*	-0.001*	-0.059	-0.019*	-0.001*	-0.044	-0.018*	-0.001*
	[-1.160]	[-1.951]	[-1.754]	[-1.313]	[-1.851]	[-1.724]	[-0.925]	[-1.767]	[-1.686]
N_obs	727	727	727	727	727	727	605	605	605
R^2	0.906	0.690	0.909	0.9053	0.6703	0.9361	0.9041	0.6691	0.9518
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 5. Two Stage Least Square Regression Evidence

This table reports estimates from two-stage least-squares (2SLS) regressions on the relation between short-term liabilities and investments in risky financial assets around the 2014 oil price crisis. Columns 1-2 estimate a first-stage regression that identifies exogenous changes in profitability from 2012 to 2016 based on the 2014 oil price shock. Columns 3-8 use the fitted changes in profitability from the first stage regressions to explain investments in risky financial assets in the second stage regressions. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. *High short-term liabilities* is an indicator that equals 1 for firms in the top tercile of Short-term liabilities/book assets and 0 otherwise. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

	First Stage		Second Stage					
Dependent Variable	Profitability	Profitability × High short-term liabilities	Log risky financial assets		Risky financial assets/ financial assets		Risky financial assets/ book assets	
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Predicted profitability			-14.793*** [-12.416]	24.116*** [132.767]	-1.033*** [-5.543]	2.050*** [70.182]	-0.091** [-2.373]	0.159*** [31.124]
Predicted profitability × High short-term liabilities				-67.956*** [-30.604]		-5.385*** [-15.600]		-0.436*** [-6.025]
Crisis	-0.189*** [-7.316]	-0.051** [-2.425]						
Log(sale)	0.039** [2.072]	0.038** [2.054]	1.590*** [48.460]	0.826*** [45.457]	0.098*** [15.048]	0.038*** [10.202]	0.010*** [10.127]	0.005*** [9.923]
Market-to-book	-0.026 [-1.090]	-0.037** [-2.040]	-0.323*** [-6.751]	-1.943*** [-21.952]	-0.037*** [-4.220]	-0.165*** [-11.021]	-0.003** [-2.233]	-0.013*** [-4.785]
Dividend ratio	0.217 [0.795]	0.089 [0.447]	8.628*** [6.920]	-6.651*** [-6.249]	0.680*** [3.507]	-0.531*** [-3.151]	0.045 [1.288]	-0.053* [-1.857]
Capital investment	-0.182 [-1.132]	0.057 [0.645]	4.908*** [8.049]	-1.617*** [-3.302]	0.505*** [3.758]	-0.012 [-0.111]	0.051*** [2.801]	0.009 [0.666]
Total liabilities	-0.035 [-1.591]	-0.022* [-1.663]	-0.403*** [-8.608]	-0.955*** [-15.523]	-0.034*** [-4.157]	-0.078*** [-7.430]	-0.003** [-2.228]	-0.006*** [-3.506]
N_obs	727	727	727	727	727	727	727	727
R^2	0.6439	0.6590	0.9052	0.9052	0.7196	0.7196	0.8845	0.8845
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y

Table 6. Bankruptcy

This table reports estimates from panel regressions on the relation between future bankruptcy and investment in risky financial assets around the 2014 oil price crisis. The sample consists of 131 oil and gas firms with nonmissing observations from 2014 to 2016, out of which 21 firms filed for bankruptcy during this period. *Bankruptcy* is an indicator that equals 1 if a firm went bankrupt from 2014-2016 based on bankruptcy data from the UCLA-LoPucki Bankruptcy Research Database. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

