Risk Management with Supply Contracts

Heitor Almeida
University of Illinois, Urbana-Champaign

Kristine Watson Hankins
University of Kentucky

Ryan Williams
University of Arizona

May 2016

Abstract:

Purchase obligations are forward contracts with suppliers. This paper is the first to document that these contracts are a risk management tool and have a material impact on corporate hedging activity. Purchase obligations are used more broadly than traded commodity derivatives, even when firms approach financial distress. Firms that expand their risk management options following the introduction of steel futures contracts substitute financial hedging for purchase obligations. Further, firms that experience a negative shock to bank-provided liquidity increase their use of purchase obligations. This paper shows that firms use purchase obligations to manage risk, and that the availability of financial hedging options is an important determinant of hedging through purchase obligations.

We gratefully acknowledge financial support from the GARP Risk Management Research Award Program. We would like to thank Söhnke M Bartram, Martijn Cremers, Andrea Gamba, Jose-Miguel Gaspar, Gerald Gay, Jayant Kale, Yelena Larkin, Omesh Kini, Harley (Chip) Ryan, Mark Weinstein, and participants at Florida State University, HEC Paris, Ivey School of Business, Lehigh University, the University of Arizona, University of Florida, the University of Southern California Finance Organization and Markets Conference, UK/UT Jim and Jack Conference, LUBRAFIN, and the EFMA meetings for thoughtful comments. We also thank Di Kang for research assistance.

How do firms manage risk? Hedging is potentially beneficial in a world with capital market frictions such as taxes and agency issues (Smith and Stulz, 1985; Froot, Scharfstein, and Stein, 1993). But empiricists have struggled to map the rich theoretical predictions regarding risk management to observed firm hedging behavior. One potential issue is that theory papers often examine "hedging" without specifying how firms hedge (e.g., DeMarzo and Duffie, 1995) while most empirical analysis focuses on traded derivatives usage (e.g., futures) as their proxy for corporate hedging (e.g., Nance, Smith, and Smithson, 1993; Graham and Rogers, 2002).

In this paper, we focus on a common yet overlooked hedging tool – the purchase obligation. Purchase obligations are non-cancelable contracts with suppliers for materials or services, generally over one to three year horizons. Accounting regulations treat a purchase obligation (PO) as an off-balance sheet liability, but it is also a forward contract with properties similar to a tradable derivative. Like a future, it can minimize input price volatility. Moreover, these contracts are not restricted to exchange-traded products and thus are more common than derivatives use. We hand-collect a comprehensive database of the use of purchase obligations and traded derivatives by non-financial Compustat firms and document some key empirical regularities regarding their usage. Of non-financial firms in Compustat during our sample period of 2003–2010, 21.5% use purchase obligations and 15.8% use traded commodity derivatives. Moreover, these purchase obligations are economically significant contracts, averaging 11.8% of total assets and 21.4% of COGS. The contracts have an average length of slightly more than 2 years.

Previous literature focusing on traded derivatives shows that they are used mostly by large, financially strong firms (Mian, 1996; Guay and Kothari, 2003; Purnanandam, 2008), and that usage of traded derivatives decreases as firms approach financial distress (Rampini, Sufi and

Vishwanathan, 2014). Our summary statistics show that these patterns do not hold for purchase obligations. PO users are similar to the median firm in our sample, and the usage of POs does not decrease as firms approach financial distress. These preliminary findings suggest that POs can significantly expand firms' risk management options.

At least some firms recognize that purchase obligations are a substitute for futures contracts. For example, Starbucks reports that 90% of its purchase obligations are green coffee (unroasted coffee beans) purchase commitments, and reports in the Commodity Price Risk section of its 2014 10-K filing:

> "We purchase commodity inputs, including coffee, dairy products and diesel that are used in our operations and are subject to price fluctuations that impact our financial results. We use a combination of pricing features embedded within **supply contracts and financial derivatives to manage our commodity price risk exposure**, such as fixed-price and price-to-be-fixed contracts for coffee purchases." (emphasis added)

However, there are also other reasons why firms use them. For example, supply contracts can help avoid hold-up problems between suppliers and customers (e.g., Williamson, 1985; Joskow, 1987; Costello, 2013; and Williams, 2015). Thus, documenting that POs are broadly used is not sufficient to prove that they have an economically important risk management role.

To identify the risk management role of POs, we explore the introduction of steel futures products on the London Metals Exchange and the Chicago Mercantile Exchange in mid-2008. The availability of steel futures would have no impact on purchase obligation (PO) use if POs are not used for risk management purposes. However, we find that firms with an exposure to steel simultaneously increase their financial hedging and decrease their use of purchase obligations when the new derivative is introduced, relative to a control group of similar firms that do not benefit from the introduction of steel derivatives. To our knowledge, this is the first evidence that purchase obligations are used as a hedging tool.

In addition, we provide cross-sectional evidence on which types of firms respond to the introduction of traded derivatives by adjusting their purchase obligation use. As noted by Rampini and Vishwanathan (2010), firms may refrain from using traded derivatives because of collateral constraints. Consistent with this result, we show that only financially healthy firms respond to the introduction of futures by reducing their reliance in POs. Firms that are closer to financial distress continue to rely on POs even after futures are introduced. We also exploit cross-sectional variation in the costs of using POs. POs may become too expensive or too risky for the downstream firm if suppliers have significant bargaining power or if there is significant settlement risk. Consistent with this intuition, we show that the impact of traded derivatives on POs is stronger when POs are less expensive and safer, and thus more likely to be a viable substitute for traded derivatives.

Our interpretation for these results is that the introduction of steel derivatives causes treated firms to reduce their operational hedging through POs. This interpretation requires us to assume that in the absence of the introduction of new derivatives, treated firms would not have changed their usage of POs relative to control firms. We provide several pieces of evidence that are consistent with this interpretation. Firms with an exposure to steel look similar to control firms prior to the introduction of steel derivatives. Differential growth in usage of POs across treated and control firms arises only in the aftermath of the event, and is not observed around other placebo periods.

This paper also contributes to the growing literature on liquidity management (see, e.g., Almeida et al., 2014). Liquidity management tools such as credit lines and cash can reduce the likelihood of underinvestment as well as expected bankruptcy costs (Nance, Smith, and Smithson, 1993) and thus can provide alternative hedging. Extending this literature, we document that purchase obligations also substitute for liquidity using the failure of a firm's line of credit provider as a shock to liquidity. In this test, we focus on financially healthy borrowers to mitigate the possibility that the firm itself contributed to the line of credit provider's failure. The results support the hypothesis that purchase obligations are a form of risk management which substitute for precautionary liquidity. Following the shock to bank liquidity, affected firms move away from credit lines and increase their reliance on POs. These results are driven by firms which should face lower costs of using POs (low supplier bargaining power) and low settlement risk (financially healthy suppliers).

This substitution between POs and liquidity also hints at the key economic distinction between POs and trade credit. Unlike trade credit, POs are contracted upon *ex-ante* and can provide liquidity insurance to firms. Firms can also try to respond to liquidity shortages by delaying payables with suppliers (financing with trade credit). The problem is that in this case, the supplier needs to agree *ex-post* to extend financing. If the supplier is unwilling to provide financing, the firm may be unable to extend payables or may only be able to do so at a very large cost.[1] Consistent with this intuition, we find that treated firms did not substitute trade credit for bank liquidity following the failure of a credit line provider.

[1] Trade credit does allow a downstream firm to purchase inventory without payment for a very short window, somewhere between 10-60 days generally. This possibility may create a very short term hedge with the explicit repayment/price schedule. However, it does little to insure the downstream firm against future input price volatility.

Demonstrating that forward contracts with suppliers are recognized as a hedging tool contributes to the mounting theoretical and empirical evidence suggesting that traded derivatives are only one part of risk management activity. Guay and Kothari (2003) highlight the limits of financial hedging, stating:

> "…much of the overall risk facing non-financial firms (e.g., operating risks) cannot be managed through the use of standard derivatives contracts written over asset prices such as interest rates, exchange rates, and commodity prices."

Indeed, Guay and Kothari find evidence that traded derivatives usage does not have a large economic impact on firms and note that earlier research focusing only on financial hedging may overlook the potentially important effects of operational hedges. While exchange-traded derivatives may be more efficient than individual forward contracts in the absence of transaction costs (as discussed in Williamson, 1985), the availability of traded derivatives is limited and collateral constraints can limit their use even when they are available (Rampini, Sufi, and Viswanathan, 2014).

Evidence that firms find alternative means to address cash flow volatility also lends support to the models of Smith and Stulz (1985) and Froot, Scharfstein, and Stein (1993), where the goal of risk management is to minimize costly variance. Operational decisions can mimic the benefits of hedging with traded derivatives (Smith and Stulz, 1985; Petersen and Thiagarajan, 2000). Recent papers by Bolton, Chen, and Wang (2011) and Gamba and Triantis (2014) expand the theoretical work in this area while Bonaimé, Hankins, and Harford (2014), Disatnik, Duchin and Schmidt (2014), Hankins (2011), and Hirshleifer (1988) document the operational hedging benefits of specific corporate choices such as payout flexibility, cash, and vertical integration. A key contribution of this paper is to expand the definition of hedging. Firms use purchase obligations with suppliers to manage a variety of input prices and the limited availability of financial hedging options affects the use of purchase obligations.

This paper is organized as follows. Section I develops the main hypotheses that we test. Section II describes our hand-collected data on purchase obligations and traded derivatives use as well as the rest of the panel data used in the analysis. We present summary statistics, including calculations on the extent to which a firm's inputs are hedgeable with traded derivatives. This new measure adds to extant studies examining the determinants of corporate derivatives usage (e.g., Jorion, 1991; Nance, Smith, and Smithson, 1993; Graham and Rogers, 2002).[2] Section III explores the substitution of operational and financial hedging in a natural experiment and presents the placebo tests and graphs of parallel trends. In Section IV, we expand the discussion of risk management and show that purchase obligations also substitute for bank lines of credit. Section V concludes.

I. Theory of Risk Management Alternatives

Central to firm value is the ability to undertake valuable projects and hedging can increase the likelihood that adequate funds exist. However, multiple hedging choices may exist. We develop a simple theoretical framework to understand the substitution between liquidity and operational hedging through purchase obligations, and the effects of the introduction of a new futures contract. This model is presented in Appendix A. In the model, the firm can use POs, futures, or liquidity (cash and credit lines) to manage its exposure to positions such as variation in input prices. The introduction of a new futures contract that expands the firm's risk

[2] Froot and Stein (1998), Allayannis and Weston (2001), Campello et al. (2011), and Perez-Gonzalez and Yun (2013) are examples of other recent papers examining corporate hedging.

management set will then change the usage of purchase obligations (POs), depending on the firm's initial risk management choices.

Three frictions are introduced to this model of risk management substitution. First, firms may face a collateral constraint as in Rampini and Viswanathan (2010). The collateral constraint creates a motivation for hedging, as a negative shock to cash flow may cause inefficient liquidation of the firm's investment. In addition, the collateral constraint affects the firm's choice of which tool it uses for hedging. The key difference between futures and POs (forwards) is that the futures position requires the firm to post collateral initially (at the time the futures position is opened), while the forward contract can be settled *ex-post*.[3] Because of this wedge, hedging through forwards can alleviate the firm's collateral constraint. This mechanism reduces the desirability of futures for financially weak firms, as in Rampini and Viswanathan (2010).

Second, unlike exchange traded derivatives, POs are the product of a bargaining game between customers and suppliers. The surplus of this bargaining game is allocated based on negotiation power (Nash, 1950; Stiglier, 1964), not a market. Some firms will have more or less ability to negotiate favorable terms with their suppliers and this may affect the cost of using POs.

Third, POs contain an element of settlement risk. The treatment of purchase obligations and other supply contracts by bankruptcy courts has varied over time and by circuit court. While the bankruptcy code was expanded in 1982 to protect forward contracts, the safe harbor for counterparties was limited to financial derivatives. Throughout the 2000s, a series of circuit court rulings (including *Mirant*, *Kmart*, and *MBS Management*) left the treatment of purchase

[3] As we show in the model, the ex-post settlement of purchase obligations relies on the supplier's greater ability to extract pledgeable income from the buyer. The trade credit literature relies on a similar rationale to motivate the positive response of trade credit to negative financial shocks (Petersen and Rajan, 1997, Garcia-Appendini and Montoriol-Garriga, 2013, Shenoy and Williams, 2016).

obligations and other executory contracts ambiguous. For example, SunEdison, a semiconductor and solar energy firm, canceled purchase obligation contracts during a restructuring and expected such cancelation to result in at least some litigation.

> "As part of our restructuring activities announced in the fourth quarter of 2011, we provided notice to several of our vendors with whom we had long-term supply contracts that **we will no longer be fulfilling our purchase obligations under those contracts**...We also included in our estimate of losses consideration around whether we believe the obligation will be settled through arbitration, litigation or commercially viable alternative resolutions or settlements." (emphasis added)

Although the circuit courts appear to be shifting toward recognizing standard purchase obligations as protected forward contracts, settlement risk is a potential additional cost of POs relative to financial hedging with exchange-traded products. Like bargaining power, we expect settlement risk to affect the use of purchase obligations.

