Corporate Hedging, Contract Termination Rights, and Basis Risk

Arizona State University

Overview

- Literature on corporate hedging documents low hedge ratios for firms close to default.
  - May be considered puzzling (risk-averse managers want to avoid default (Tufano (1996)), hedging is more valuable with a higher likelihood of distress (Campello et. al (2011)).
  - One explanation is based on collateral constraints (Rampini and Vishwanathan (2010)).
- A standard OTC derivative contract gives an option to terminate the contract conditional on certain events of default. We document that such option is often exercised (62%).
- The model shows that the exercise policy and option value depend on basis risk, bankruptcy costs, value of relationship, and ability to negotiate/postpone payments in default.
- Derivative terminations by the counterparties can explain risk management policies of firms in distress.

Prior Literature

- Our work is related to studies on treatment and priority of derivatives for firms that enter bankruptcy. Bolton and Oehmke (2015) (and earlier Roe (2011)) compare the cases when the derivative have priority in bankruptcy and when they do not.
- The literature by Rampini and Viswanathan (2010) and Purnanandam (2008) models and tests hedging of constrained firms. Subsequently, Rampini, Sufi, and Viswanathan (2014) test the predictions of theory using a sample of 23 U.S. commercial airlines from 1996 to 2009, finding that more financially constrained airlines are less likely to hedge fuel costs.
- Literature on risk management by ways other than derivatives: Almeida, Hankins, Watson, and Williams (2021) study purchase obligations (POs)

Background: Contingencies and Consequences of Terminating a Hedging Position

- Derivative contracts are highly standardized and are typically guided by "master agreements." The standard is the ISDA Master Agreement (ISDA.org), this contract serves for all over-the-counter (OTC) derivatives transactions.
- The ISDA Master Agreement contains eight standard events of default, when the derivative position can be closed before maturity, but most agreements include additional events in the attached schedules.
- ...include the following events for the party at fault: a) failure to pay; b) breach of agreement; c) failure of the external credit support; d) misrepresentation; e) default on other (separately specified) transaction; f) cross-default; g) bankruptcy of the firm; h) merger without full assumption of liabilities.

Details of ISDA

- Upon an event of default or termination event with respect to one party (the "defaulting party"), the other party will be entitled to terminate all the outstanding transactions or the affected transactions pursuant to a termination event, value them and net out amounts owed by the defaulting party from any amounts that may be owed to the defaulting party.
- An event of default creates an option, but usually not the requirement, to close the agreement. There are a number of scenarios where a party may not wish to close out an ISDA Master Agreement, even if an event of default has occurred.
- As most other agreements, the derivative agreements typically provide for the "grace period" before they can be closed, to give the opportunity to react to an event.

Examples

- *"On October 1, 2008, we received a notice of early termination from BNP Paribas ("BNP") with respect to our natural gas and interest rate swap derivatives" (Aurora Oil & Gas Corp., 2008-12-31, in default with lenders).*
- *"...certain of the Company's derivative positions were terminated prior to July 15, 2015 as a result of defaults under Sabine's derivative agreements that occurred prior to the filing of the Bankruptcy Petition."* (Forest Oil Group, 10-K report for 2015, in Chapter 11 bankruptcy)
- *"On June 14, 2018, the Company's hedging counterparty, Koch Supply & Trading LP, terminated the only outstanding hedge contract resulting in a settlement of $0.5 million."* (PetroQuest Energy Inc., 2019, in Chapter 11 bankruptcy)

Example of Termination Without Bankruptcy Filing

- On April 12, 2021, Morgan Stanley, a hedge counterparty to several of our hedging contracts, sent us notice of events of default and early termination with respect to the hedging contracts.
- The notice indicates MS's election to exercise termination rights under the hedge contracts, which have arisen as a result of the occurrence of events of default under our first lien credit facility, of which MS is a lender, holding 3.7% of the outstanding obligations.
- The Notice of Default describes events of default occurred: (i) our failure to file timely our Form 10-K for the fiscal year 2020, (ii) our failure to deliver audited financial statements without a "going concern" and (iii) other defaults.

