Should Derivatives be Privileged in Bankruptcy?

Patrick Bolton and Martin Oehmke
Columbia University

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Background

Derivatives benefit from **privileges in bankruptcy:**

- not subject to the automatic stay
- netting, collateral, and closeout rights
- can keep eve-of-bankruptcy payments

⇒ To the extent that their net exposure is collateralized, derivative counterparties get paid before anyone else...

But why should/shouldn’t derivatives be effectively senior?

Aim of this paper:

- provide a framework to analyze the overall effect of derivatives treatment in bankruptcy
- focus on transfer of risk between debt and derivative markets
Why We Should be Interested

- Role of derivatives in the demise of Lehman Brothers

  “This caused a massive destruction of value.”
  Harvey Miller (2009)

- Treatment of Qualified Financial Contracts (QFCs) which include derivatives under Dodd-Frank

- Ex-ante distortions of seniority for derivatives

  “It’s plausible to wonder whether Bear’s financing counterparties would have so heavily supported Bear’s short-term repo financings were they unable to enjoy the Code’s advantages.”
  Mark Roe (2010)
Central insights:

Derivatives serve a valuable role as risk management tools, **BUT**

1. senior derivatives may **raise** overall cost of hedging
2. seniority for derivatives may lead to **excessively large derivative positions**
3. seniority for derivatives may induce **speculation rather than hedging**

**Why?** Seniority for derivatives dilutes existing debtholders

- Increases cost of debt ⇒ firm has to take larger derivative position to hedge
- Firm may have an incentive to increase derivative exposure beyond efficient level/use derivative less suited for hedging
Related Literature


- **Hedging:** Smith and Stulz (1985), Froot, Scharfstein and Stein (1993), Biais, Heider and Hoerova (2010), Cooper and Mello (1999)

The Model

Three periods: $t = 0, 1, 2$

Risk-neutral firm has investment project:

- investment at $t = 0$: $F$
- cash flows at $t = 1$: $\{C_1^H, C_1^L\}$ with prob $\{\theta, 1 - \theta\}$
- cash flows at $t = 2$: $C_2$

Project can be liquidated at $t = 1$ for $L < C_2$

Liquidation value at $t = 2$ normalized to zero
The Model

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Risk-neutral firm has investment project:

- investment at \( t = 0 \): \( F \)
- cash flows at \( t = 1 \): \( \{ C_1^H, C_1^L \} \) with prob \( \{ \theta, 1 - \theta \} \)
- cash flows at \( t = 2 \): \( C_2 \)

Project can be liquidated at \( t = 1 \) for \( L = 0 < C_2 \)

Liquidation value at \( t = 2 \) normalized to zero
Debt Financing

Firm finances project using **debt**

- single risk-neutral creditor

Firm faces **limited commitment** à la Hart and Moore

- at $t = 1$ only minimum cash flow $C^L_1$ verifiable
- borrower can divert $C^H_1 - C^L_1$ at $t = 1$
- $C_2$ not pledgeable

Debt contract specifies **contractual repayment** $R$ at $t = 1$

- if firm repays $R$, has right to continue and collect $C_2$
- otherwise creditor can liquidate firm

Cannot finance with risk-free debt: $C^L_1 < F$
Benchmark: The Model without Derivatives

Two types of default:

- If $C_1 = C_1^L$ firm has no option but default
- If $C_1 = C_1^H$ firm repays if IC satisfied ($R$ not too high)

\[ C_1^H - R + C_2 \geq C_1^H - C_1^L \]

Which projects attract financing?