Dependent Variable	Log risky financial assets			Risky financial assets/ financial assets			Risky financial assets/ book assets		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-1.428*** [-2.879]			0.177* [1.959]			0.100* [1.951]		
Bankruptcy	0.288 [1.071]	0.852* [1.785]	0.993** [2.189]	0.127* [1.936]	0.218* [1.691]	0.229* [1.793]	-0.015 [-1.409]	-0.001 [-0.125]	0.002 [0.116]
Log(sale)	0.751*** [10.661]	0.009 [0.030]	0.143 [0.451]	0.022** [2.099]	-0.061 [-1.321]	-0.049 [-1.014]	-0.007 [-1.096]	-0.007 [-0.767]	-0.006 [-0.591]
Profitability	-1.398*** [-3.160]	-0.307 [-0.570]	0.088 [0.145]	-0.086 [-0.986]	-0.052 [-0.548]	-0.023 [-0.236]	0.004 [0.222]	-0.007 [-0.510]	0.001 [0.083]
Market-to-book	-0.03 [-0.274]	-0.212 [-1.261]	-0.136 [-0.804]	-0.014 [-0.485]	-0.012 [-0.401]	-0.008 [-0.237]	-0.018 [-1.375]	-0.007 [-1.368]	-0.005 [-1.027]
Dividend ratio	7.72 [1.495]	-1.996 [-0.686]	-1.629 [-0.543]	2.285** [2.250]	-0.416 [-0.624]	-0.388 [-0.561]	1.312 [1.477]	0.064 [0.820]	0.07 [0.838]
Capital investment	-2.842*** [-2.670]	0.002 [0.002]	0.663 [0.678]	-0.139 [-0.728]	0.309 [1.142]	0.353 [1.302]	-0.088* [-1.801]	-0.003 [-0.152]	0.015 [0.654]
Total liabilities	-0.088 [-1.213]	0.03 [0.423]	-0.002 [-0.021]	-0.006 [-0.428]	-0.008 [-0.547]	-0.01 [-0.623]	0.002 [0.539]	0.001 [0.754]	<0.001 [0.119]
N_obs	357	355	355	357	355	355	357	355	355
R^2	0.4936	0.8957	0.8993	0.1035	0.7364	0.7379	0.1996	0.94	0.9408
Firm FE	N	Y	Y	N	Y	Y	N	Y	Y
Year FE	N	N	Y	N	N	Y	N	N	Y

Table 7. Univariate Evidence on the Role of Collateral

This table presents evidence on the relation between a firm's outstanding short-term liabilities and collateral at the onset of the oil price crisis (the second quarter of 2014) and its investments in risky financial assets. Firms in the bottom two terciles of short-term liabilities (measured in the second quarter of 2014) are classified as *Low short-term liabilities* (Panel A) and those in the top tercile are classified as *High short-term liabilities* (Panel B). The firms in each panel are then sorted based on their ratio of *Collateral/book assets*. The table reports annual average investments in risky financial assets for the sample period 2011-2016 as well as a difference-in-means test between 2013 and 2016. T-statistics are reported in brackets. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. All variable definitions appear in Appendix A.

Panel A. Low Short-term Liabilities

	Year	2011	2012	2013	2014	2015	2016	2016 - 2013
High collateral	Risky financial assets($millions)	87 [2.605]	99 [2.485]	111 [2.348]	109 [2.613]	96 [2.542]	106 [2.481]	-4 [-0.095]
	Risky financial assets/ financial assets	0.33 [6.150]	0.374 [7.161]	0.353 [6.432]	0.421 [7.256]	0.334 [6.175]	0.317 [6.297]	-0.036 [-0.495]
	Risky financial assets/ book assets	0.019 [3.016]	0.016 [2.861]	0.015 [2.858]	0.018 [3.041]	0.021 [2.913]	0.045 [1.980]	0.03 [1.403]
	N of Firms	41	41	41	41	41	41	41
Low collateral	Risky financial assets($millions)	1608 [1.698]	1481 [1.843]	1416 [1.682]	1534 [1.753]	1385 [1.678]	1036 [1.373]	-380 [-0.640]
	Risky financial assets/ financial assets	0.358 [6.667]	0.394 [7.236]	0.385 [7.151]	0.367 [6.676]	0.332 [5.812]	0.341 [6.58]	-0.044 [-0.845]
	Risky financial assets/ book assets	0.064 [2.439]	0.068 [2.568]	0.062 [2.373]	0.064 [2.498]	0.057 [2.233]	0.057 [2.271]	-0.005 [-0.418]
	N of Firms	40	40	40	40	40	40	40