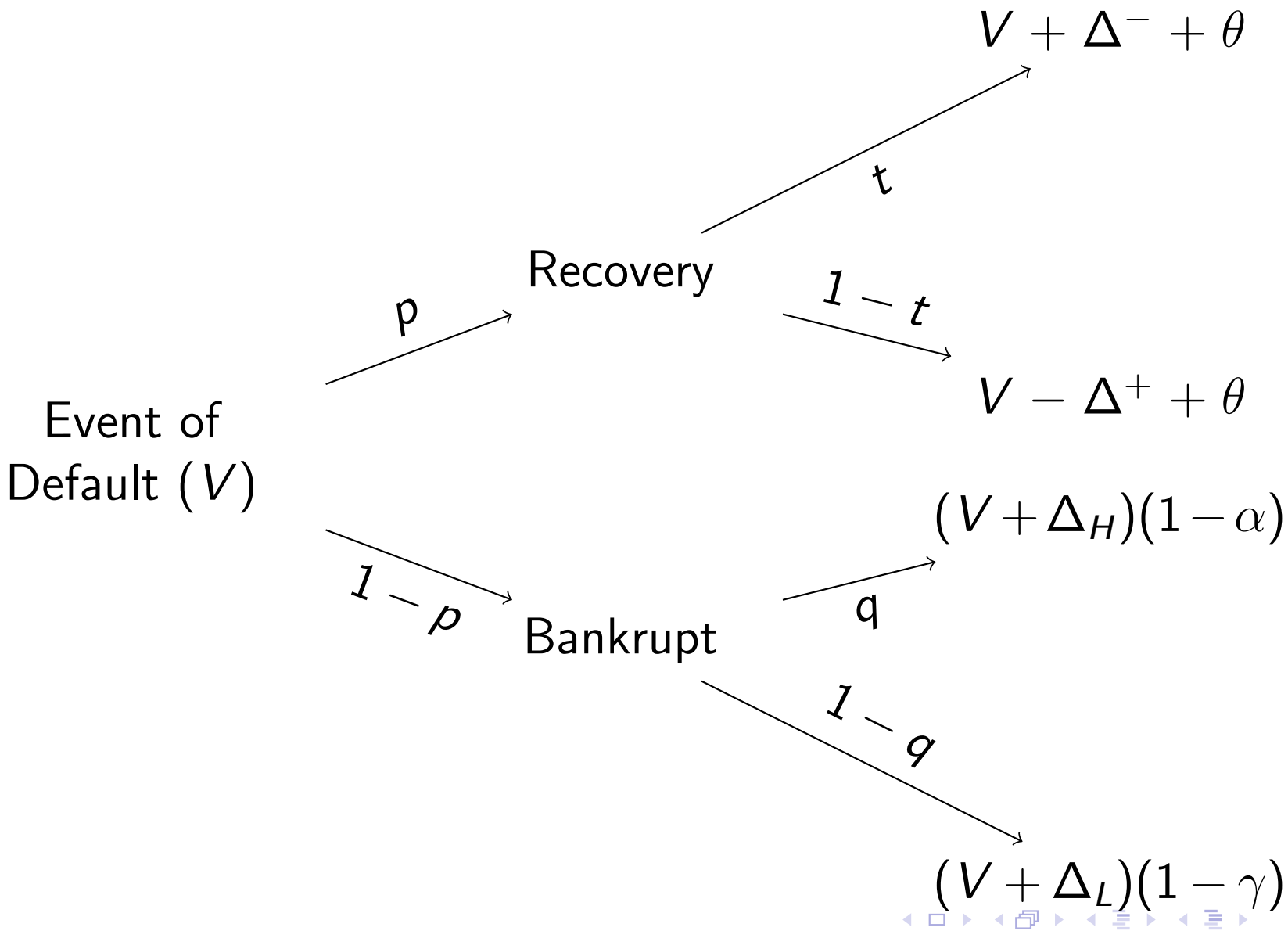
Model: Assumptions

- The hedging contract is signed at $t = 0$ at a fair value. Payments are contingent on the value of "underlying" and are imperfectly correlated with the firm performance (basis risk).
- At $t = 1$, the firm performance can be good with probability π or bad with probability $1 - \pi$, in which case an event of default is triggered.
- Following the event of default, the value of the derivative is assumed to be V, payable if the contract is terminated.
- We assume that continuing the contract with the firm has value for the counterparty, $\theta > 0$, which are realized only if the firm recovers.

Assumptions continued

- After an event of default has been triggered, the firm can recover with probability p or experience a costly bankruptcy/liquidation with probability $1 - p$. The probability of recovery may depend on the value of derivative portfolio, in which case $p = p(V)$.
- If there is a bankruptcy/liquidation, then the derivative contract payments depend on the value of the hedging portfolio.
  - If the money is owed by the firm to the counterparty, we assume the firm first pays a proportional cost, α.
  - In contrast, if the counterparty owes money to the firm, we assume it could lower its payments by a proportional amount γ.