We derive the following implications from the model:

1. Risk Management Substitution: The introduction of traded derivatives will reduce firms' demand for POs, on average.

2. Collateral: The impact of the introduction of traded derivatives on POs is stronger for firms that are financially stronger and thus better able to post collateral for the futures position. Financially weak firms will not reduce PO usage as much.

3. Expected PO Use: The introduction of traded derivatives will reduce the firm's demand for POs if the cost of using POs is low (settlement risk and supplier bargaining power are low), thus making POs a reasonable hedging option. In contrast, the impact of the introduction of traded derivatives on POs is weaker when the cost of using POs is high (high settlement risk or high supplier bargaining power).

In the empirical tests, we focus mostly on the substitution between traded derivatives and POs since the main goal of the paper is to show that POs have a risk management role. The model does have the additional implication that the introduction of traded derivatives reduces the firm's demand for liquidity when the costs of using POs are high. Rather than trying to measure the impact of traded derivatives on alternative liquidity management tools which has been done in previous literature (Disatnik, Duchin and Schmidt, 2014; and Lee, 2015), we focus on an alternative experiment which can show evidence that POs are a substitute for other liquidity management tools.

Consider a situation in which a firm uses credit lines to manage hedgeable risk. Here the main friction regarding credit lines is that there is a risk that their access will be revoked because of covenant violations. Firms use credit lines to manage liquidity risk when revocation risk is low (Sufi, 2009). However, credit lines are provided by banks and thus rely on the bank's ability to honor drawdowns. A negative shock to bank liquidity can cause firms to lose access to credit lines, and force them to switch to an alternative risk management strategy.

This leads to the following additional implications:

4. Liquidity Management Substitution: A negative shock to bank liquidity will increase firms' demand for POs, on average.

5. Expected PO Use: A negative shock to bank liquidity will not affect the firm's demand for POs if the cost of using PO is high (supplier bargaining power, settlement risk). In contrast, if the cost of using POs is lower and POs are a better hedging option, then a negative shock to bank liquidity is more likely to affect the firm's demand for POs.

II. Purchase Obligations and Risk Management Tools

To examine the role of purchase obligations in risk management, we build a comprehensive database of the use of purchase obligations and traded derivatives by non-financial Compustat firms. We then add data on the firm and supplier characteristics. We describe the construction of our dataset in detail below.

A. Purchase Obligations

A purchase obligation is an executory contract where both parties have not yet performed their duties — neither an asset nor a liability for either party. However, the downstream firm must disclose purchase obligations with other major contractual obligations such as long term debt, capital leases, and operating leases. All firms are required to report these contracts in 10-K filings since December 15, 2003, following SEC requirements related to Sarbanes-Oxley. The only exception is for small businesses with revenues and a public float less than $25 million. Thus, the sample consists of all Compustat firm-years with a year-end between 12/15/2003–12/31/2010 and an available 10-K filing on the SEC's EDGAR site. After excluding financial firms (SIC codes between 6000 and 6999) and firms which switch two digit SIC industries, the eight-year panel dataset consists of 26,430 firm-years.

Firms report up to 5 years of future purchase obligations, but there is a sizable skew in the contracts with the majority due in the following year. The average (median) firm using contracts reports an average contract length of 2.49 years (3 years). The purchase agreements contractually obligate the customer to purchase a fixed or minimum quantity at a fixed, minimum, or variable price from a supplier. Firms with commitments to their suppliers break out the disclosure in a table contained in a footnote, labeled as a separate line item titled "Purchase obligations". As noted above, this line item usually includes the dollar amount of supplier purchase obligations for the subsequent five years, but commitments with variable pricing are omitted. Using the scripting language Perl, we automatically search the contractual obligations footnote in relevant 2003–2010 10-K filings for the "Purchase obligation" line item, and create an indicator variable, *Purchase Obligation*, which equals one for all firms which report purchase obligations, and zero otherwise.[4] More than 21% of all firm-year observations report purchase obligations in their 10-K filings.

Further, we also extract the aggregate dollar amounts of the purchase obligations for the next five years from this footnote and report the dollar amounts under contract scaled by either total assets (Aggregate Contractual Dollar $\text{Amount}_{(t+1,\ t+6)}$/Total Assets_t) or current year cost of goods sold (Aggregate Contractual Dollar $\text{Amount}_{(t+1,\ t+6)}$/$\text{COGS}_t$). The average firm using contracts commits to purchase 12% of its COGS in year *t*+1, 7% in year *t*+2, 5% in year *t*+3, and less than 1% in future years. POs vary by industry as well as by firm. For example, manufacturers can contract on raw material inputs while retailers often contract on merchandise. Finally, although purchase obligations are certainly used by suppliers to prevent hold-up problems (e.g., Williamson, 1985).

B. Traded Derivatives Use and Exposure

Next we collect information on financial hedging, focusing on commodity derivatives to parallel the potential hedging of input prices with purchase obligations. Input and commodity prices are a ‘top ten concern’ for U.S. businesses according to the 2014 Duke / CFO Magazine Business Outlook. Again, we use Perl scripts to collect information on derivatives use and report our search keywords in Appendix B. *Commodity Hedger* is equal to one if a firm reports using commodity derivatives, zero otherwise.[5]

[4] Appendix B provides additional detail on this data collection process.
[5] To ensure that our automated data procedure used to populate Commodity Hedger accurately captures commodity derivatives usage in firms, we compare our data to the hand collected data used in Emm, Gay, and Lin (2007). For the 3,000 firm-years which overlap, over 99% of observations are coded identically. We read the 10-K filing for observations which are inconsistent with Emm, Gay, and Lin (2007). A manual reading of the 10-K filings indicates that the data used in our paper are correctly coded.

As the exposure to commodity prices varies by firm, we also compute *% of Input Traded* to capture the percentage of a firm's input which is traded on financial markets and proxy for the availability of financial hedging. To construct this variable, we start with the 2002 Bureau of Economic Analysis' (BEA) benchmark Input-Output (IO) tables and the November 2009 issue of *Futures* magazine to identify all six-digit Input-Output industries which are traded on a major financial exchange. The industries actively traded on an exchange are listed in Appendix C and steel related industries are listed in bold. *FuturesMarket* is equal to one if the six-digit IO industry output is traded actively on a futures market, zero otherwise. This variable is coded as zero for steel-exposed industries as steel futures are introduced in the middle of the sample and will be examined directly. For each downstream industry in the IO tables, we identify all six-digit upstream industries and weight each upstream industry's *FuturesMarket* value by the percentage of input supplied to each customer industry. Thus, *% of Input Traded* is the weighted sum of all upstream industries' *FuturesMarket* value. We map this weighted-average supplier industry variable from the BEA IO Tables to each firm's two-digit NAICS industry in Compustat. We expect *% of Inputs Traded* to be positively related to *Commodity Derivatives.* We also expect *% of Inputs Traded* to be negatively related to *Purchase Obligation*, as these contracts are the solution to a bargaining game and are on average less efficient than competitive market-based outcomes such as the prices on commodity exchanges (Williamson, 1985). We then calculate *% of Input Steel* using the same methodology as *% of Inputs Traded* using the steel exposed industries listed in Appendix C.

C. Firm and Supplier Variables

We control for a variety of firm characteristics in the multivariate tests. Following Purnanandam (2008), which demonstrates the non-monotonic relationship between debt and risk management, we include both *Market Leverage* (the book value of debt divided by the sum of the market value of equity plus book value of debt) and *Leverage Squared*. Following Nance, Smith, and Smithson (1993), we control for growth options with R&D and sales, and control for liquidity needs and operational hedging with cash and trade credit (e.g., Petersen and Thiagarajan, 2000; Haushalter, Klasa, and Maxwell 2007; Garcia-Appendini and Montoriol-Garriga, 2013; Disatnik, Duchin, and Schmidt, 2014). *R&D Intensity* is defined as a firm's R&D expense divided by total assets while firms which have not reported R&D expenses are assigned a *R&D Intensity* value of zero. *Sales,* defined as sales scaled by total assets, controls for possible demand-side pressures faced by the customer. *Cash* is cash holdings divided by total assets and *Trade Credit* is accounts payable scaled by assets. Finally, we control for capital expenditures and firm size. *CapEx* equals capital expenditures/total assets and *Ln*(*Assets*) is defined as the natural logarithm of total book value of assets.

Section I describes how the use of purchase obligations may vary with bargaining power and settlement risk. While we are unable to identify the specific suppliers or counterparties on a firm's purchase obligations, we can proxy for a firm's supplier landscape using data from the BEA IO tables. This allows us to analyze subsamples based on expected PO usage.

Following Stigler (1964) and Kale and Shahur (2007), we use supplier industry concentration to proxy for bargaining power. We can calculate the *Supplier Industry HHI* for each supplier industry using two-digit NAICS codes and then sales-weight them using the IO tables. For each customer industry, we weight each six-digit supply industry characteristic by the percentage of input they supply to the customer industry according to the "Use" table from the Input-Output tables.

$$SupplierIndustry\ HHI\ =\sum_{\substack{i=1\\ i\neq j}}^{n} Industry\ Input\ Coefficient_{ij}\ \times Industry\ HHI_i$$

where j is the firm's primary six-digit IO industry, and i is the six-digit IO industry for each supplier industry, n is the number of industries which sell inputs to the reference firm, *Industry HHI* is the Herfindahl index of the industry and the *Industry Input Coefficient* is the percentage of industry j's input which comes from industry i. For example: if "Energy" has an HHI of 20% and it supplies 50% of a customer industry's input, and "Retail" has an HHI of 10% and it supplies the other 50% of a customer industry's input, the weighted average supplier Herfindahl index for that customer would be 15%.

This industry level aggregation doesn't yield a precise measure of a firm's bargaining power with each specific supplier but it does provide some perspective on the composition of inputs. If all supplies are sourced from monopolistic industries, we would expect the downstream firm to have little bargaining power and the cost of purchase obligations to be higher, all else equal. The supplier industry concentration is used then to split the sample based on expected bargaining power. *Supplier Bargaining Power* is 'High' if the firm's *Supplier Industry HHI* is above the annual mean and 'Low' is below that threshold. We acknowledge that this is but a rough estimate and we limit its use to straight-forward, cross-sectional predictions of purchase obligation use. Higher *Supplier Bargaining Power* is predicted to correlate with lower use of purchase obligations.

Next, we calculate settlement risk using the sales weighted average of all supplier industry Z-scores. As seen in Section I's SunEdison example, firms in distress may not honor existing purchase obligation contracts. To construct the variable, we first calculate the Z-score

(Altman, 1968) for all firms in Compustat and then aggregate firm-year Z-scores by two-digit NAICS code to construct industry characteristics and define *Industry Z-Score* as the median industry Z-score. Next, we link the industry-year leverage to each six-digit IO industry from the 2002 Input-Output tables from the BEA. We construct *Supplier Z-Score* for each firm in industry *j* as follows:

$$Supplier\ Z-Score\ =\sum_{\substack{i=1\\ i\neq j}}^{n} Industry\ Input\ Coefficient_{ij}\ \times Industry\ Z-Score_{i}$$

where *j* is the firm's primary six-digit IO industry, and *i* is the six-digit IO industry for each supplier industry, *n* is the number of industries which sell inputs to the reference firm, *Industry Z-Score* is the Z-score of the industry and the *Industry Input Coefficient* is the percentage of industry *j*'s input which comes from industry *i*. Again, we identify firms which are more or less likely to use purchase obligations by dividing the sample based on *Supplier Z-Score*. Supplier settlement risk is high if the *Supplier Z-Score* is below the sample mean and low if above that threshold.[6] High settlement risk is predicted to correlate with lower purchase obligation use.

D. Summary Statistics

Table 1 presents summary statistics on the variables described above during the 2003–2010 panel of Compustat (non-financial) firms with the mean, median, and standard deviation for the whole sample as well as the subsample means for purchase obligation users (*PO Users*) and commodity hedgers (*Comm Hedgers*). Of the 26,430 firm-year observations, the use of derivatives and purchase obligations is common (15.8% and 21.5% of firm-year observations, respectively) and some firms use both. Although purchase obligations are used most frequently, risk management choice varies by firm. We also find that the median firm has *% of Inputs*

[66] We cannot use the traditional thresholds for distress here because of the weighting methodology.

Traded of roughly 1% and a mean value of 3.9%, highlighting that a large portion of U.S. non-financial firms' inputs cannot be hedged directly using standard derivative contracts. This is consistent with the evidence from Guay and Kothari (2003).