Panel B. High Short-term Liabilities

	year	2011	2012	2013	2014	2015	2016	2016 - 2013
High collateral	Risky financial assets($millions)	259 [1.736]	230 [1.628]	225 [1.581]	255 [1.444]	189 [1.327]	226 [1.684]	1 [0.011]
	Risky financial assets/ financial assets	0.197 [3.341]	0.139 [2.560]	0.16 [3.051]	0.145 [3.189]	0.189 [3.581]	0.210 [3.704]	0.050 [0.730]
	Risky financial assets/ book assets	0.021 [2.532]	0.015 [1.864]	0.009 [3.016]	0.009 [2.700]	0.01 [2.767]	0.018 [3.487]	0.009 [2.007]
	N of Firms	21	21	21	21	21	21	21
Low collateral	Risky financial assets($millions)	591 [2.101]	663 [1.801]	756 [1.702]	797 [1.877]	1311 [1.754]	1259 [2.071]	501 [2.165]
	Risky financial assets/ financial assets	0.246 [3.967]	0.231 [3.864]	0.267 [5.011]	0.342 [5.304]	0.352 [4.889]	0.464 [8.599]	0.196 [3.628]
	Risky financial assets/ book assets	0.029 [3.461]	0.029 [3.636]	0.034 [4.270]	0.04 [4.643]	0.054 [3.332]	0.079 [5.647]	0.045 [3.141]
	N of Firms	20	20	20	20	20	20	20

Table 8. Regression Evidence on the Role of Collateral

This table reports estimates from triple-differences regressions on the relation between short-term liabilities, collateral, and investments in risky financial assets around the 2014 oil price crisis. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. *High short-term liabilities* is an indicator that equals 1 for firms in the top tercile of *Short-term liabilities/book assets* and 0 otherwise. *Low collateral* is an indicator that equals 1 for firms in the bottom half of *Collateral/book assets* and 0 otherwise. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

Dependent Variable	Log risky financial assets			Risky financial assets/ financial assets			Risky financial assets/ book assets		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-1.240** [-2.360]			0.190** [2.560]			0.060* [1.770]		
High short-term liabilities	-0.570 [-1.140]			-0.160** [-2.480]			0.020 [1.330]		
Low collateral	-0.110 [-0.260]			-0.020 [-0.270]			0.040* [1.900]		
Crisis	-0.390** [-2.380]			-0.010 [-0.280]			0.010 [1.250]		
High short-term liabilities × Low collateral	-0.390 [-0.500]	-0.508** [-2.514]	-0.471** [-2.256]	<0.001 [0.020]	-0.080* [-1.786]	-0.077 [-1.591]	-0.040 [-1.550]	0.008 [0.816]	0.013 [1.004]
Low collateral × Crisis	0.300 [1.120]	0.193 [0.939]	0.203 [0.843]	0.010 [0.220]	0.028 [0.606]	0.020 [0.285]	-0.020 [-1.400]	-0.003 [-0.514]	-0.014 [-1.315]
High short-term liabilities × Crisis	0.090 [0.460]	-0.065 [-0.491]	-0.06 [-0.330]	-0.050 [-0.770]	-0.032 [-0.854]	-0.041 [-0.615]	-0.030* [-1.900]	-0.006 [-0.913]	-0.019 [-1.298]
High short-term liabilities × Crisis × Low collateral	0.460 [1.260]	0.641* [1.898]	0.598 [1.641]	0.150* [1.870]	0.135* [1.933]	0.142 [1.622]	0.050*** [2.740]	0.037*** [3.103]	0.047*** [2.878]
Log(sale)	0.770*** [10.040]	0.232** [2.230]	0.236** [2.148]	0.030*** [3.100]	-0.007 [-0.336]	-0.008 [-0.336]	-0.010 [-1.100]	-0.003 [-0.523]	-0.005 [-0.682]
Profitability	-1.600*** [-4.080]	-0.144 [-0.607]	0.123 [0.472]	-0.070 [-1.060]	-0.010 [-0.158]	0.005 [0.093]	0.010 [0.640]	-0.009 [-1.102]	0.009 [0.820]
Market-to-book	0.060 [0.740]	0.032 [0.651]	0.038 [0.623]	-0.010 [-0.500]	-0.010 [-0.748]	-0.011 [-0.850]	-0.010 [-1.470]	-0.002 [-0.746]	<0.001 [-0.178]
Dividend ratio	8.060* [1.890]	0.219 [0.129]	0.204 [0.111]	2.020** [2.350]	0.090 [0.273]	0.081 [0.238]	1.280 [1.580]	0.001 [0.021]	0.007 [0.146]
Capital investment	-2.560* [-1.940]	-0.175 [-0.295]	0.131 [0.217]	-0.050 [-0.280]	0.108 [0.586]	0.127 [0.645]	-0.090 [-1.480]	0.010 [0.270]	0.032 [0.689]
Total liabilities	-0.100 [-1.240]	-0.025 [-0.546]	-0.037 [-0.773]	<0.001 [0.150]	-0.012 [-1.025]	-0.012 [-0.999]	<0.001 [0.250]	0.001 [0.917]	<0.001 [-0.290]
N_obs	727	727	727	727	727	727	727	727	727
R^2	0.500	0.904	0.9057	0.138	0.661	0.662	0.232	0.878	0.881
Firm FE	N	Y	Y	N	Y	Y	N	Y	Y
Year FE	N	N	Y	N	N	Y	N	N	Y