Model


$V + \Delta^- + \theta$
t
Recovery
p
$1 - t$
Event of
Default (V)
$V - \Delta^+ + \theta$
$(V + \Delta_H)(1 - \alpha)$
$1 - p$
q
Bankrupt
$1 - q$
$(V + \Delta_L)(1 - \gamma)$

Mechanics

- Conditional on value V, the counterparty must choose between accepting V on the spot or taking the continuation value.
- As for the continuation value, assuming that the value of the hedging portfolio is V' at $t = 2$, the counterparty expects

$$(1 - \alpha) \max(V', 0) + (1 - \gamma) \min(V', 0),$$

  when the firm is liquidated with probability $(1 - p)$, and it expects $\theta + V'$ when the firm recovers with probability p.
- Intuitively, the value of the option to terminate the portfolio depends on the volatility of the portfolio value at the time of "event of default."

Exercise decision

From our assumptions, the derivative is terminated if

$$V > p \underbrace{(V + \Delta + \theta)}_{\text{expected payment in recovery}} + (1-p)\underbrace{\left(q\left(V+\Delta_H\right)(1-\alpha) + (1-q)\left(V+\Delta_L\right)(1-\gamma)\right)}_{\text{expected payment to the firm in bankruptcy}} \tag{1}$$

$$(1-p)\left[\underbrace{\left(V+\Delta_H\right)\alpha q}_{\text{lower deadweight cost}} + \underbrace{\left(V+\Delta_L\right)\gamma\left(1-q\right)}_{\text{value of renegotiation}}\right] > \underbrace{p\theta}_{\text{continuation value}} \tag{2}$$

Termination Option Exercise Policy

- The contract is more likely to be terminated by the counterparty if the value of the derivative to the counterparty, V, is high.
- Higher bankruptcy costs, α, make the termination of the contract more attractive (and particularly so when the basis risk $(1 - q)$ is high).
- Greater ability to postpone payments if the firm becomes bankrupt, γ, implies a lower incentive to terminate the contract.
- Higher benefits of contract continuation, θ, naturally imply the lower incentive to terminate the contract.
- Higher basis risk (low q) implies greater incentive to terminate.

Value of the Option

- Value of the option depends on the volatility of V, the expected value conditional on exercise, and on the basis risk.
- We can capture the correlation between firm's cash flow and derivative value by assuming that $P(V < 0 | \textit{Good peformance}) = \rho > 1/2$. An imperfect correlation constitutes a basis risk, that is $\rho < 1$.
- Intuitively, proper hedging allows for the payment to the firm when its performance is low. Basis risk increases the possibility that the firm must pay to settle its derivatives obligation while its performance is low. Since the counterparty expects a payment, it is more likely to terminate.

Extensions

- Modeling debt and asset values. The firm is in event of default when the payment on debt is not made. Liquidation follows when performance is even lower.
- The option to terminate decreases deadweight costs to the counterparty (through α, which can be passed to shareholders/debtholders). However, the redistribution of payments (through γ) is at the expense of more risky debt.
- The counterparty holding a "basket" of hedging portfolios for different firms. Diversification effect.

Data on Bankruptcies

- Data on the events of default are from several sources. Most events are from (UCLA LoPucki Bankruptcy Research Database), which however does not include firms with assets less than $100 million (in 1980 dollars).
- We add a set of default events from Dou, Taylor, Wang, and Wang (2021) and Ma, Tong, and Wang (2021), which includes bankruptcies (Chapter 7 and Chapter 11) filed by public, nonfinancial U.S. firms from 1981 to 2012 from New Generation Research's (Bankruptcydata.com), Public Access to Court Electronic Records (PACER), National Archives at various locations, and U.S. Bankruptcy Courts for various districts.

Detailed Sample of Commodities

- Finally, we hand-collect events of default for four commodities where we have detailed hedging portfolio data for the period 2001-2020: oil and gas producers, coal producers, steel producers, and scheduled airlines.
- Main benefits: (i) we can quantify hedging (hedge ratios, maturity, securities used for hedging) (ii) we can identify derivative termination events
  - We obtain the information on the events of default by searching their 10-K and 10-Q statements for the keywords associated with the non-payment or default
  - Oil and gas firms hedge crude oil and natural gas (317)
  - Coal firms hedge diesel fuel (29)
  - Airlines hedge kerosine (36)
  - Steel producers hedge chrome, nickel, copper, etc. (72)