Separating the sample by risk management choice, Column 4 summarizes the mean variable values for firms which use purchase obligations and Column 5 reports the same for firms which use commodity derivatives. These are not mutually exclusive, however, and some firms use both. The most notable pattern in Table 1 is that firms that use POs are much more similar to the average Compustat firm than firms that use commodity derivatives. Consistent with previous literature, Table 1 shows that traded derivatives users are larger, have higher leverage, lower cash, lower R&D intensity, and higher capital expenditures than the average Compustat firm. The differences are economically large. For example derivatives users hold 7.6% of their assets as cash, while the average is 15.3% for the average Compustat firm. In contrast, PO users are much more similar to the average Compustat firm. For example, PO users hold 14.8% of their assets in cash, on average. They have lower leverage, higher R&D intensity, lower capital expenditures, and are smaller than traded derivatives users.

Table 2 splits the sample based on a proxy for the expected cost of using purchase obligations, specifically using supplier bargaining power and supplier settlement risk. *Supplier Bargaining Power* is 'High' if the *Supplier Herf Index* is above the annual mean. Supplier settlement risk is 'High' if *Supplier Z-Score* is below the annual mean. As expected, hedging with POs appears to be a function of the risk and expense of the contract. Firms are less likely to use purchase obligations and use lower levels, scaled by either Assets or COGS, when *Supplier Bargaining Power* is 'High' and *Supplier Z-Score* is 'Low'. All differences between the two groups are statistically significant.

We next consider when firms use purchase obligations. We examine whether firms initiate or increase purchase obligation contracts as their financial condition worsens using three distress indicators and present these results in Table 3. *Enters Distress* equals one if Altman's (1968) Z score is less than 1.81 and was not below that threshold in the prior year. *Enters Grey Distress* captures a less severe or earlier form of financial deterioration and equals one if Altman's (1968) Z score is less than 2.99 and was not below that threshold in the prior year. Lastly, Petersen and Rajan (1997) point out that the value of the supplier firm consists of future cash flows from customers. Therefore, suppliers may be willing to assist financially distressed but economically viable customers, but avoid more permanently distressed firms. Thus, we also use a variable for financial (but not economic) distress following Andrade and Kaplan (1998). *Enter Fin (not Econ) Distress* equals one if the firm has a positive operating margin but is in distress (as defined by Z-score less than 1.81) and, again, was not distressed by that measure in the prior year. *Enter Econ Distress* equals one if the firm has a Z-score less than 1.81 and a negative operating margin, and was not distressed in the prior year.

The summary statistics in Table 3 indicate that firms adjust their risk management choices as their financial condition deteriorates. Like Rampini, Sufi, and Viswanathan (2014), we document that firms are more likely to stop financial hedging in the earlier stages or grey period of distress. Further, we document these mildly distressed firms also are more likely to report an increase in purchase obligations (measured either as new contracts or the combination of new and increased existing contracts). A similar pattern emerges when looking at firms entering distress or financial (not economic) distress. Firms initiate new purchase obligations at every stage of increasing distress but are most likely to stop financial hedging before entering severe distress. Lastly, we examine the years when firms cease derivatives use and find they are far more likely to start or increase their use of purchase obligations during that time. Finally, firms who enter economic distress are not able to increase POs with suppliers, as presumably suppliers are worried about the customer as a going concern and have reason to doubt that they will continue to receive cash flows from the customer in expectation. Together, these summary statistics provide evidence that firms increase their use of forward contracts with suppliers as they become distressed and are less able to use financial hedging.

III. Substitution of Purchase Obligations and Derivatives

If purchase obligation contracts are a tool for risk management, then the use of POs may affect other risk management decisions as discussed in the model of Section I. The introduction of steel futures provides a natural setting in which to examine risk management substitutions. In this section, we document that firms treat purchase obligations and traded derivatives as alternative hedges for controlling input price volatility.

A. Evidence from the introduction of steel futures

In 2008, steel futures products were introduced on the London Metals Exchange in April and the Chicago Mercantile Exchange in August. Understanding the origination of the steel futures market is important to the validity of the empirical strategy. If the futures were introduced in response to an explicit dissatisfaction with purchase obligations, then this financial innovation would not be exogenous to shifts in firms' demand for purchase obligations. However, this does not appear to be the case. News coverage of the rollout described highly skeptical industry participants expressing concern about speculation. A 2007 GE Industry Research Monitor report asserts, "[M]any steel producers remain reluctant to see the development of a transparent exchange-based pricing system (which invites the bogeyman speculator into the equation), preferring instead to offer direct forward-contract pricing (with raw material surcharges in some cases) to their customers" (Aldrich, 2007).[7]

Even if industry participants did not drive the creation of steel futures (Scinta, 2006), they did encounter a different set of hedging tools after 2008 and could adjust their risk management decisions. If purchase obligations are similar to an exchange-traded futures contract but not as efficient, firms with steel exposure could switch to steel futures to manage input price volatility (Implication 1 of the model). We identify firms with a non-trivial exposure to steel prices based on their input industries. *Steel Exposure* equals one if the percentage of a firm's input which is steel is greater than 1%. The *Futures Available* indicator equals one after the introduction of steel futures. The interaction of *Futures Available* and *Steel Exposure* captures the change in risk management behavior for firms with steel exposure after the introduction of the new derivative.

Before examining the results, we compare firms affected by the introduction of steel futures to other firms. A range of firms and industries have steel exposure. Appendix D summarizes industry level exposure based on the percent of observations with *% of Input Steel* greater than 1%. As there are over 170 six-digit NAICS industries represented, we use Fama-French 48 industry codes to aggregate the data. Not surprisingly, agriculture, food, soda, books, and the like had no steel exposed observations. But more than half of the industry groups had non-trivial exposure. There are some unexpected industries included, such as Toys and Retail. However, Toys includes fishing, hunting, and trapping; boat building and repair, musical instruments, household AV, and more. Likewise, Retail includes dealers of autos, RVs, boats, and mobile homes. Also of note, the Fama French Steel category doesn't have 100% steel

[7] Carlton (1984) describes several necessary conditions for the introduction of futures markets, such as price uncertainty and large transaction values. These factors tend to be outside the control of individual participants and thus exogenous to individual firms.

exposure but that grouping also includes nonferrous metal production such as copper and aluminum.

Table 4 presents summary statistics showing that steel exposed firms are somewhat similar to non-steel firms across a number of dimensions even though the firms generally are in different industries. There is no statistical difference in the mean or median size between the two groups. Median *Sales* are higher for steel firms but there is no difference in the means. Likewise, *CapEx* differs in the mean but not median. *Leverage* is slightly lower and statistically different for the steel firms. Lastly, both the mean and median *Cash* and *Trade Credit* levels are different but in offsetting manners. Steel exposed firms have lower mean *Cash* and *Trade Credit* but higher median values. In noting the similarities, we are not dismissing the differences. We address the differences between our treated and control sample three ways. First, we include firm fixed effects to analyze within-firm responses. Second, we include basic and more extended control variables in our multivariate regressions. Lastly, we conduct a nearest neighbor match to ensure the robustness of our results.

Table 5 presents the steel futures natural experiment results. Regressions are presented with the inclusion of both firm and year fixed effects. As *Steel Exposure* is time-invariant, it is absorbed by the firm fixed effect. However, we can estimate the interaction with *Steel Futures Available*. Consistent with expectations, the interaction coefficient shows that the introduction of steel futures is associated with an increased likelihood of financial hedging for firms with steel exposure. To address the concern of endogenous (post-event) right hand side variables, we present three specifications. Column 1 excludes firm level control variables, presenting only the steel future shock interaction with firm and year fixed effects. Columns 2 and 3 include the base and extended controls, where the post-event control variables are scaled by 2007 total assets to minimize the endogeneity. Next, Table 5 also documents a decrease in the use of POs for steel exposed firms when steel futures become available in columns 4 through 6. This decrease in operational hedging following an increase in the availability of financial derivatives holds across the same three model specifications.

Since both *Steel Exposure* and *Steel Futures Available* are dummies, the coefficient on their interaction can be directly interpreted as the relative change in the usage of POs for treated firms. Thus, Table 5 suggests that *Aggregate PO/Assets* decreased by 2.6% to 3% more for treated firms, after the introduction of steel futures. Since the average level of *Aggregate PO/Assets* for PO users is 11.8% (Table 1), this relative change is highly significant economically. These results suggest that the introduction of a new financial hedging product affects both traded derivatives and purchase obligation use, consistent with firms using non-cancelable supply contracts as alternative to exchange-traded derivatives (Implication 1 of the model).

The above interpretation relies on the assumption of parallel trends, i.e., that changes in the usage of POs would have been similar for treated and control firms, had it not been for the introduction of steel derivatives in 2008. While this assumption cannot be tested directly, it is useful to verify that this assumption is satisfied in the period that precedes the shock. To that effect, we graph *PO/Total Assets* from 2006 to 2010, segmented by steel exposure. We present *PO/Total Assets* net of the 2008 *PO/Total Assets* so that all firms PO usage is shown with respect to the shock year. We present the time-series graph in Figure 1. To control for observables, we use our matched sample to define the control group (see Section III.D for the details on the matching procedure). Firms with a non-trivial steel exposure are represented by a blue line and matched firms with little to no steel exposure are represented by an orange line. We see that treated and control firms follow similar trends prior to 2008. The evidence from these figures supports the validity of the natural experiment.

B. Financial Health

An important implication of the model is that the choice between risk management alternatives depends in part of the costs of the hedging tools. To use financial hedging, a firm must be able to post collateral (Rampini and Viswanathan, 2010). Financially stronger firms are better situated to bear these costs and initiate derivatives programs while financially weaker firms are expected to continue to use POs (Implication 2 of the model). Table 6 replicates the baseline Table 5 natural experiment, but splits the sample based on financial health. Steel exposed firms with Z scores above 3 increase their use of financial hedging following the introduction of steel futures, while more constrained firms do not. At the same time, financially healthy firms scale back their use of purchase obligations, while the low Z score firms do not. These results show that the patterns identified in Table 5 are driven by financially healthy firms, which is consistent with Implication 2 and Rampini and Vishwanathan (2010).

C. Cross-sectional Variation in Purchase Obligation Use

The introduction of steel futures provides a natural setting to test the hypothesis that purchase obligations and financial hedging are substitute hedging tools. However, forward contracting with purchase obligations can present distinct costs and risks. Section I highlights that both bargaining power and settlement risk may influence the cost of hedging with POs. Implication 3 of the model suggests that firms should decrease their use of purchase obligations only if they used POs as a hedge in the pre-treatment period. Purchase obligations are less attractive for firms contracting with more concentrated (powerful) or leveraged (risky) suppliers.

For these categories of firms, we'd expect little or no response to the introduction of steel futures.

Table 7 presents the results across this expected cross-sectional variation in purchase obligations use. Firms facing higher *Supplier Bargaining Power* and higher supplier settlement risk (lower *Supplier Z-Score*) are expected to regard purchase obligations less attractive for risk management. Firms with low *Supplier Bargaining Power* and high *Supplier Z-Score* are expected to respond more to the introduction of steel futures. Indeed, Table 7 shows that use of POs decreases statistically only when supplier bargaining power is low and when supplier settlement risk is low. Firms encountering less expensive or less risky purchase obligations appear to use PO for risk management and adjust in response to the new derivative. These results support Implication 3 of the model.

D. Placebo Tests

To further ensure that the results above are not affected by spurious correlation in either the cross section or the time series, we consider two placebo tests in Table 8. First, we identify two-digit SIC industries with no steel exposure (defined as steel comprising less than 0.01% of industry input). We next flag these firms as placebo "steel" firms and re-estimate our tests from Table 5, presenting again the identical base and extended control variables. The introduction of steel futures has no material impact on purchase obligations by the placebo steel firms across all specifications. That is, firms do not respond to the introduction of an unrelated derivative product.

In the second four columns of Table 8, we consider an additional falsification test related to the timing of the introduction of steel futures. Specifically, we replace the indicator variable *Steel Futures Available,* which equals one for years after the 2008 introduction of steel futures, with *Placebo Steel Futures Available* which equals one if the year is 2006 or 2007 and zero otherwise. We present these results for the whole sample as well as excluding the actual treated period of 2008 onwards. We find that firms with steel exposure are not changing in the pre-treatment period. Combined with our parallel trends analysis and the results from Table 5, the falsification tests in Table 8 provide additional evidence that the introduction of steel futures truly represents a shock to hedging opportunities which affects firms' usage of purchase obligations.

E. Matching

To confirm our evidence that purchase obligations and derivatives are substitute risk management tools, we revisit the steel futures introduction using nearest neighbor matching. Table 9 has three panels of results for this test. Panel A presents summary statistics for the treated and matched control sample. They are similar but not perfectly matched. This is similar to the Table 4 broad sample results and, given the broad industry differences between firms with and without steel exposures, some variation isn't surprising. What we gain with the nearest neighbor match, however, is an improvement in the control group observables. While *Cash* and *CapEx* differ significantly between the two groups, a comparison of the means shows that the difference is in the thousandth decimal place and likely not economically relevant.