Table 9. Univariate Evidence on the Role of Hedging

This table presents evidence on the relation between a firm's outstanding short-term liabilities and hedging at the onset of the oil price crisis (the second quarter of 2014) and its investments in risky financial assets. Firms in the bottom two terciles of short-term liabilities (measured in the second quarter of 2014) are classified as *Low short-term liabilities* (Panel A) and those in the top tercile are classified as *High short-term liabilities* (Panel B). The firms in each panel are then sorted based on whether or not they report using *oil derivatives* contracts in 2014. The table reports annual average investments in risky financial assets for the sample period 2011-2016 as well as a difference-in-means test between 2013 and 2016. T-statistics are reported in brackets. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. All variable definitions appear in Appendix A.

Panel A. Low Short-term Liabilities

	Year	2011	2012	2013	2014	2015	2016	2016 - 2013
Hedging	Risky financial assets($millions)	913 [1.264]	765 [1.448]	704 [1.318]	756 [1.387]	622 [1.350]	180 [2.609]	-523 [-0.973]
	Risky financial assets/ financial assets	0.410 [7.399]	0.446 [8.376]	0.408 [7.644]	0.459 [8.322]	0.377 [7.050]	0.380 [7.410]	-0.027 [-0.421]
	Risky financial assets/ book assets	0.022 [3.779]	0.022 [3.899]	0.020 [3.815]	0.026 [3.814]	0.023 [4.011]	0.042 [2.103]	0.023 [1.098]
	N of Firms	43	43	43	43	43	43	43
No Hedging	Risky financial assets($millions)	791 [1.320]	833 [1.340]	858 [1.283]	918 [1.301]	914 [1.283]	1048 [1.320]	190 [1.463]
	Risky financial assets/ financial assets	0.293 [6.103]	0.330 [6.602]	0.347 [6.490]	0.336 [6.095]	0.307 [5.443]	0.279 [5.768]	-0.068 [-1.112]
	Risky financial assets/ book assets	0.064 [2.324]	0.065 [2.335]	0.061 [2.228]	0.059 [2.176]	0.059 [2.179]	0.064 [2.254]	0.002 [0.174]
	N of Firms	38	38	38	38	38	38	38

Panel B. High Short-term Liabilities

	year	2011	2012	2013	2014	2015	2016	2016 - 2013
Hedging	Risky financial assets($millions)	232 [1.993]	156 [1.916]	130 [1.819]	166 [2.114]	275 [1.305]	338 [1.485]	208 [1.090]
	Risky financial assets/ financial assets	0.145 [3.003]	0.134 [2.682]	0.135 [2.889]	0.128 [3.304]	0.166 [3.305]	0.221 [4.191]	0.086 [1.669]
	Risky financial assets/ book assets	0.022 [2.458]	0.016 [2.122]	0.010 [3.154]	0.011 [2.984]	0.014 [2.538]	0.030 [3.105]	0.019 [2.132]
	N of Firms	22	22	22	22	22	22	22
No Hedging	Risky financial assets($millions)	564 [1.812]	704 [1.749]	806 [1.674]	843 [1.778]	1153 [1.492]	1188 [1.777]	382 [1.819]
	Risky financial assets/ financial assets	0.260 [3.754]	0.208 [3.251]	0.258 [4.427]	0.342 [4.835]	0.342 [4.494]	0.448 [6.969]	0.190 [2.678]
	Risky financial assets/ book assets	0.024 [3.273]	0.026 [2.988]	0.031 [3.609]	0.036 [3.930]	0.047 [2.748]	0.065 [4.554]	0.033 [2.599]
	N of Firms	19	19	19	19	19	19	19