Textual Search

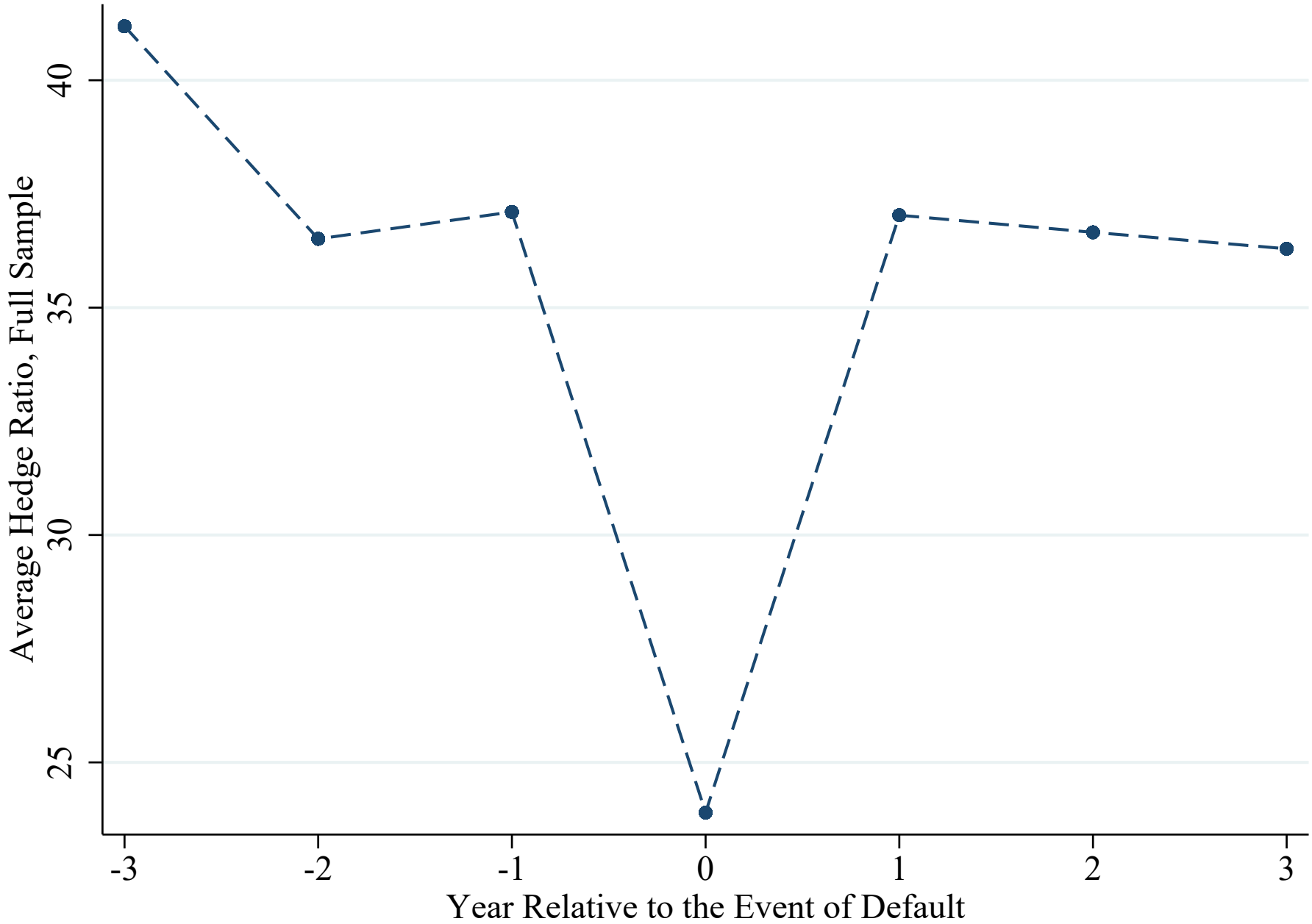
- We use the standard tools to read the firm's annual statements.
- To quantify the derivative use for all firms, we search for keywords ('collar', 'derivative', 'hedg', 'risk management', 'forwards', 'forward contract', 'futures', 'swap'). We normalize by the total number of words in 10-K.
- To identify events of default, we search for keywords ('default', 'event of default', 'bankrupt', 'defaulted', 'bankruptcy')
- To identify derivative terminations, we parse 10-Ks for any keywords ('cancel', 'terminat', 'liquidat', 'unwound'), any keywords pointing to the nature of the contract ('deriv', 'hedg', 'swap', 'position') and any keywords pointing to the reason for termination or a governing document ('event of default', "master agreement', 'master contract', 'ISDA', 'hedging agreement').