Panel B of Table 9 presents the difference-in-difference results of how the treated (Steel) and control (matched non-steel firms) groups responded to the introduction of steel futures. Aggregate PO use declines a statistically significant -0.012 relative to the control group's change. Panel C reports the nearest neighbor matching average treatment effect on the treated (ATT) estimates for the same test which are very similar to the basic diff-in-diff results but make an adjustment for the imperfect matching. The coefficient estimate is almost the same as with the unadjusted diff-in-diff comparison of the treated and control groups. In aggregate, the Table 9 nearest neighbor matching process confirms the Table 5 firm fixed effects regressions. The introduction of steel futures leads affected firms to decrease their use of purchase obligations.

IV. Risk Management and Liquidity

Thus far, we have focused on testing the hypothesis that purchase obligations are a risk management tool that substitutes for traded derivatives. However, our model also shows that corporate liquidity can act as a substitute hedging mechanism. We therefore expect PO use to increase following a shock to banks which affects their ability to honor credit lines (Implication 4 of the model). Our hypothesis that a bank liquidity shock leads to an increased reliance on forward contracts with suppliers corresponds with evidence from the trade credit literature. Cunat (2007) and Garcia-Appendini and Monteriol-Garriga (2013) find that suppliers are liquidity providers during periods of financial constraint.[8]

We exploit the failure of a firm's line of credit lead arranger. To implement this test, we first identify firms which have a line of credit using Perl script. We use search terms identical to those in Sufi (2009).[9] After identifying line of credit firms, we identify their lead arrangers using DealScan. *LOC Shock* equals one if the firm's lead arranger on a line of credit failed during the prior year. While DealScan reports a range of relationship titles, lead arranger, mandated arranger, coordinating arranger, bookrunner, and senior managing agent are primary lending relationships and we categorize these as lead arrangers. Bank failures are identified from FDIC data (11 bank failures during 2003-2010) and major investment bank failures during 2008 (an

---

[8] Note also that suppliers cannot themselves intentionally *force* their customers into financial distress using these purchase obligations (e.g., *Northern Indiana Public Service v. Carbon County Coal Co*., 799 F.2d.265 (7th Cir. 1986)).

[9] Sufi (2009) further argues that the lack of a credit line is a good proxy variable for a financially constrained firm. Chava and Purnanandam (2011) also consider bank-dependent borrowers in their examination of the financial crisis.

additional 10 failures). There are 372 firms which experience a *LOC Shock* and 261 observations have three years (*t*-1, *t*+1) of purchase obligation data around the event.

A. Bank Failures and Corporate Lines of Credit

Our empirical strategy is to show that the failure of a firm's lead lender affects their credit line status. Losing a credit line potentially reduces a firm's liquidity management options. Firms therefore may increase POs as an alternative risk management tool. In Table 10, we first test whether *LOC Shock* actually affects a firm's ability to retain its credit line. We estimate logit and OLS models predicting *Has LOC*, an indicator variable equal to one if a firm has a credit line in year *t* and zero otherwise. We indeed find that the failure of a firm's lead lender for its line of credit is positively related to the loss of a credit line in the next period. To alleviate the possibility of endogenous matching between "bad" banks and financially unhealthy firms, we re-estimate our tests on a subsample of financially healthy firms (Z-score greater than 3) in models 2 and 4. We find similar results in this subsample. It therefore appears that the failure of the lead lender for a firm's credit line negatively affects the firm's ability to retain its credit line, even among healthy firms.

B. Banking Shocks and PO Usage

Having established a linkage between our exogenous shock and corporate liquidity management options, we next consider the effect of *LOC Shock* on purchase obligation usage. We first consider graphical evidence of the initiation of new purchase obligations how PO usage changes around bank failure events. In Figure 2, we plot *New Contract*, an indicator variable equal to one if the firm adds a purchase obligation at time *t*, and zero otherwise, for three groups of firms: firms with credit lines who experienced the failure of their lead lender, firms with credit lines who did not experience a lead lender failure, and firms without credit lines. The shock most severely affects the first group; firms who should not be affected by the shock do not appear to experience significant changes in their initiation of PO. At the same time, the three groups of firms follow similar trends in the period prior to the year of the bank failure.

Next, in Model 1 of Table 11, we estimate fixed-effect logit models where the dependent variable is *New Contract*. We find that the *LOC Shock* positively enhances the probability of a firm adding a PO the next period. This shock does not affect traded derivatives use significantly (Column 2). In models 3-6, we use the continuous variable *PO/Total Assets*. Model 3 uses the whole sample of financially healthy firms whereas Model 4 is limited to the subsample of financially healthy firms. The coefficient on *LOC Shock* is positive and similar in magnitude in both regressions but only is statistically significant in the larger sample. However, in models 5 and 6, we split the financially healthy firms into those with and without a credit rating. The second subsample is more likely to be reliant on bank debt (as opposed to public debt) and therefore should respond more strongly to our line of credit shock. We indeed document that the increase in POs occurs primarily in the bank dependent subsample – those firms without a credit rating. These results are consistent with Implication 4 of the model.

C. Further Evidence on the LOC Shock

In Table 12 Panel A, we again consider subsamples on *Supplier Z-Score* and *Supplier Bargaining Power* as in Table 7. Implication 5 of the model suggests that the increase in POs should be driven by sub-samples in which the cost of using POs is low: when the supplier's bargaining power and settlement risk are low (high supplier Z score). The results in Panel A support this implication: POs only respond to the credit line shock if suppliers have low bargaining power and when settlement risk is low.

We next estimate two placebo tests to ensure that our results are not driven by spurious correlations. In Panel B, we first consider firms that do not have a credit line, but create a placebo shock in 2008 (the year of most of our bank failures). These estimates are reported in models 1 and 3. We document no significant relation between this placebo shock and changes in either *New Contract* or *PO/Total Assets*. Next, we consider a placebo shock by shocking firms that do have a line of credit but whose primary lender survived the crisis in models 2 and 4. We again find no significant relation between the placebo shock and the use of purchase obligations.

We confirm the increased reliance on purchase obligations following liquidity shocks using nearest neighbor matching and present these results in Table 13. Panel A presents summary statistics for the treated and matched control sample. Like Table 8, the treated and matched controls are not perfectly matched but similar across the four dimensions: *Size*, *Leverage*, *Cash*, and *CapEx*. This sample is smaller than the earlier Tables 10 and 11 panel analyses as we require a two year pre-event period for the matching covariates. The difference-in-difference results are shown in Panel B. *Aggregate PO* use increases more for the firms experiencing a LOC shock related to the control group. Panel C reports the nearest neighbor ATT estimates which adjust for the imperfect match. Again this documents the increased use of purchase obligations following a liquidity shock and supports the conclusion that purchase obligation are a salient component of risk management.

Finally, we address concerns that our liquidity tests in Tables 10-13 might be capturing changes in trade credit flows. Specifically, the extant trade credit literature documents that suppliers tend to support distressed customers with increased trade credit flows, and that positive banking shocks to supplier firms enhance downstream trade credit (e.g., Petersen and Rajan, 1997, Garcia-Appendini and Montoriol-Garriga, 2013, Shenoy and Williams, 2016). A potential concern might be that *LOC Shock* triggers more trade credit flows from the supplier, causing a spurious increase in POs. In Table 14, we estimate the effect of *LOC Shock* on *Trade Credit*. Model 1 considers the whole sample and Model 2 reports only financially healthy firms (Z>3). In both models we do not find evidence of increases in trade credit, implying that trade credit is unlikely to be a latent variable driving our results.

V. Conclusion

We show that purchase obligations – non-cancellable futures contracts written with suppliers – are a risk management tool and a substitute for financial hedging. Purchase obligations are used more broadly than traded commodity derivatives, even when firms approach financial distress. Following a shock that increases the availably of traded derivatives for firms with steel exposure, these firms increase financial hedging and decrease their use of purchase obligations. Firms more likely to use POs as hedging tools adjust PO usage whereas other firms do not. Finally, we present complementary evidence on the substitution of credit lines and purchase obligations from a distinct test that focuses on a shock to banks' ability to honor credit lines. Firms experiencing a liquidity shock increase PO usage.

Overall, our research offers new insights into corporate risk management. We document that purchase obligations are a widespread but overlooked hedging tool which closely mirrors the structure of a futures contract. Further, we document that firms recognize the risk management component of these supply contracts. This substantially expands the understanding of who manages risk and the channels available for firms without exchange-traded exposures, complementing the Froot, Scharfstein, and Stein (1993) discussion of how to manage unmarketable risks.

References

Aldrich, Richard, 2007, In focus: The “future” of steel?, *GE Commercial Finance Research Industry Research Monitor*,1-4.

Allayannis, G., J. Weston, 2001, The use of foreign currency derivatives and firm market value, *Review of Financial Studies* 14, 243-276.

Almeida, H., M. Campello, I. Cunha, and M. S. Weisbach, 2014, Corporate liquidity Management: A conceptual framework and survey, *Annual Review of Financial Economics* 6, 135-162.

Altman, E. I., 1968, Financial ratios, discriminant analysis and the prediction of corporate bankruptcy, *Journal of Finance* 23, 589–609.

Andrade, G. and S. N. Kaplan, 1998, How costly is financial (not economic) distress? Evidence from highly leveraged transactions that became distressed, *Journal of Finance* 53, 1443–1493.

Bolton, P., H. Chen, and N. Wang, 2011, A unified theory of Tobin's q, corporate investment, financing, and risk management, *Journal of Finance* 66, 1545–1578.

Bonaimé, A., K. Hankins, and J. Harford, 2014, Financial flexibility, risk management, and payout choice, *Review of Financial Studies* 27, 1074-1101.

Campello, M., Lin, C., Ma, Y. and Zou, H., 2011, The real and financial implications of corporate hedging, *Journal of Finance* 66, 1615–1647.

Carlton, D., 1984, Futures markets: Their purpose, their history, their growth, their successes and failures, *Journal of Futures Markets* 4, 237-271.

Chava, S. and A. Purnanandam, 2011, The effect of banking crisis on bank-dependent borrowers, *Journal of Financial Economics* 99, 116-136.

Costello, A., 2013, Mitigating incentive contracts in inter-firm relationships: Evidence from long-term supply contracts, *Journal of Accounting and Economics*, 56, 19-39.

Cunat, V., 2007, Trade Credit: Suppliers as debt collectors and insurance providers, *Review of Financial Studies* 20, 491-527.

DeMarzo, P. and D. Duffie, 1995, Corporate incentives for hedging and hedge accounting, *Review of Financial Studies*, 8, 743-771.

Disatnik, D., R. Duchin, and B. Schmidt, 2014, Cash flow hedging and liquidity choices, *Review of Finance* 18, 715-748.

Emm, E., G. Gay, and C. Lin, 2007, Choices and best practice in corporate risk management disclosure, *Journal of Applied Corporate Finance* 19, 82-93.

Froot, K., D. Scharfstein, J. Stein, 1993, Risk management: coordinating corporate investments and financing policies, *Journal of Finance* 5, 1629-1658.

Froot, K. and J. Stein, 1998, Risk management, capital budgeting, and capital structure policy for financial institutions: An integrated approach, *Journal of Financial Economics* 47, 55-82.

Gamba, A. and A. Triantis, 2014, Corporate risk management: Integrating liquidity, hedging, and operating policies, *Management Science* 60, 246-264

Garcia-Appendini, E., Montoriol-Garriga, J., 2013. Firms as liquidity providers: Evidence from the 2007-2008 financial crisis. *Journal of Financial Economics* 109, 272-291.

Graham, J. and D. Rogers, 2002, Do firms hedge in response to tax incentives, *Journal of Finance* 57, 815-839.

Guay, W. and S. Kothari, 2003, How much do firms hedge with derivatives?, *Journal of Financial Economics* 70, 423-461.

Hankins, K., 2011, How do financial firms manage risk? Unraveling the interaction of financial and operational hedging, *Management Science* 57, 2197-2212.

Haushalter, D., S. Klasa, and W. Maxwell, 2007, The influence of product market dynamics on the firm's cash holdings and hedging behavior, *Journal of Financial Economics* 84, 797-825.

Hirshleifer, D., 1988, Risk, Futures pricing, and the organization of production in commodity markets, *Journal of Political Economy* 96, 1206-1220.

Holmström, B. and J. Tirole, 1998, Private and public supply of liquidity, *Journal of Political Economy* 106, 1-40.

Jorion, P., 1991, The pricing of exchange rate risk in the stock market, *Journal of Financial and Quantitiative Analysis* 26, 363-376.

Joskow, P, 1987, Contract duration and relationship specific investments: Empirical Evidence from Coal Markets, *American Economic Review,* 77, 168-185

Kale, J. and H. Shahur, 2007, Corporate capital structure and the characteristics of suppliers and customers, *Journal of Financial Economics* 83, 321-365.

Lee, Jiyoon, 2015, Does derivatives speculation affect liquidity holdings? Working paper.

Mian, S., 1996, Evidence on corporate hedging policies, *Journal of Financial and Quantitiative Analysis*, 31, 419-439.