Table 10. Regression Evidence on the Role of Hedging

This table reports estimates from triple-differences regressions on the relation between short-term liabilities, hedging, and investments in risky financial assets around the 2014 oil price crisis. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. *High short-term liabilities* is an indicator that equals 1 for firms in the top tercile of *Short-term liabilities/book assets* and 0 otherwise. *No hedging* is an indicator that equals 1 for firms that have no oil derivatives contracts in 2014 and 0 otherwise. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

Dependent Variable	Log risky financial assets			Risky financial assets/ financial assets			Risky financial assets/ book assets		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-1.340** [-2.480]			0.240*** [3.010]			0.050* [1.670]		
High short-term liabilities	-0.160 [-0.380]			-0.110* [-1.680]			0.040* [1.690]		
No hedging	-0.840* [-1.950]			-0.260*** [-4.030]			0.010 [0.890]		
Crisis	-0.440*** [-2.980]			-0.040 [-1.060]			<0.001 [-0.040]		
High short-term liabilities × No hedging	-0.130 [-0.170]	-5.943*** [-6.190]	-5.776*** [-5.497]	0.180* [1.940]	-0.661*** [-3.495]	-0.655*** [-3.265]	-0.040 [-1.370]	-0.066* [-1.885]	-0.065 [-1.598]
No hedging × Crisis	0.190 [0.960]	-0.085 [-0.797]	-0.095 [-0.516]	0.020 [0.290]	-0.009 [-0.206]	-0.004 [-0.062]	-0.010 [-0.920]	-0.003 [-0.471]	-0.007 [-0.687]
High short-term liabilities × Crisis	0.300 [1.330]	0.297* [1.742]	0.280 [1.309]	0.050 [0.800]	0.059 [1.336]	0.064 [1.051]	-0.010 [-1.000]	0.003 [0.478]	<0.001 [-0.029]
High short-term liabilities × Crisis × No hedging	0.340 [0.890]	0.565* [1.663]	0.551 [1.472]	0.080 [1.070]	0.090 [1.279]	0.084 [1.001]	0.030* [1.900]	0.024* [1.833]	0.026* [1.814]
Log(sale)	0.760*** [10.79]	0.216** [2.094]	0.221** [1.999]	0.030*** [3.150]	-0.005 [-0.284]	-0.005 [-0.259]	<0.001 [-0.920]	-0.001 [-0.295]	-0.001 [-0.304]
Profitability	-1.450*** [-3.640]	-0.121 [-0.486]	0.130 [0.468]	-0.050 [-0.720]	-0.028 [-0.495]	-0.010 [-0.178]	0.020 [1.370]	-0.002 [-0.359]	0.004 [0.569]
Market-to-book	0.090 [1.050]	0.034 [0.623]	0.039 [0.576]	-0.010 [-0.510]	-0.011 [-0.972]	-0.011 [-0.959]	-0.010 [-1.430]	<0.001 [0.132]	0.001 [0.492]
Dividend ratio	7.890* [1.810]	-0.073 [-0.048]	-0.203 [-0.121]	1.990** [2.260]	-0.083 [-0.255]	-0.109 [-0.327]	1.300 [1.630]	-0.023 [-0.548]	-0.023 [-0.508]
Capital investment	-1.680 [-1.540]	0.255 [0.466]	0.683 [1.305]	0.020 [0.130]	0.342* [1.968]	0.363** [2.055]	-0.090* [-1.770]	-0.001 [-0.037]	0.015 [1.010]
Total liabilities	-0.110 [-1.130]	-0.039 [-0.744]	-0.052 [-0.983]	<0.001 [-0.260]	-0.018* [-1.705]	-0.018* [-1.765]	<0.001 [0.700]	-0.001 [-0.678]	-0.001 [-1.269]
N_obs	727	727	727	727	727	727	727	727	727
R^2	0.5033	0.9049	0.9068	0.1751	0.6694	0.6706	0.2623	0.9364	0.9373
Firm FE	N	Y	Y	N	Y	Y	N	Y	Y
Year FE	N	N	Y	N	N	Y	N	N	Y