Summary Statistics

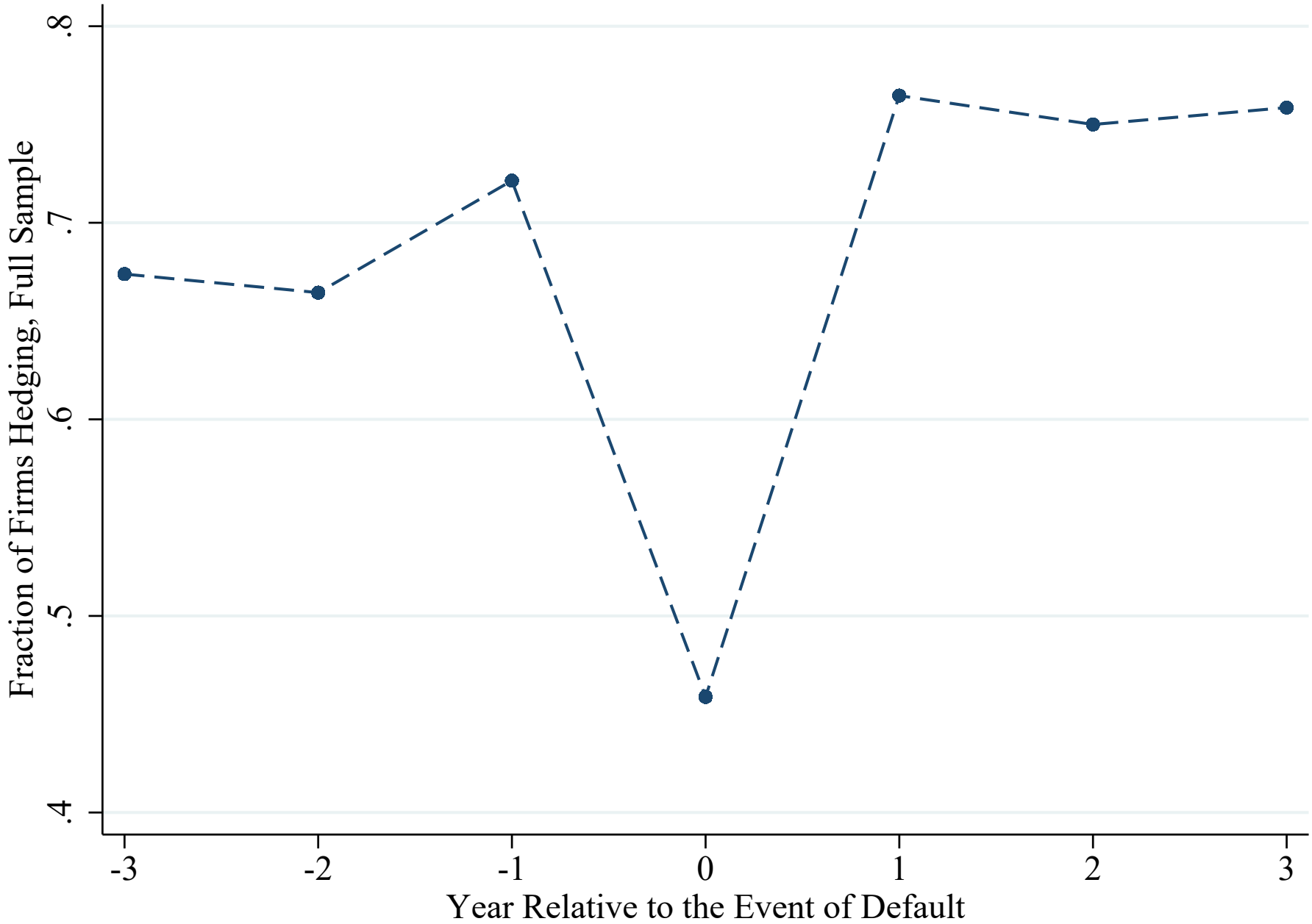
Compustat/SEC Sample	*N*	*Mean*	*Std. Dev.*
Derivative user	128,181	0.199	0.400
Bankruptcy	140,810	0.006	0.077
Hedging intensity (%)	79,571	0.122	0.170
Default words frequency (%)	79,571	0.039	0.059

Commodity Sample	*N*	*Mean*	*Std. Dev.*
Commodity hedger	3,825	0.519	0.500
Hedge ratio (%)	3,825	27.382	41.285
Hedge maturity (months)	3,975	13.622	17.853
Bankruptcy	3,975	0.038	0.191
High-cost bankruptcy (free fall)	3,975	0.016	0.124
Low-cost bankruptcy (prepackaged)	3,975	0.022	0.147
Negative derivative fair value	141	0.227	0.420
Derivative termination	95	0.621	0.488