- Firm can finance project as long as: $F \leq C_1^L + \theta C_2$
- Social surplus: $\theta (C_1^H + C_2) + (1 - \theta) C_1^L - F$

Limited commitment leads to inefficiency:

- early termination after $C_1^L$
- expected surplus loss of $(1 - \theta) C_2$
Introducing Derivatives

**Derivative contract:**

- specifies payoff contingent on realization of a *verifiable* random variable $Z \in \{Z^H, Z^L\}$
- $Z$ is correlated with the firm’s cash flow risk
- position chosen after debt is in place (and $R$ has been set)

**Interpretation of $Z$:**

- asset price
- a financial index

**Payoffs of derivative:**

- counterparty pays notional $X$ when $Z = Z^L$
- firm owes payment $x$ when $Z = Z^H$
Using the Derivative to Hedge Cash Flow Risk

- Derivative pays off $X$ with probability:

$$\Pr[Z = Z^L] = 1 - p$$

- Usefulness in hedging determined by correlation to cash flow:

$$\Pr[Z = Z^L | C_1 = C^L_1] = \gamma$$

$\gamma = 1$ means that derivative is a perfect hedge (*no basis risk*)

- Counterparty to derivative (protection seller) incurs hedging costs
Using the Derivative to Hedge Cash Flow Risk

- Derivative pays off $X$ with probability:
  \[ Pr[Z = Z^L] = 1 - p = 1 - \theta \]

- Usefulness in hedging determined by correlation to cash flow:
  \[ Pr[Z = Z^L | C_1 = C_1^L] = \gamma \]
  \[ \gamma = 1 \] means that derivative is a perfect hedge (no basis risk)

- Counterparty to derivative (protection seller) incurs hedging costs
Counterparty has assets $A$ that it can invest for a return $\Gamma > 1$.

Counterparty can take an unobservable action $a \in \{0, 1\}$ which alters the riskiness of its assets.

When $a = 1$, the return on its assets is $\Gamma > 1$.

When $a = 0$, the return on its assets is risky and equal to $\Gamma$ only with probability $p < 1$; with probability $(1 - p)$ the gross return is equal to zero.
Endogenous Hedging cost for Derivative Counterparty

- When the counterparty chooses action $a = 0$ it obtains a private benefit $b > 0$ per unit of assets on the balance sheet.

- It is efficient to choose $a = 1$: $\Gamma > p\Gamma + b$.

- Incentive Constraint: The minimum fraction $\zeta$ of assets that needs to be posted as collateral is then given by

$$\zeta = \frac{X - AP}{A(1 - P)},$$

where, we define $P = \Gamma - \frac{b}{(1-p)}$ as the counterparty's pledgeable income per unit of assets.
Benchmark: No Basis Risk ($\gamma = 1$)

Can eliminate default following the realization of $C_1^L$ by setting:

$$X = R - C_1^L \text{ and } R = F$$

Derivatives add value if and only if

$$\underbrace{(1 - \theta) C_2}_{\text{reduction in default costs}} - \underbrace{(1 - \theta)(\Gamma - 1) \left( \frac{F - C_1^L - AP}{A(1-P)} \right)}_{\text{hedging cost}} > 0$$

Optimal derivative position just eliminates default:

$$X^* = R - C_1^L = F - C_1^L$$
Benchmark: No Basis Risk ($\gamma = 1$)

If firm *can commit* to derivative position taken ex-post:

- all surplus accrues to firm
- firm takes optimal derivative position $X = F - C^L_1$
- bankruptcy treatment irrelevant, since no default occurs

If firm *cannot commit* to derivative position taken ex-post:

- under senior derivatives harder to sustain hedging
- firm may take ‘short’ position in derivative
- channels funds form bad state to good state at expense of creditors
Basis Risk ($\gamma < 1$): Commitment to Senior Derivatives

To eliminate default, with probability $(1 - \theta)\gamma$, need to set:

$$X = R - C_1^L$$

- $R$ is determined by creditor breakeven condition:

$$[\theta + (1 - \theta)\gamma] R + (1 - \theta)(1 - \gamma)(C_1^L - x) = F$$

- $x$ determined by derivative counterparty breakeven condition:

$$\theta x = (1 - \theta)[X + (\Gamma - 1)\zeta]$$

- Gain in social surplus when:

$$(1 - \theta)\gamma C_2 - (1 - \theta)(\Gamma - 1)\zeta > 0,$$

where

$$\zeta \equiv \frac{R - C_1^L - AP}{A(1 - P)}.$$
Basis Risk ($\gamma < 1$): Commitment to Junior Derivatives