Table 11. Univariate Evidence on Short-term Liabilities and Risky Real Investments

This table presents evidence on the relation between a firm's outstanding short-term liabilities at the onset of the oil price crisis (the second quarter of 2014) and its investments in risky real assets (exploratory wells). Firms in the bottom two terciles of short-term liabilities (measured in the second quarter of 2014) are classified as *Low short-term liabilities* (Panel A) and those in the top tercile are classified as *High short-term liabilities* (Panel B). The table reports annual average investments in risky real assets for the sample period 2011-2016 as well as a difference-in-means test between 2013 and 2016. T-statistics are reported in brackets. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. All variable definitions appear in Appendix A.

Panel A. Low Short-term Liabilities

Year	2011	2012	2013	2014	2015	2016	2016 - 2013
Risky real assets($millions)	2365 [1.158]	376 [3.488]	304 [4.755]	48 [4.606]	226 [4.000]	375 [2.986]	71 [0.619]
Risky real assets/ real assets	0.310 [7.754]	0.339 [8.339]	0.302 [7.587]	0.334 [7.696]	0.272 [6.567]	0.372 [7.584]	0.071 [1.521]
Risky real assets/ book assets	0.073 [5.514]	0.072 [7.721]	0.069 [6.075]	0.079 [6.032]	0.045 [4.964]	0.062 [4.714]	-0.007 [-0.474]
N of Firms	55	55	55	55	55	55	55

Panel B. High Short-term Liabilities

Year	2011	2012	2013	2014	2015	2016	2016 - 2013
Risky real assets($millions)	1154 [2.320]	1213 [2.505]	849 [2.924]	757 [3.095]	472 [2.799]	463 [3.322]	-386 [-1.842]
Risky real assets/ real assets	0.341 [5.637]	0.398 [6.664]	0.334 [6.549]	0.327 [6.045]	0.287 [4.949]	0.336 [5.945]	0.002 [0.039]
Risky real assets/ book assets	0.104 [4.228]	0.125 [4.066]	0.096 [4.786]	0.075 [4.578]	0.061 [4.299]	0.067 [3.327]	-0.030 [-1.209]
N of Firms	27	27	27	27	27	27	27

Table 12. Regression Evidence on Short-term Liabilities and Risky Real Investments

This table reports estimates from difference-in-differences regressions on the relation between short-term liabilities and investments in risky real assets around the 2014 oil price crisis. The sample consists of 82 oil and gas firms with nonmissing observations from 2011 to 2016. *High short-term liabilities* is an indicator that equals 1 for firms in the top tercile of Short-term liabilities/book assets and 0 otherwise. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