Nance, D., C. Smith Jr., and C. Smithson, 1993, On the determinants of corporate hedging, *Journal of Finance* 48, 267-284.

Nash Jr., J. 1950, The bargaining problem, *Econometrica* 18, 155-162.

Perez-Gonzalez, F. and H. Yun, 2013, Risk management and firm value: Evidence from weather derivatives, *Journal of Finance* 68, 2143–2176.

Petersen, M. and R. Rajan, 1997, Trade credit: theories and evidence, *Review of Financial Studies* 10, 661-691.

Petersen, M. and S. Thiagarajan, 2000, Risk measurement and hedging: with and without derivatives, *Financial Management,* 29, 5-30.

Purnanandam, A., 2008, Financial distress and corporate risk management: Theory and evidence, *Journal of Financial Economics* 87, 706-739.

Rampini, A., and S. Viswanathan, 2010, Collateral, risk management, and the distribution of debt capacity, *Journal of Finance* 65, 2293–2322.

Rampini, A., A. Sufi, and S. Viswanathan, 2014, Dynamic risk management, *Journal of Financial Economics* 111, 271–296.

Scinta, C., 2006, Steel co execs aren't excited by idea of steel futures, *Dow Jones Newservice*, June 20, 2006.

Shenoy, J. and R. Williams, 2016, Trade credit and the joint effects of supplier and customer financial characteristics, *Journal of Financial Intermediation*, forthcoming.

Smith, C. and R. Stulz, 1985, The determinants of firms' hedging policies, *Journal of Financial and Quantitative Analysis*, 28, 391-405.

Stigler, G., 1964, The theory of oligopoly, *The Journal of Political Economy* 72, 44-61.

Sufi, A., 2009, Bank lines of credit in corporate finance: an empirical analysis, *Review of Financial Studies* 22, 1057-1088.

Williams, R., 2015, Vertical firm boundaries: supplier-customer contracts and vertical integration, working paper, University of Arizona.

Williamson, O., 1985, *The Economic Institutions of Capitalism*. New York Free Press.

Appendix A: A Model of Risk Management Alternatives

We use a simple liquidity management model along the lines of Holmström and Tirole (1998). Start with an initial (date-0) investment = I, which is fixed. The firm also starts with net worth A > 0. The investment produces a payoff R at the final date (date 2). At date-1, the firm has to make an additional (random) investment to continue the project. If this investment is not made, the project is liquidated and produces zero. With probability λ, the required investment is ρ, and it is zero in the other state. We assume that $\rho < R$ (so that continuation is efficient in state λ), and that $R > I + \lambda \rho$ (so the project is positive NPV). Everyone is risk-neutral, and the discount rate is 1 for simplicity.

The main friction is that the firm faces a collateral constraint, as in Rampini and Vishwanathan (2010). We model it by assuming that the firm can only borrow against the fixed investment I (that is, the cash flow R is not pledgeable). The maximum amount that the firm can borrow against fixed assets is given by τI. Thus, the firm faces a potential financing constraint. We assume that $\tau I < \rho$. This assumption means that in the state associated with probability λ, the firm will not have sufficient pledgeable income to continue the project.

In addition to the shock in state λ, the firm is exposed to a (zero mean) additional shock. With probability $x = 0.5$, there is a shortfall equal to $-\mu$, and with probability 0.5 the firm gains μ. The difference between λ and x is that the exposure associated with x can be hedged, either with an operational hedge or derivatives. For example, we can assume that the variation in the required investment ρ is not contractible (it is firm-specific and due to the firm's own performance), while the exposure μ is due to variation in input prices. State x is a state in which input prices are high.

Since the exposure associated with λ cannot be hedged, the firm must hold liquidity to withstand the shock. Suppose initially that the firm holds cash to manage the exposure to the shock λ (we will discuss credit lines below as well). The amount of cash that the firm must hold to withstand the shock λ is:

$$C_{min} = \rho - \tau I$$

C_{min} because is the minimum amount of cash that the firm must hold to be able to continue in state λ. Following Holmström and Tirole (1998), we assume that there is a liquidity premium q associated with cash holdings (the firm pays a price q > 1 for cash at the initial date). Given this, the firm will be able to continue in state λ if:

$$A + \tau I \; > I + \lambda\rho + (q - 1)\, C_{min}$$

We assume that this condition holds (that is, the firm can always fund C_{min}). The associated payoff is:

$$U = R - I - \; \lambda\, \rho - (q - 1)\, C_{min},$$

which we assume to be greater than zero (the project is still positive NPV after accounting for the liquidity premium).

A. *Hedgeable risk*

How does the exposure associated with x affect the firm? Notice that eliminating the exposure in state $1 - \lambda$ is irrelevant. It reduces the variance of cash flows but has no effect on investment policy or the firm's payoff. On the other hand, in state λ, the firm must eliminate this exposure because it will cause inefficient liquidation. If the firm holds cash equal to C_{min} and input prices go up (state x), then the firm will face a shortfall equal to $-\mu$ and will not have sufficient pledgeable income to continue.

One way to manage this risk is by holding additional cash. If cash goes up to:

$$C = C_{min} + \mu,$$

then the firm has enough cash to continue the investment in all states of the world. However, holding additional cash is costly. The additional cash will cause the firm to pay a liquidity premium $(q - 1)\mu$. This premium reduces the payoff of the project, and tightens the financial constraint:

$$U_c = U - (q - 1)\,\mu,$$

which is feasible when:

$$A + \tau I > I + \lambda\rho + (q - 1)\,C$$

The firm can also hedge the exposure. Assume first that derivatives (futures) are not available. Then the firm can use purchase obligations (POs). If it is costless to use POs, then the firm will always use POs rather than cash to eliminate the exposure μ. There are however several possible sources for the cost of using POs.

B. Supplier bargaining power

The pricing may not be efficient (actuarially fair), since suppliers may capture some of the surplus through bargaining power (the average input price may go up for example). We can capture this through a premium k, so that using POs has a deadweight cost of $k\mu$. This deadweight cost reduces the final payoff to $R - k\mu$.

With the forward premium, the firm's payoff is:

$$U_k = U - k\mu.$$

The forward is feasible when:

$$A + \tau I > I + \lambda\rho + (q - 1)C_{min},$$

which we assumed to hold. The forward relaxes the financial constraint relative to cash, because the forward contract does not require a date-0 payment. In contrast, cash requires a fully collateralized position at date-0 (the firm must hold an amount that is sufficient to eliminate the entire exposure μ, from date-0 to date-1). In addition, notice that this formulation assumes that the premium $k\mu$ can be paid off the non-pledgeable income R. This formulation reflects the assumption that supplier are in a position to extract more pledgeable income from buyers, relative to external investors. This assumption is also common in the trade credit literature.

The firm will either cash or POs to manage the hedgeable exposure, depending on the relative costs k and q. If $k < q - 1$, then the firm uses POs to manage the hedgeable exposure. This choice increases the firm's payoff ($U_k > U_C$). If $k > q - 1$, then the firm uses cash to manage hedgeable risk provided that cash is feasible, that is:

$$A + \tau I > I + \lambda\rho + (q - 1)\, C$$

If the firm cannot finance the cash position C ($A + \tau I < I + \lambda\rho + (q - 1)\, C$), it will use POs to manage the hedgeable exposure as long as the payoff is positive ($U_k = U - k\mu > 0$). In this case the firm chooses forwards because they relax the financial constraint, even though they are more expensive overall than cash. Finally, if $U_k = U - k\mu < 0$, then the firm will remain exposed to the hedgeable exposure.

C. Settlement risk

In addition, there may be settlement risk. We can capture this in the model through a probability s that the supplier does not honor the contract. Thus, the firm is liquidated with a probability equal to $\lambda s/2$. This risk of liquidation will reduce the firm's payoff and may cause the firm to use cash rather than POs to manage the hedgeable risk. Suppose in addition that $k = 0$, to isolate the role of settlement risk in the model.

In this case, the firm's payoff when using the purchase obligation is:

$$U_s = U - (\lambda s/2)(R - \rho).$$

Thus the payoff is reduced by the liquidation cost $R - \rho$. The firm will switch to cash if $U_c > U_s$.[10] If $(\lambda s/2)(R - \rho) > (q - 1)\mu$ the firm will use POs, and if $(\lambda s/2)(R - \rho) < (q - 1)\mu$ the firm will prefer to use cash. However, as in the analysis above, cash must be feasible given the liquidity premium. The required condition is the same as above:

$$A + \tau I > I + \lambda\rho + (q - 1)\,C$$

If this condition does not hold, then the firm will use POs instead to relax the financing constraint. Notice that POs are always feasible despite the settlement risk:

$$A + \tau I > I + \lambda(1 - s/2)\rho + (q - 1)C_{min}.$$

Thus, similarly to the case above, the firm may choose to use forwards because they relax the financial constraint, even though they reduce the firm's payoff relative to a case when the firm uses cash to manage the hedgeable risk.

D. General case with both a forward premium and settlement risk

Given the analysis above, the general expression for a firm's payoff when using forwards is:

$$U_{s,k} = U - (\lambda s/2)(R - \rho) - (1 - \lambda s/2)\, k\mu.$$

This expression follows directly from the analysis above. The only point to note is that this expression assumes that the forward premium $k\mu$ is not paid when the firm is liquidated, given that the forward is settled *ex-post*.[11] The firm will use forwards either when $U_{s,k} > U_c$, or when $U_{s,k} < U_c$, but the feasibility constraint binds so that the firm cannot afford to hedge with cash.

E. Introduction of Futures

[10] The firm will never use both cash and POs to manage hedgeable risk. If a firm switches to cash it needs to hold a position that fully hedges the firm against liquidation ($C = C_{min} + \mu$) and thus POs become unnecessary. The firm still holds cash to manage the non-hedgeable risk in any case.

[11] We note that nothing substantial changes in the analysis if forward counterparties have greater than zero recovery in the event of liquidation.

Consider now traded derivatives (futures). Rather than forwards, the firm can open a futures position equal to μ to eliminate the hedgeable exposure. However, this future position will force the firm to open a margin account with the exchange. We assume that the required amount is given by $\zeta\mu$, with $\zeta < 1$. The futures position should have negligible settlement risk, thus the relevant cost for the futures is the cost of the margin account.

In the model, the margin account will behave similarly to an increase in cash holdings (it needs to be in place at date-0). Assuming that the exchange pays an interest rate on the margin account that is equivalent to what the firm earns on liquid assets, the margin account will create a liquidity premium equal to $(q - 1)\zeta\mu$. Thus, when using futures the firm will achieve the following payoff:

$$U_f = U - (q - 1)\zeta\mu.$$

The futures position is feasible when:

$$A + \tau I > I + \lambda\rho + (q - 1)(C_{min} + \zeta\mu).$$

Notice that this solution is equivalent to an increase in cash holdings from C_{min} to $C_{min} + \zeta\mu$.

The key assumptions here are that: (i) the futures trade at a fair price, but require cash collateral; (ii) the interest rate on the margin account is the same as what the firm earns on cash; (iii) the cash collateral effectively belongs to the firm, though it is deposited at the exchange. If the collateral is not used, it is returned to the firm.

Only assumption (i) is crucial for the results in the model. Intuitively, futures collateral will tighten the financial constraint relative to forwards, but it is likely to reduce overall hedging costs for the firm (otherwise the introduction of futures would not matter).

Consider now what happens if firms move from an equilibrium with no futures available, to an equilibrium in which futures are available. There are essentially two cases to consider, depending on whether the firm used cash or forwards to manage the hedgeable exposure prior to the introduction of futures. As we discuss above, firms can switch to cash either because of a forward premium ($k > 0$) or because of settlement risk ($s > 0$).

Suppose first that both k and s are small enough, so that firms use POs in equilibrium to manage hedgeable risk. In that case, firms may move from POs to futures if the cost of using futures, (q - 1)ζ, is small enough. This would happen when $U_{s,k} < U_f$. However, the firm can only move to futures if it has sufficient collateral ($A + \tau I > I + \lambda\rho + (q - 1)(C_{\min} + \zeta\mu)$). Otherwise it will keep using forwards even when $U_{s,k} < U_f$.

If in contrast either k or s or both are large enough such that the firm uses cash rather than forwards to manage hedgeable risk, then the firm will always switch from cash to futures after futures are introduced. Futures strictly dominate cash in the model, since $\zeta < 1$. In all of these cases, the firm will continue to use cash to manage the non-hedgeable liquidity risk.

F. Credit lines and bank liquidity

The model does have the additional implication that the introduction of traded derivatives reduces the firm's demand for liquidity when the costs of using POs are high. Consider a situation in which a firm uses credit lines to manage hedgeable risk. This means that credit lines dominate cash, and thus it should also use credit lines rather than cash to manage non-hedgeable. As discussed in previous literature (see Almeida et al. 2014 for a survey), the main friction regarding credit lines is that there is a risk that their access will be revoked because of covenant violations or deterioration in bank health. Similar to the forward, the credit line economizes on date-0 collateral and reduces the liquidity premium.