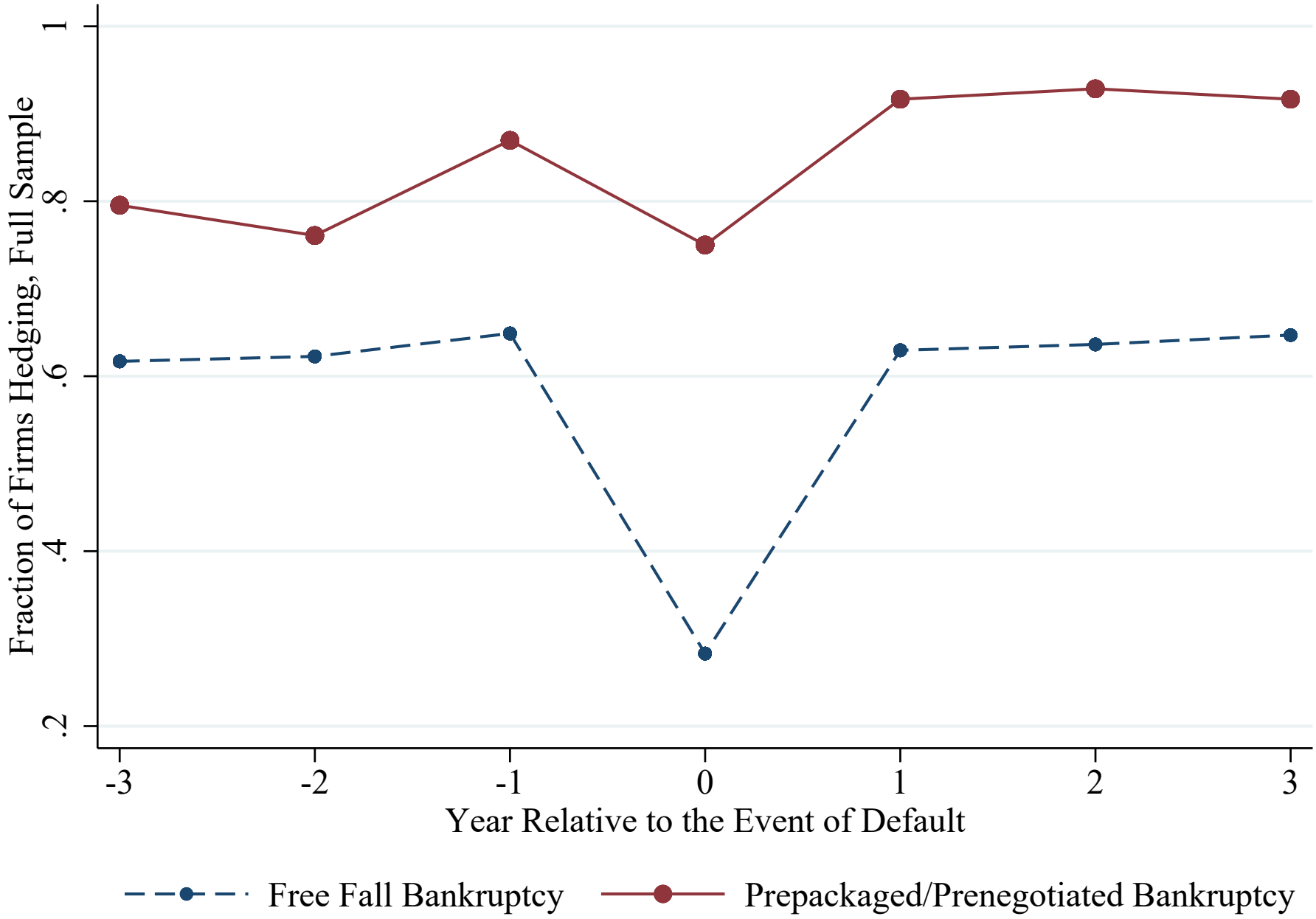
Events of Default and Hedge Ratio



Events of Default and Fraction of Firms Hedging



Type of Bankruptcy and Fraction of Firms Hedging



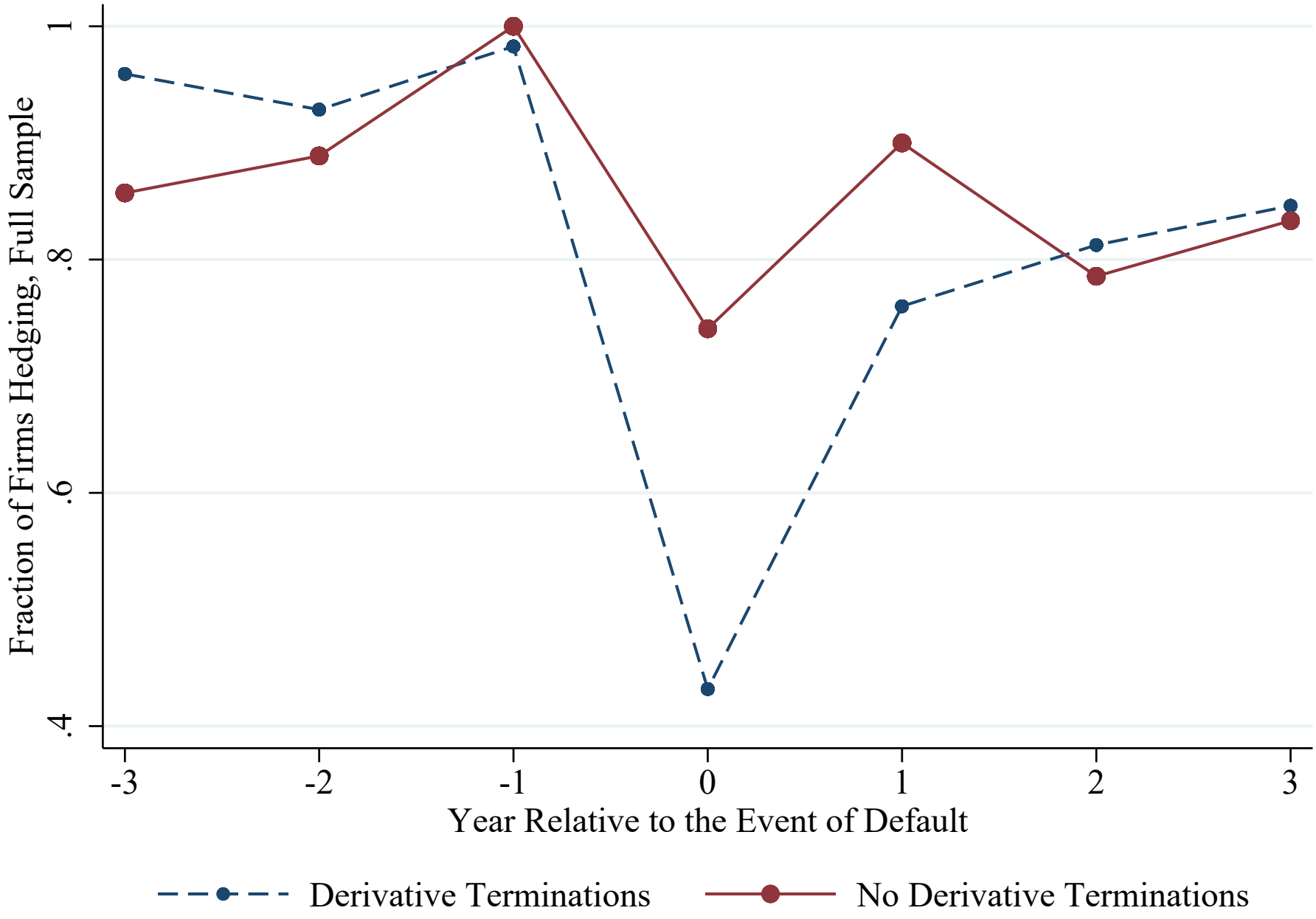
Events of Default and Risk Management

Dep. variable:	*Derivative User*			*Hedging Intensity*		
Bankruptcy	-0.16***			-0.05***		
	[-5.99]			[-5.75]		
High-cost bankruptcy		-0.23***			-0.08***	
		[-4.40]			[-4.77]	
Low-cost bankruptcy		-0.11***			-0.03***	
		[-4.33]			[-3.85]	
Default words frequency			-0.06**			-0.16***
			[-2.07]			[-14.11]
Firm size	0.03***	0.03***	0.04***	0.02***	0.02***	0.02***
	[16.07]	[16.14]	[12.30]	[14.15]	[14.21]	[13.84]
Observations	126,864	126,864	74,595	78,453	78,453	78,453
R-squared	0.699	0.699	0.684	0.755	0.755	0.756
t-stat		-1.97**			-2.42**	
Controls	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Commodity Sample: Better Measures of Hedging

Dep. variable:	*Hedge Ratio*		*Hedge Maturity*		*Commodity Hedger*	
Bankruptcy	-14.96***		-0.57***		-0.17***	
	[-3.27]		[-3.96]		[-3.75]	
High-cost bankruptcy		-23.46***		-0.89***		-0.23***
		[-2.95]		[-3.76]		[-3.26]
Low-cost bankruptcy		-7.64		-0.30*		-0.11**
		[-1.63]		[-1.87]		[-2.16]
Firm size	4.91***	5.03***	0.23***	0.23***	0.06***	0.06***
	[2.96]	[3.06]	[4.76]	[4.85]	[3.88]	[3.96]
Observations	3,815	3,815	3,965	3,965	3,815	3,815
R-squared	0.565	0.566	0.767	0.768	0.751	0.752
t-stat		-1.71*		-2.01**		-1.49
Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y

Do Terminations Explain Low Hedging in Distress?