Dependent Variable	Log risky real assets			Risky real assets/real assets			Risky real assets/book assets		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-0.680 [-0.990]			0.300*** [2.990]			0.110* [1.810]		
High short-term liabilities	0.200 [0.430]			<0.001 [0.010]			0.070 [1.550]		
Crisis	-0.590*** [-3.980]	-0.169 [-1.242]		0.010 [0.310]	0.031 [0.963]		-0.010 [-0.730]	0.006 [0.593]	
High short-term liabilities × Crisis	-0.330 [-1.160]	-0.280 [-1.079]	-0.134 [-0.525]	-0.050 [-1.010]	-0.044 [-0.959]	-0.020 [-0.459]	-0.030 [-1.520]	-0.028 [-1.260]	-0.022 [-1.026]
Log(sale)	0.760*** [8.380]	-0.048 [-0.326]	0.073 [0.520]	<0.001 [-0.160]	-0.025 [-0.746]	-0.019 [-0.570]	-0.010 [-1.550]	-0.034* [-1.909]	-0.031* [-1.774]
Profitability	-0.330 [-0.550]	1.186*** [2.919]	0.661* [1.804]	-0.050 [-0.540]	0.044 [0.478]	0.125 [1.163]	<0.001 [0.050]	0.038 [1.253]	0.040 [1.031]
Market-to-book	0.260** [2.010]	0.219*** [2.775]	0.143* [1.855]	0.030 [1.170]	0.035** [2.016]	0.034* [1.969]	0.020 [1.100]	0.029 [1.354]	0.027 [1.286]
Dividend ratio	-15.530*** [-4.910]	-5.628* [-1.852]	-5.206 [-1.595]	-2.070*** [-3.460]	-1.917 [-1.451]	-2.002 [-1.512]	-0.620** [-2.320]	-0.475 [-1.141]	-0.486 [-1.144]
Capital investment	2.420** [2.080]	1.493 [1.434]	1.513 [1.534]	0.070 [0.390]	0.030 [0.191]	0.069 [0.420]	0.170** [2.500]	0.059 [0.839]	0.069 [0.895]
Total liabilities	-0.220*** [-2.890]	-0.109 [-0.928]	-0.080 [-0.717]	0.020 [0.740]	0.012 [0.779]	0.009 [0.605]	-0.010 [-1.080]	-0.008 [-1.168]	-0.008 [-1.161]
N_obs	492	492	492	492	492	492	492	492	492
R^2	0.472	0.835	0.846	0.065	0.679	0.686	0.130	0.698	0.700
Firm FE	N	Y	Y	N	Y	Y	N	Y	Y
Year FE	N	N	Y	N	N	Y	N	N	Y

Table 13. The Relation between Risky Financial Assets and Risky Real Assets

This table reports estimates from panel regressions on the relation between short-term liabilities, investments in risky real assets, and investments in risky financial assets around the 2014 oil price crisis. The sample consists of oil and gas firms with nonmissing observations from 2011 to 2016. Across the different columns, *High short-term liabilities* is an indicator that equals 1 for firms in the top tercile, quartile or quintile of Short-term liabilities/book assets, respectively, and 0 otherwise. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. *Risky financial assets* is a continuous variable. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

Dependent Variable	Log risky real assets			Risky real assets/real assets			Risky real assets/book assets		
	Top Tercile	Top Quartile	Top Quintile	Top Tercile	Top Quartile	Top Quintile	Top Tercile	Top Quartile	Top Quintile
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Risky financial assets	-0.105	-0.035	-0.017	0.047	0.039	0.026	-0.313	-0.230	-0.188
	[-0.799]	[-0.300]	[-0.153]	[0.790]	[0.682]	[0.481]	[-1.381]	[-1.086]	[-0.884]
High short-term liabilities × Risky financial assets	0.335	0.367	0.449	-0.185*	-0.228**	-0.225	0.529**	0.680**	0.585*
	[1.584]	[1.620]	[1.650]	[-1.819]	[-2.033]	[-1.562]	[1.996]	[2.160]	[1.905]
High short-term liabilities × Crisis × Risky financial assets	-0.088	-0.140*	-0.197*	-0.135	-0.269**	-0.302**	-0.242*	-0.507**	-0.513**
	[-1.231]	[-1.737]	[-1.675]	[-1.526]	[-2.275]	[-2.142]	[-1.700]	[-2.336]	[-2.465]
Log(sale)	0.073	0.066	0.077	-0.026	-0.024	-0.028	-0.018	-0.017	-0.017
	[0.676]	[0.602]	[0.722]	[-0.932]	[-0.873]	[-0.995]	[-1.449]	[-1.390]	[-1.380]
Profitability	0.727**	0.729**	0.794***	0.136	0.144	0.14.	0.057	0.055	0.056
	[2.464]	[2.478]	[2.765]	[1.449]	[1.566]	[1.488]	[1.511]	[1.467]	[1.507]
Market-to-book	0.091	0.087	0.085	0.024	0.025*	0.026*	0.022	0.022	0.022
	[1.632]	[1.549]	[1.508]	[1.597]	[1.718]	[1.699]	[1.559]	[1.567]	[1.564]
Dividend ratio	-6.658**	-6.697**	-6.691***	-1.500	-1.529	-1.515	-0.564	-0.569	-0.567
	[-2.535]	[-2.621]	[-2.645]	[-1.249]	[-1.273]	[-1.271]	[-1.638]	[-1.646]	[-1.639]
Capital Investment	4.202***	4.132***	4.131***	-0.098	-0.084	-0.079	0.275***	0.272***	0.273***
	[5.370]	[5.301]	[5.351]	[-0.603]	[-0.515]	[-0.486]	[2.825]	[2.789]	[2.795]
Total liabilities	-0.087	-0.090	-0.084	0.002	0.003	0.002	-0.006	-0.006	-0.006
	[-1.139]	[-1.162]	[-1.069]	[0.107]	[0.217]	[0.177]	[-1.209]	[-1.226]	[-1.221]
N_obs	611	611	611	611	611	611	611	611	611
R^2	0.866	0.866	0.867	0.728	0.731	0.730	0.709	0.708	0.709
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 14. Overall Risk