To capture the effects that we are after, we assume that the risk of credit line revocation is initially very small so that firms prefer to use credit lines (in fact, assume that they are riskless).

If credit lines are riskless, they will generate the highest possible payoff ($U_{LC} = U$), and will always be feasible ($A + \tau I > I + \lambda\rho$). Thus firms will indeed choose to use credit lines to manage both non-hedgeable and hedgeable liquidity exposures.

Next, consider what happens if a firm's access to the credit line is suddenly revoked, or alternatively if the risk of revocation goes up sufficiently such that the credit line is no longer the preferred option. The firm will then seek risk management alternatives. It will switch to cash to manage the non-hedgeable exposure, and it will switch to the best possible alternative to manage the hedgeable exposure.

Appendix B. Description of Data Collection

Purchase Obligations:

If a firm uses the text "purchase obligation" in its footnote, but reports $0 for the aggregate dollar amount of the contracts, we code *Purchase Obligation* equal to zero. Using this definition, roughly 20.8% of all Compustat firm-year observations are for firms which have entered into purchase contracts with their suppliers. The raw data containing the dollar values of the aggregate purchase obligations have several potential problems. One problem is that in addition to columns for years *t*+1 to *t*+6, the footnote line item also includes a "Total" column; sometimes this occurs before year *t*+1 and sometimes after *t*+6. We are able to automatically remove the "Total" column through programming. A related problem exists for the data we collect on contract length. Although many firms report the dollar amount of purchase obligations for years *t*+1, *t*+2, *t*+3, *t*+4, *t*+5, *t*+6 and onward, some firms group years *t*+2 and *t*+3 together, years *t*+4 and *t*+5 together, etc. For these firms, the estimate for contract length will be systematically too short. We are unable to solve this problem programmatically, although firms are unlikely to systematically differ in reporting based on the hedging propensity. The third problem is that firms use different scales (millions, thousands, etc.) when reporting footnote tables depending on firm size. We use a combination of automated and manual techniques to identify the scale a firm is using. First, we automatically search the contractual obligations footnote for common text used to report scale (e.g., "in millions", "in 000s", etc.). Second, we manually examine the time-series of the amount of each firm's supplier purchase obligations and compare the scale in consecutive years to ensure consistency. Lastly, we manually examine firms which have annual purchase obligations that are higher than current year cost of goods sold to ensure that the scale is correct and adjust the scale if necessary. The resulting unique database identifies the existence of a firm's contractual purchase obligations to its suppliers as well as estimates of the lengths and amounts of these obligations.

List of Search Terms Used to Identify Commodity Derivatives Users:

hedge fuel, fuel hedge, fuel call option, commodity derivative, commodity contract, commodity forward, commodity future, commodity hedge, commodity hedging, commodity option, commodity swap, hedges of commodity price, uses derivative financial instruments to manage the price risk, uses financial instruments to manage the price risk, uses derivative financial instruments to manage price risk, uses derivatives to manage the price risk, uses derivatives to manage price risk, forward contracts for certain commodities, forward contracts for commodities derivatives to mitigate commodity price risk, futures to mitigate commodity price risk, options to mitigate commodity price risk, swaps to mitigate commodity price risk, corn future, cattle future commodity price swap

Appendix C: List of Industries with Traded Futures

NAICS	Industry Name
111110	Soybeans
111120	Oilseeds
111140	Wheat
111150	Corn
111160	Rice
111920	Cotton
111930	Sugarcane
111991	Sugar beets
112110	Cattle
112210	Swine
112410	Sheep and wool
211111	Crude petroleum and natural gas
211112	Liquid natural gas
212112	Coal
212113	Anthracite coal
212221	Gold ores
212222	Silver ores
212231	Lead and zinc ores
212234	Copper and nickel ores
311222	Soybean oil
311223	Other oilseed
311225	Margarine
311310	Sugar
311512	Creamery butter
311611	Meat products (except poultry)
311920	Coffee and tea
311942	Spices and extracts
324110	Petroleum refinery products
325212	Synthetic rubber
331111	**Iron and steel mills (only post-2008)**
331112	**Ferroalloy product manufacturing (only post-2008)**
331210	**Iron and steel pipe and tube manufacturing (only post-2008)**
331221	**Rolled steel shape manufacturing (only post-2008)**
331222	**Steel wire drawing (only post-2008)**
331512	**Steel foundries, investment (only post-2008)**
331513	**Steel foundries, non-investment (only post-2008)**
332111	**Iron and steel forging (only post-2008)**
331312	Primary aluminum
331314	Secondary aluminum
331315	Aluminum sheets
331411	Primary copper
331419	Primary metals (except copper and aluminum)

Appendix D: Steel Exposure by Industry

This table summarizes steel exposure across the Fama-French 48 industry categories. The left hand column lists the industry number and label while the right-hand column reports the percentage of observations with steel exposure as defined in Section II B. For brevity, all industries with zero steel exposure are reported together.

FF48 Industry	**% Steel Exposed**
1 Agriculture, 2 Food Products, 3 Candy & Soda, 4 Beer & Liquor, 5 Tobacco Products, 7 Entertainment, 8 Printing and Publishing, 13 Pharmaceutical Products, 31 Utilities, 32 Communication, 33 Personal Services, 34 Business Services , 40 Transportation, 41 Wholesale, 43 Restaurants, Hotels, Motels	0.00
11 Healthcare	0.01
35 Computers	0.03
14 Chemicals	0.10
48 Other/Almost Nothing	0.10
42 Retail	0.11
10 Apparel	0.13
15 Rubber and Plastic Products	0.14
16 Textiles	0.15
30 Petroleum and Natural Gas	0.21
38 Business Supplies	0.21
6 Recreation	0.27
36 Electronic Equipment	0.28
39 Shipping Containers	0.29
17 Construction Materials	0.51
9 Consumer Goods	0.59
26 Defense	0.67
19 Steel Works Etc	0.74
25 Shipbuilding, Railroad Equipment	0.78
37 Measuring and Control Equipment	0.83
23 Automobiles and Trucks	0.85
12 Medical Equipment	0.87
22 Electrical Equipment	0.88
21 Machinery	1.00
18 Construction	1.00
20 Fabricated Products	1.00
24 Aircraft	1.00
27 Precious Metals	1.00
28 Non-Metallic and Industrial Metal Mining	1.00
29 Coal	1.00

Figure 1: Aggregate POs, Steel Futures

Figure 1 presents the time series analysis of firms using purchase obligations. The y-axis is *PO/Total Assets*; adjusted by the 2008 *PO/Total Assets.* The graph is centered on the 2008-09 introduction of steel futures. The blue line plots the aggregate level of POs among firms with steel exposure and the orange line plots the aggregate level of POs among firms with low/no steel exposure.

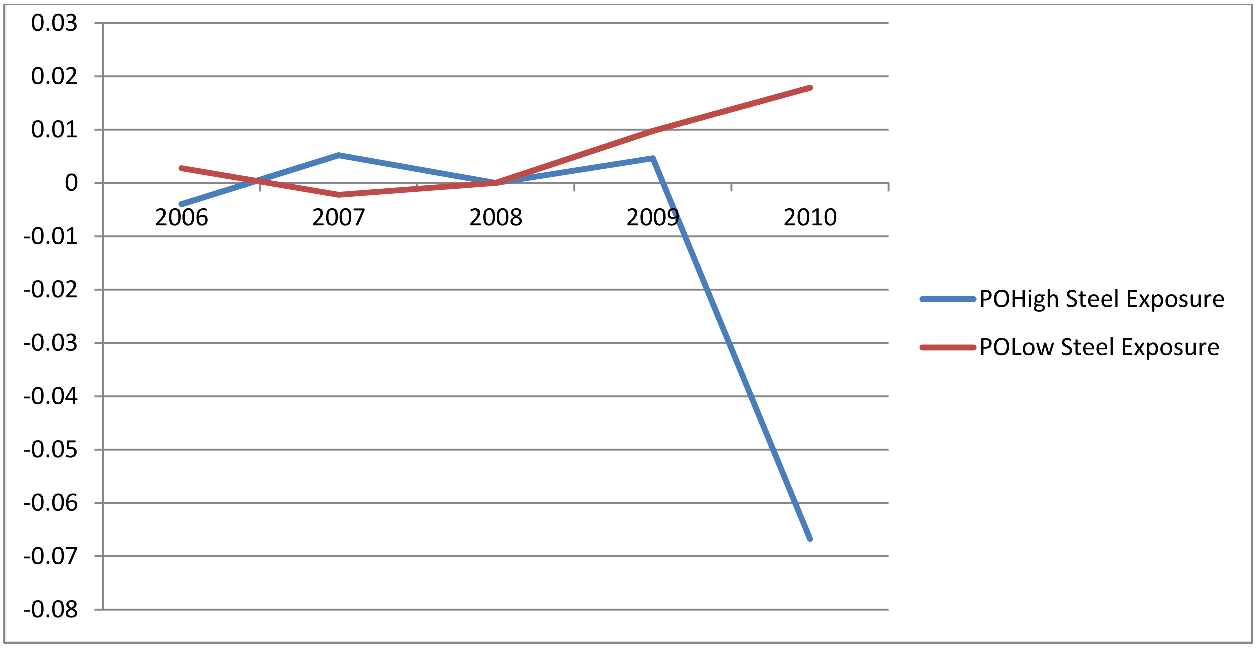

Figure 2: PO Initiation, Lead Lender Shock

This figure presents the initiation of new POs (*New Contract*) for three groups of firms. The y-axis is the indicator variable *New Contract*, which is equal to one if the firm initiated a new PO in a given year. The solid blue line represents firms with a line of credit who experienced the failure of their lead lender in year *t*. The dashed red line represents firms who had a line of credit whose lead lender did not fail. The dashed-and-dotted green line represents firms without a line of credit and therefore without a lead lender.

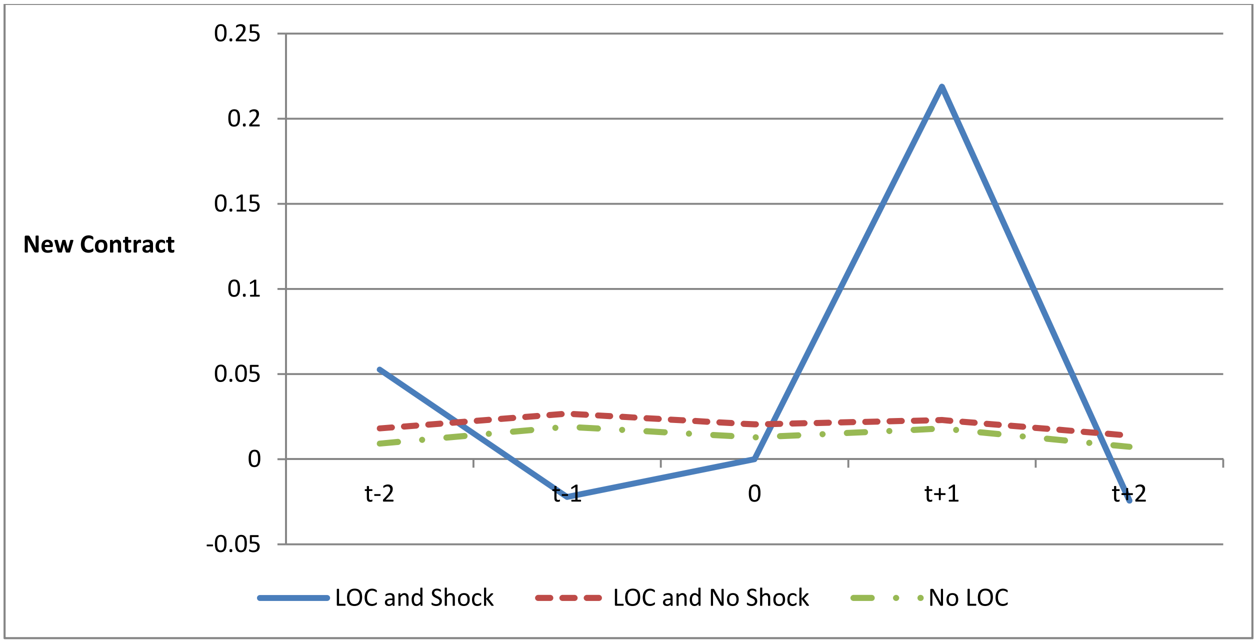

Table 1
Summary Statistics

The tables presents summary statistics using all nonfinancial Compustat firms from 2003-2010. Panel A presents the mean, median, and standard deviation for the entire sample as well as the mean for purchase obligation users (*PO Users*) and firms using commodity hedges (*Comm. Hedgers*). *Purchase Obligation* is equal to one if the firm reports purchase obligations in its 10-K filing and zero otherwise. *AggregatePO/Assets* is the sum of the future purchase obligations scaled by total assets. *AggregatePO/COGS* is the sum of the future purchase obligations scaled by current cost of goods sold. *Commodity Hedger* is equal to one if a firm reports using commodity derivatives, zero otherwise. *% Input Traded* is equal to the percentage of input which is traded on an active futures exchange. *% Input Steel* is equal to the percentage of a firm's input accounted for by steel. *Market Leverage* is the book value of debt divided by the sum of the market value of equity and the book value of debt. *Cash* is cash holdings divided by total assets. *Investment/Assets* R&D + CAPEX + Advertising divided by total assets. *Sales/Assets* is total net revenues divided by total assets. *R&D Intensity* is the firm's own RD/Assets. *CapEx* is the firm's capital expenditures divided by total assets. *Firm Size* is the natural logarithm of the firm's book assets. *Trade Credit* is AP/Total Assets. In Panel B, *Supplier Herf Index* is the weighted average Herf Index of all the firm's supplier industries and *Supplier Bargaining Power* is 'High' if the *Supplier Herf Index* is above than the annual mean.