Do Terminations Explain Low Hedging in Distress?

Dependent Variable:	*Hedge Ratio*	*Hedge Maturity*	*Commodity Hedger*
Bankruptcy with derivative terminations	-30.861*** [-4.07]	-1.198*** [-5.09]	-0.420*** [-6.02]
Bankruptcy without derivative terminations	-7.977* [-1.83]	-0.303* [-1.88]	-0.053 [-1.07]
Observations	3,815	3,965	3,815
R-squared	0.567	0.769	0.754
t-stat	-2.62***	-3.14***	-4.28***
Controls	Y	Y	Y
Year FE	Y	Y	Y
Firm FE	Y	Y	Y

Form of Hedging May Matter

- If a firm hedges not with derivatives, but with physical delivery contracts (also called supply agreements), the option to terminate upon an event of default does not apply.
  - Firm default is non-event. But, in case firm fails to deliver according to contract, there are penalties and other conditions.
  - Almeida, Hankins, and Williams (2021) show that hedging with purchase obligations does not subside as much in distress (attribute to greater pledgeability)

Placebo Test: Hedging with Derivatives vs. Supply Agreements in Coal Industry

Dep. variable:	(1) *Hedge Ratio*	(2) *Hedge Maturity*	(3) *Commodity Hedger*	(4) *Hedge Ratio*	(5) *Hedge Maturity*	(6) *Commodity Hedger*
Bankruptcy, deriv. termin.	-30.20*** [-8.26]	-1.47*** [-5.00]	-0.52*** [-5.34]	0.32 [0.12]	0.06 [0.32]	-0.06 [-1.50]
Bankruptcy, no deriv. termin.	0.54 [0.06]	-0.27 [-1.11]	-0.06 [-0.62]	-15.73 [-1.10]	-0.48 [-0.74]	-0.19 [-1.06]
Observations	202	220	202	209	195	209
R-squared	0.746	0.738	0.750	0.928	0.954	0.961
t-stat	-3.18***	-3.13***	-3.21***	1.10	0.80	0.72
Controls	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Hedging type	Diesel Derivatives			Coal Supply Agreements		

Derivative Terminations and Fair Value at Default

	(1)	(2)	(3)	(4)	(5)	(6)
Derivative fair value	-0.56***	-0.66***	-7.54***			
	[-3.27]	[-3.03]	[-2.61]			
Negative fair value				0.32***	0.38***	2.32***
				[3.38]	[3.68]	[2.74]
Hedge ratio		0.001	0.008		0.000	0.002
		[1.31]	[1.28]		[0.34]	[0.42]
Firm size		-0.012	0.056		-0.018	-0.067
		[-0.26]	[0.26]		[-0.44]	[-0.34]
Observations	94	88	88	94	88	88
(Pseudo) R-squared	0.073	0.144	0.152	0.118	0.205	0.184
Controls	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Estimation	OLS	OLS	Logit	OLS	OLS	Logit

Oil Price Movements Before Bankruptcy and Hedging

Dependent Variable:	(1) *Hedge Ratio*	(2) *Hedge Maturity*	(3) *Commodity Hedger*
Bankruptcy×Positive 1-Month Oil Return	-32.064*** [-3.14]	-0.825*** [-3.25]	-0.261*** [-3.70]
Bankruptcy×Negative 1-Month Oil Return	-13.198 [-1.46]	-0.482** [-2.05]	-0.169*** [-2.74]
Firm size	5.059*** [2.69]	0.234*** [4.50]	0.065*** [4.21]
Observations	2,613	2,626	2,613
R-squared	0.518	0.751	0.726
t-stat	-1.38	-0.99	-0.98
Controls	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y

Conclusion

- The option to terminate the OTC derivative contract is valuable and explains the observed under-hedging in distressed firms.
  - The exercise probability increases in bankruptcy costs, but decreases in recontracting costs and the ability to postpone or negotiate payments in default. The ex-ante value of the option increases in basis risk.
  - Using hand-collected data on hedging portfolios, we document that the termination right is exercised in 62% of default cases. The termination of derivative contracts by the counterparties contributes to explaining the previously documented low corporate hedging in distress.
- Next steps...