This table provides evidence on the effect of investments in risky financial assets around the 2014 oil price crisis on the firm's overall risk, as measured by the volatility of cash flows (columns 1-3), profitability (columns 4-6), and asset growth (columns 7-9) over the 12 quarters following the onset of the crisis. For each measure of volatility, we report results from 3 separate regressions in which risky financial assets are measured as *Log risky financial assets*, *Risky financial assets/financial assets*, and *Risky financial assets/book assets*, respectively. The sample consists of 122 oil and gas firms with nonmissing observations from 2011 to 2016. *Crisis* is an indicator that equals 0 in 2011-2013 and equals 1 in 2014-2016. All variable definitions appear in Appendix A. The t-statistics [in brackets] are adjusted for heteroscedasticity and clustered by firm. Significance levels are indicated as follows: *=10%, **=5%, ***=1%.

Dependent Variable	Volatility of cash flow growth			Volatility of profitability			Volatility of asset growth rates		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Risky financial assets × Crisis	0.263**	8.494	3.780***	0.007***	0.092	0.076***	0.010**	-0.036	0.095*
	[2.231]	[1.443]	[2.822]	[3.082]	[0.793]	[3.192]	[2.161]	[-0.137]	[1.894]
Log(sale)	1.323*	1.398*	1.074	0.008	0.010	0.003	-0.019	-0.016	-0.023
	[1.880]	[1.920]	[1.657]	[0.505]	[0.637]	[0.230]	[-0.790]	[-0.679]	[-0.981]
Profitability	-0.344	-0.518	-0.405	0.052	0.048	0.050	-0.011	-0.017	-0.014
	[-0.208]	[-0.309]	[-0.249]	[1.448]	[1.376]	[1.383]	[-0.227]	[-0.351]	[-0.294]
Market-to-book	-0.251	-0.226	-0.149	-0.014	-0.013	-0.012	0.004	0.005	0.007
	[-0.779]	[-0.674]	[-0.456]	[-0.690]	[-0.642]	[-0.575]	[0.211]	[0.300]	[0.365]
Dividend ratio	0.722	1.878	2.072	-0.014	0.017	0.018	0.073	0.118	0.119
	[0.118]	[0.310]	[0.331]	[-0.081]	[0.105]	[0.106]	[0.228]	[0.402]	[0.378]
Capital investment	-4.753	-4.393	-4.441	0.038	0.049	0.047	0.038	0.055	0.053
	[-1.260]	[-1.169]	[-1.149]	[0.291]	[0.383]	[0.374]	[0.198]	[0.284]	[0.275]
Total liabilities	-0.006	-0.015	-0.062	0.006	0.005	0.005	-0.025	-0.026	-0.027
	[-0.023]	[-0.055]	[-0.233]	[0.269]	[0.246]	[0.216]	[-1.042]	[-1.050]	[-1.073]
N_obs	627	627	627	632	632	632	633	633	633
R^2	0.610	0.607	0.620	0.663	0.658	0.667	0.710	0.707	0.711
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y