	All Firms			PO Users	Comm. Hedgers	
Variable	Mean	Median	StDev	Mean	Mean	N
	(1)	(2)	(3)	(4)	(5)	(6)
Purchase Obligation	0.215	0.000	0.411	1.000	0.252	26,430
AggregatePO/Assets	0.026	0.000	0.268	0.118	0.028	25,358
AggregatePO/COGS	0.046	0.000	0.362	0.214	0.048	25,944
Commodity Hedger	0.158	0.000	0.364	0.184	1.000	26,430
% of Input Traded	0.039	0.009	0.087	0.040	0.092	26,430
% of Input Steel	0.014	0.001	0.032	0.018	0.016	26,430
Market Leverage	0.193	0.117	0.220	0.180	0.286	25,026
Cash/Assets	0.153	0.088	0.180	0.148	0.076	24,935
Investment/Assets	0.132	0.082	0.158	0.121	0.112	24,655
Sales/Assets	1.021	0.851	0.824	1.039	0.996	25,099
R&D Intensity	0.076	0.004	0.174	0.057	0.017	26,430
CapEx	0.050	0.029	0.066	0.052	0.086	24,655
Firm Size	5.744	5.760	2.148	6.578	7.287	26,430
Trade Credit	0.097	0.055	0.140	0.081	0.087	25,059

Table 2
Summary statistics – by Bargaining Power and Settlement Risk

The tables presents summary statistics using all nonfinancial Compustat firms from 2003-2010. The sample is split on high/low *Supplier Bargaining Power* with "high" equaling one if the supplier's Herfindahl index is greater than the sample mean, or high/low *Supplier Z-Score*, with "high" equaling one if the supplier's industry Z-score is greater than the sample mean. P-Values for the differences in means and medians are presented. Other variables are as defined in Table 1.

Panel A:

	Supplier Bargaining Power							
		High			Low			
	# Obs	Mean	St Error	# Obs	Mean	St Error	Diff	P Value
Purchase Obligation	11,147	0.201	0.004	15,283	0.225	0.003	0.024	0.000
AggregatePO/Assets	10,699	0.023	0.002	14,659	0.028	0.003	0.005	0.072
AggregatePO/COGS	10,964	0.038	0.001	14,981	0.046	0.001	0.009	0.000

Panel B:

	Supplier Z-Score							
		High			Low			
	# Obs	Mean	St Error	# Obs	Mean	St Error	Diff	P Value
Purchase Obligation	14,640	0.233	0.003	11,787	0.193	0.004	0.040	0.000
AggregatePO/Assets	14,053	0.029	0.003	11,302	0.021	0.002	0.008	0.011
AggregatePO/COGS	14,334	0.047	0.001	11,608	0.038	0.001	0.009	0.000

Table 3
Changing Risk Management Decisions

This table presents summary statistics on changes in risk management as the firm financial condition deteriorates. For each type of firm event, such as entering distress, a t-test compares firm quarters with this event to all other observations. *Entering 'Grey' Distress* equals one for a firm-year observation when the Altman Z score drops below 2.99. *Entering Distress* equals one when the Altman Z score drops below 1.81. *Entering Fin (not Econ) Distress* equals one when the firm enters distress but has a positive operating margin. *Stop Derivatives Use* equals one when firms cease to use commodity hedging. *New Contract* equals one when the firm starts to report purchase obligations.

	Firm Event			No Event					
	Obs	Mean	St Err	Obs	Mean	St Err	Diff	P Value	
Enter 'Grey' Distress									
Stop Derivatives Use	694	0.027	0.006	28,588	0.017	0.001	0.010	0.023	**
New PO Contract	694	0.048	0.008	28,588	0.034	0.001	0.013	0.029	**
Enter Fin (not Econ) Distress									
Stop Derivatives Use	681	0.029	0.006	28,601	0.017	0.001	0.012	0.009	***
New PO Contract	681	0.048	0.008	28,601	0.034	0.001	0.014	0.022	**
Enter Econ Distress									
Stop Derivatives Use	442	0.016	0.006	25,998	0.017	0.001	0.00	0.80	
New PO Contract	442	0.029	0.008	25,998	0.038	0.001	0.01	0.35	
Enter Distress									
Stop Derivatives Use	1,077	0.022	0.004	28,205	0.017	0.001	0.005	0.114	
New PO Contract	1,077	0.043	0.006	28,205	0.034	0.001	0.008	0.067	*
Stop Derivatives Use									
New PO Contract	514	0.058	0.010	28,768	0.034	0.001	0.024	0.001	***

Table 4
Summary statistics – by Steel Exposure

The tables presents summary statistics using all nonfinancial Compustat firms from 2003-2010. The sample is split on steel exposure with exposure equaling one if steel is greater than 1% of inputs as identified by the BEA IO tables. P-Values for the differences in means and medians are presented. Other variables are as defined in Table 1.

	Steel Exposure				No Steel Exposure				Diff in Means	Diff in Median
	# Obs	Mean	Median	StdError	# Obs	Mean	Median	StdError	P Value	P Value
Firm Size	6303	5.757	5.793	0.026	20127	5.740	5.752	0.015	0.59	0.31
Sales/Assets	5970	1.034	0.961	0.008	19129	1.017	0.801	0.006	0.18	0.00
CAPEX/Assets	5959	0.044	0.028	0.001	18696	0.052	0.029	0.001	0.00	0.12
Market Leverage	5941	0.165	0.097	0.003	19085	0.202	0.126	0.003	0.00	0.00
Cash/Assets	5934	0.144	0.093	0.002	19001	0.156	0.087	0.001	0.00	0.01
Trade Credit	5971	0.086	0.067	0.001	19088	0.101	0.051	0.001	0.00	0.00

Table 5
Natural Experiment

The table presents multivariate estimates using nonfinancial Compustat firms from 2003-2010. The dependent variable in the logit estimates in models 1-3 is *Commodity Hedger* and the OLS estimates in models 4-6 is *AggregatePO/Assets*. *Steel Futures Available* is an indicator equal to one if the year is after 2008, zero otherwise. *Steel Exposure* is equal to one if percentage input from steel is greater than the 1%, zero otherwise. All control variables are as described in Table 1 and included with a one year lag. Post-event firm control variables (after 2007) are scaled by 2007 total assets. *t*-Statistics are presented in parenthesis and are calculated from robust standard errors clustered by firm. All models include year and firm indicator variables. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Commodity Hedger			*Aggregate PO/Assets*		
	(1)	(2)	(3)	(4)	(5)	(6)
Steel Futures Available	0.710***	0.347**	0.305**	0.023***	0.008	0.009
	(4.760)	(2.305)	(1.985)	(3.186)	(1.092)	(1.110)
*Futures Available*Steel Exposure*	0.467**	0.328	0.359*	-0.030***	-0.026**	-0.027**
	(2.515)	(1.609)	(1.750)	(-3.096)	(-2.468)	(-2.478)
Leverage		-0.239	-0.757		-0.020	-0.015
		(-0.561)	(-0.744)		(-0.895)	(-0.303)
Cash		0.221	0.322		-0.026	-0.027
		(0.408)	(0.567)		(-1.294)	(-1.312)
Firm Size		0.199	0.288**		-0.001	-0.001
		(1.495)	(2.063)		(-0.091)	(-0.165)
Capex		0.910	0.637		0.006	0.008
		(0.904)	(0.610)		(0.103)	(0.144)
% Input Traded (non-steel)			1.554			-0.017
			(1.509)			(-0.330)
Leverage Squared			0.780			-0.005
			(0.646)			(-0.086)
Sales			0.352**			0.001
			(2.233)			(0.142)
R&D Intensity			1.667			-0.005
			(1.503)			(-0.142)
Trade Credit			-0.746			-0.025
			(-0.601)			(-0.423)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	4,437	3,160	3,150	25,358	20,419	20,377

Table 6
Natural Experiment & Financial Health

The table presents multivariate estimates using nonfinancial Compustat firms from 2003-2010. The dependent variable in the logit estimates in models 1-2 is *Commodity Hedger* and the OLS estimates in models 3-4 is *AggregatePO/Assets*. *Steel Futures Available* is an indicator equal to one if the year is after 2008, zero otherwise. *Steel Exposure* is equal to one if percentage input from steel is greater than the 1%, zero otherwise. All control variables are as described in Table 1 and included with a one year lag. Post-event firm control variables (after 2007) are scaled by 2007 total assets. *t*-Statistics are presented in parenthesis and are calculated from robust standard errors clustered by firm. All models include year and firm indicator variables. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Commodity Hedger		*Aggregate PO/Assets*	
	Z>3	Z<3	Z>3	Z<3
	(1)	(2)	(3)	(4)
Steel Futures Available	0.635***	1.568***	0.008	0.009**
	(2.621)	(4.744)	(0.676)	(1.973)
*Futures Available*Steel Exposure*	0.464*	-0.045	-0.036**	0.004
	(1.778)	(-0.110)	(-2.382)	(0.586)
Leverage	-1.677	0.726	0.059	-0.045
	(-1.060)	(0.378)	(0.674)	(-1.620)
Cash	0.294	0.909	-0.033	-0.003
	(0.400)	(0.730)	(-1.163)	(-0.201)
Firm Size	0.398*	-0.161	-0.002	0.002
	(1.815)	(-0.641)	(-0.206)	(0.530)
Capex	0.814	0.047	0.005	0.010
	(0.514)	(0.028)	(0.055)	(0.355)
% Input Traded (non-steel)	1.501	1.915	-0.047	0.016
	(1.017)	(1.238)	(-0.550)	(0.643)
Leverage Squared	1.516	-0.305	-0.181	0.048
	(0.603)	(-0.154)	(-1.299)	(1.585)
Sales	0.220	1.078***	-0.003	0.006
	(1.168)	(2.694)	(-0.237)	(1.153)
R&D Intensity	1.420	2.217	-0.011	0.011
	(0.782)	(1.215)	(-0.190)	(0.623)
Trade Credit	0.422	-2.998	-0.043	0.002
	(0.243)	(-0.974)	(-0.442)	(0.071)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
# Obs	1,801	913	14,414	5,963

Table 7
Natural Experiment – Subsample Analysis

The table presents multivariate estimates using nonfinancial Compustat firms from 2003-2010. The dependent variable in the logit estimates is *AggregatePO/Assets*. *High (Low) Supplier Bargaining Power* is defined as having a supplier HHI greater (less) than the sample mean. *High (Low) Supplier Z-Score* is defined as having a supplier Z-score greater (less) than the sample mean. *Steel Futures Available* is an indicator equal to one if the year is after 2008, zero otherwise. *Steel Exposure* is equal to one if percentage input from steel is greater than the 1%, zero otherwise. All control variables are as described in Table 1 and included with a one year lag. The firm control variables are *Leverage*, *Cash*, *Firm Size*, and *CapEx* and are the same as in Columns 2 and 5 of Table 5. The 'Extended Controls', from Table 5 Columns 3 and 6, are *% Input Traded, Leverage Squared, Sales/Assets, R&D Intensity,* and *Trade Credit*. Post-event firm control variables (after 2007) are scaled by 2007 total assets. These control variables are included in the regressions but omitted in the table for brevity. *t*-Statistics are presented in parenthesis and are calculated from robust standard errors clustered by firm. All models include year and firm indicator variables. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Panel A:

Dependent Variable	*Aggregate PO/Assets*			
Sample	*High Supplier Bargaining Power*		*Low Supplier Bargaining Power*	
	(1)	(2)	(3)	(4)
Steel Futures Available	0.017***	0.016**	0.010	0.011
	(2.765)	(2.524)	(0.917)	(0.936)
*Futures Available*Steel Exposure*	-0.019	-0.019	-0.029**	-0.029**
	(-0.351)	(-0.361)	(-2.114)	(-2.140)
Firm Controls	Yes	Yes	Yes	Yes
Extended Controls	No	Yes	No	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
# Obs	4,562	4,558	15,857	15,819

Panel B:

Dependent Variable	*Aggregate PO/Assets*			
Sample	*High Supplier Z-Score*		*Low Supplier Z-Score*	
	(1)	(2)	(3)	(4)
Steel Futures Available	0.009	0.009	0.007	0.006
	(0.625)	(0.652)	(0.835)	(0.706)
*Futures Available*Steel Exposure*	-0.033**	-0.034**	0.003	0.004
	(-2.039)	(-2.084)	(0.172)	(0.190)
Firm Controls	Yes	Yes	Yes	Yes
Extended Controls	No	Yes	No	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
# Obs	11,592	11,570	8,826	8,806

Table 8
Placebo Tests

The table presents placebo tests based on the Steel shock. In the first two columns, we identify industries with no steel exposure (2-digit SIC codes 8, 9, 21, 31, 59, 81) and examine the reaction of firms in these industries (labeled '*Placebo Exposure*') to the introduction of steel futures. In last four columns, the placebo test uses the two years subsequent to the introduction of steel futures as the shock years (2006, 2007), labeled '*Placebo Futures Available*'. The firm control variables are *Leverage*, *Cash*, *Firm Size*, and *CapEx* and are the same as in Columns 2 and 5 of Table 5. The 'Extended Controls', from Table 5 Columns 3 and 6, are *% Input Traded, Leverage Squared, Sales/Assets, R&D Intensity,* and *Trade Credit*. Post-event firm control variables (after 2007) are scaled by 2007 total assets. These control variables are included in the regressions but omitted in the table for brevity. All models include year and firm indicator variables. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

	Aggregate PO/Assets					
	All Years		All Years		Exclude 2008+	
	(1)	(2)	(3)	(4)	(5)	(6)
Steel Futures Available	0.008	0.009				
	(1.075)	(1.088)				
*Placebo Exposure*Futures Available*	0.030	0.030				
	(0.614)	(0.622)				
Steel Futures Available			0.002	0.002	0.001	0.001
			(0.285)	(0.301)	(0.219)	(0.232)
*Placebo Exposure*Futures Available*			0.006	0.006	-0.007	-0.006
			(0.611)	(0.615)	(-0.900)	(-0.750)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Extended Controls	No	Yes	No	Yes	No	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	20,421	20,379	20,421	20,379	12,658	12,635

Table 9
Natural Experiment - Matching

The table presents difference-in-difference results using a matched sample between treated and untreated firms using the steel futures shock. We examine the change in average *Aggregate PO/Assets* from the 2006, 2007 pre-event window to the 2009, 2010 post-event. In Panel A, we present average *Cash*, *CAPEX*, *Firm Size*, and *Leverage* for the treated and control firms in the pre-event period (2006, 2007). Panel B presents the basic difference in difference result for the matched sample while Panel C presents the Average Treatment Effect on the Treated with a bias correction for the imperfect matching. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Panel A – Matched Samples

	Treated Obs			Matched Controls				
	# Obs	Mean	Std Error	# Obs	Mean	Std Error	Diff	P Value
Cash $_{2006,2007}$	604	0.126	0.005	604	0.122	0.005	-0.004***	0.001
CAPEX $_{2006,2007}$	604	0.052	0.002	604	0.050	0.002	-0.001**	0.016
Firm Size $_{2006,2007}$	604	6.129	0.076	604	6.145	0.074	0.016	0.266
Leverage $_{2006,2007}$	604	0.148	0.007	604	0.147	0.007	-0.001	0.716

Panel B – Diff in Diff

	Pre-Shock		Post-Shock		Difference	
Treated	0.028	***	0.037	***	0.009	*
	(0.004)		(0.004)		(0.004)	
Control	0.016	***	0.036	***	0.021	***
	(0.002)		(0.008)		(0.006)	
Difference	0.012	**	0.001		-0.012	*
	(0.005)		(0.008)		(0.007)	

Panel C – ATT Results

	# Obs	Coef	Std Error	z	P Value
Aggregate PO/Assets	2467	-0.012*	0.006	-1.92	0.055

Table 10
Line of Credit Shock

The table presents multivariate estimates using nonfinancial Compustat firms from 2003-2010. The dependent variable in all specification is *Has LOC*, an indicator equal to one if the firm has a LOC, zero otherwise *LOC Shock* equals one if the firm's lead lender failed in the previous year. All control variables are as defined in Table 1 and are included with a one year lag. All estimates include firm and year indicator variables and all standard errors are clustered by firm. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	*Has LOC*			
Estimation	Logit		OLS	
Sample	All	Z>3	All	Z>3
	(1)	(2)	(3)	(4)
LOC Shock	-0.531*	-0.657*	-0.027*	-0.037*
	(-1.872)	(-1.824)	(-1.717)	(-1.759)
Leverage	1.928***	2.823***	0.119***	0.181***
	(2.736)	(2.683)	(2.769)	(2.849)
Cash	-1.494***	-1.448***	-0.145***	-0.137***
	(-5.181)	(-4.256)	(-6.881)	(-5.436)
Firm Size	0.353***	0.425***	0.026***	0.034***
	(3.282)	(3.052)	(3.703)	(3.592)
Capex	3.426***	3.578**	0.152**	0.168*
	(2.901)	(2.199)	(2.469)	(1.904)
Leverage Squared	-2.619***	-4.025**	-0.157***	-0.254***
	(-3.141)	(-2.523)	(-3.181)	(-2.766)
Sales	0.366***	0.263	0.029***	0.025**
	(2.922)	(1.547)	(3.514)	(2.261)
R&D Intensity	-0.546	0.112	-0.054*	0.011
	(-1.270)	(0.197)	(-1.772)	(0.252)
Trade Credit	0.818	3.050**	0.038	0.121
	(1.072)	(1.979)	(0.797)	(1.583)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
# Obs	4,892	3,357	19,790	13,955

Table 11
Line of Credit Shock – Natural Experiment

The table presents multivariate estimates using nonfinancial Compustat firms from 2003-2010. In most columns, the sample is limited to financially healthy firms with Z scores greater than three. The dependent variable *New Contract* is a dummy that equals one if the firm adds a PO in the current year, and zero if they do not. The dependent variable *Commodity Hedger* is equal to one if a firm reports using commodity derivatives, zero otherwise. The dependent variable for the OLS estimates is *PO/Total Assets*. The *Rated Debt/No Rating* subsamples are split based on whether Compustat reports an S&P credit rating for the firm. *LOC Shock* equals one if the firm's lead lender failed in the previous year. All control variables are as defined in Table 1 and are included with a one year lag. All estimates include firm and year indicator variables and all standard errors are clustered by firm. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Estimation	Logit		OLS			
Dependent Variable	*New Contract*	*Commodity Hedger*	*PO/Total Assets*			
Sample	Z>3		All	Z>3		
Subsample					Rated Debt	No Rating
	(1)	(2)	(3)	(4)	(5)	(6)
LOC Shock	0.680**	-0.882	0.015*	0.019	-0.000	0.051*
	(2.250)	(-0.865)	(1.660)	(1.369)	(-0.005)	(1.872)
Leverage	-0.303	-1.588	-0.016	0.019	0.007	0.021
	(-0.245)	(-1.188)	(-0.615)	(0.444)	(0.201)	(0.364)
Cash	-0.652	-0.226	-0.021	-0.026	0.002	-0.029
	(-1.223)	(-0.272)	(-1.619)	(-1.500)	(0.065)	(-1.423)
Firm Size	-0.083	0.450**	0.001	-0.001	-0.000	-0.000
	(-0.440)	(2.022)	(0.161)	(-0.094)	(-0.080)	(-0.013)
Capex	-1.788	-0.635	-0.014	-0.049	-0.029	-0.066
	(-0.987)	(-0.349)	(-0.383)	(-0.809)	(-0.541)	(-0.870)
Leverage Squared	-0.842	1.370	-0.007	-0.100	-0.073*	-0.111
	(-0.497)	(0.770)	(-0.243)	(-1.621)	(-1.649)	(-1.302)
Sales	-0.282	0.114	0.001	-0.002	0.013*	-0.003
	(-1.101)	(0.558)	(0.261)	(-0.229)	(1.720)	(-0.273)
R&D Intensity	-1.414	1.313	0.001	-0.010	0.370***	-0.013
	(-1.223)	(0.715)	(0.031)	(-0.298)	(3.312)	(-0.342)
Trade Credit	0.425	0.877	0.017	0.067	0.047	0.087
	(0.252)	(0.446)	(0.527)	(1.229)	(0.725)	(1.329)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	3,189	1,690	19,647	13,871	3,042	10,679

Table 12
Line of Credit Shock – Robustness

The table presents placebo tests and subsample analyses for the line of credit tests. Panel A reports the effect of the LOC Shock on PO/Total Assets across subsamples based on z-score and bargaining power. High (Low) Supplier Bargaining Power is defined as having a supplier HHI greater (less) than the sample mean. High (Low) Supplier Z-Score is defined as having a supplier Z-score greater (less) than the sample mean. Panel B reports placebo tests where the dependent variable in the logit specification is *New Contract* and for the OLS estimates is *PO/Total Assets*. The sample is limited to financially healthy firms with Z scores greater than 3. *Placebo LOC Shock (No LOC, shock year)* equals one if the year is 2008 and the firm did not have a line of credit when the shock occurred. *Placebo LOC Shock (has LOC, no shock)* is equal to one if the firm has a line of credit but their lead lender did not fail. All control variables are as defined in Table 9 and are included with a one year lag. All estimates include firm and year indicator variables and all standard errors are clustered by firm. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Subsample Analysis

Dependent Variable	*PO/Total Assets*			
Estimation	OLS			
Subsample	*Supplier Z Score*		*Supplier Bargaining Power*	
	High	Low	High	Low
	(1)	(2)	(3)	(4)
LOC Shock	0.019*	-0.000	-0.022	0.031*
	(1.776)	(-0.002)	(-1.275)	(1.666)
Firm Controls	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
# Obs	8,212	5,656	3,066	10,805

Panel B: Placebo Tests

Dependent Variable	*New Contract*		*PO/Total Assets*	
Estimation	Logit		OLS	
	(1)	(2)	(3)	(4)
Placebo LOC Shock (No LOC, shock year)	0.283		0.006	
	(0.837)		(1.472)	
Placebo LOC Shock (has LOC, no shock)		-0.232		-0.001
		(-1.224)		(-0.382)
Firm Controls	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
# Obs	3,368	3,368	11,501	11,501

Table 13
LOC Shock - Matching

The table presents difference-in-difference results using a matched sample between treated and untreated firms using the LOC shock. We examine the change in average *Aggregate PO/Assets* from *t-1* to *t+1*. In Panel A, we present average *Cash*, *CAPEX*, *Firm Size*, and *Leverage* for the treated and control firms in the pre-event period (2006, 2007). Panel B presents the basic difference in difference result for the matched sample while Panel C presents the Average Treatment Effect on the Treated with a bias correction for the imperfect matching. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Panel A – Matched Samples

	Treated Obs			Matched Controls				
	# Obs	Mean	Std Error	# Obs	Mean	Std Error	Diff	P Value
Cash $_{2006,2007}$	174	0.078	0.006	174	0.078	0.006	0.000	0.669
CAPEX $_{2006,2007}$	174	0.060	0.004	174	0.058	0.004	-0.001*	0.020
Firm Size $_{2006,2007}$	174	8.018	0.133	174	7.997	0.132	-0.021*	0.054
Leverage $_{2006,2007}$	174	0.190	0.013	174	0.190	0.013	0.000	.0.546

Panel B – Diff in Diff

	Pre-Shock		Post-Shock		Difference	
Treated	0.036	**	0.060	**	0.022	**
	(0.015)		(0.023)		(0.009)	
Control	0.025	***	0.024	***	0.003	
	(0.005)		(0.005)		(0.004)	
Difference	0.011		0.036		0.019	*
	(0.015)		(0.023)		(0.010)	

Panel C – ATT Results

	# Obs	Coef	Std Error	z	P Value
Aggregate PO/Assets	8616	0.018*	0.009	1.95	0.051

Table 14
Line of Credit Shock – Trade Credit Channel

The table estimates the effect of the line of credit shock on the firm's upstream trade credit borrowings. The dependent variable is upstream *Trade Credit*. *LOC Shock* equals one if the firm's lead lender failed in the previous year. All control variables are as defined in Table 1 and are included with a one year lag. All estimates include firm and year indicator variables and all standard errors are clustered by firm. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	*Trade Credit*	
Sample	All	Z>3
	(1)	(2)
LOC Shock	-0.049	-0.003
	(-0.740)	(-0.043)
Leverage	0.394**	0.050
	(2.157)	(0.249)
Cash	-0.274***	0.047
	(-3.068)	(0.593)
Firm Size	-0.115***	-0.067**
	(-3.946)	(-2.223)
Capex	1.170***	0.786***
	(4.464)	(2.808)
Leverage Squared	-0.309	-0.034
	(-1.473)	(-0.117)
Sales	0.084**	-0.017
	(2.464)	(-0.503)
R&D Intensity	0.338***	0.199
	(2.627)	(1.444)
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
# Obs	19,976	14,077