To eliminate default, with probability $(1 - \theta)\gamma$, need to set:

$$X^S = R^S - C_1^L$$

- $R^S$ determined by creditor breakeven condition:

$$[\theta + (1 - \theta)\gamma] R^S + (1 - \theta)(1 - \gamma) C_1^L = F$$

- $x^S$ determined by derivative counterparty breakeven condition:

$$[\theta - (1 - \theta)(1 - \gamma)] x^S = (1 - \theta) [X^S + (\Gamma - 1) \zeta^S]$$

- Gain in social surplus when:

$$(1 - \theta) \gamma C_2 - (1 - \theta)(\Gamma - 1)\zeta^S > 0,$$

where

$$\zeta^S \equiv \frac{R^S - C_1^L - A\mathcal{P}}{A(1 - \mathcal{P})}.$$
**Key Observation: Senior Derivatives Raise Cost of Debt**

Face value of debt is lower when debt is senior:

\[ R^S \leq R \]

\[ \iff \]

\[ R^S - C_1^L \leq R - C_1^L \]

- Required derivative position is smaller when debt senior
- This is more efficient because it reduces the deadweight cost of hedging at the level of the firm:

\[ (1 - \theta) (\Gamma - 1) \frac{R - C_1^L - A\mathcal{P}}{A(1 - \mathcal{P})}. \]
Consider a representative derivative counterparty writing many derivative contracts with many different firms.

There is a continuum of identical firms (with unit mass), each faced with the same set-up cost $F$, identical cash-flow shocks $(C^L, C^H)$ in period 1, and each receiving a continuation value $C_2$ if not liquidated.

The representative counterparty’s balance sheet is now composed of its initial endowment of assets $A$ and a continuum of (identical) derivative contracts $(X, x)$.

We consider three cases: 1) $C_1$ and $Z$ are i.i.d. across firms; 2) $C_1$ and $Z$ are perfectly correlated across firms; 3) $C_1$ is perfectly correlated, but $Z$ are i.i.d across firms.
Case 1: No Systematic Risk

**Law of large numbers** → $Z = Z^H$ for a fraction $\theta$ of derivative contracts and $Z = Z^L$ for a fraction $1 - \theta$ so that when derivatives are senior to debt, the balance sheet of the representative counterparty is

$$A\Gamma + \theta x - (1 - \theta) X$$

Zero-profit condition:

$$A\Gamma + \theta x - (1 - \theta) X = A\Gamma$$

$$\Rightarrow$$

$$\theta x - (1 - \theta) X = 0$$

$$\Rightarrow$$ the representative counterparty has no net liability $$\Rightarrow$$ incentive constraint for $a = 1$ is satisfied for $\zeta = 0$ (no deadweight costs)

Analogous argument when derivatives are junior to debt $$\Rightarrow$$ incentive constraint for $a = 1$ is satisfied for $\zeta^S = 0$. 
Case 2: Systematic Cash Flow and Basis Risk

- **Derivatives senior:** Counterparty incurs an aggregate liability of $X$ if $Z = Z^L$, leading to collateral requirement

\[ \zeta = \frac{X - A\mathcal{P}}{A(1 - \mathcal{P})}. \]

- **Derivatives senior:** Counterparty incurs an aggregate liability of $X^S$ if $Z = Z^L$, leading to collateral requirement

\[ \zeta^S = \frac{X^S - A\mathcal{P}}{A(1 - \mathcal{P})}. \]

- **Since** $R > R^S$ **we have** $X^S > X$, **so that** $\zeta > \zeta^S$.

- Seniority for derivatives does not generate any diversification benefits for the derivative counterparty.

- The only relevant efficiency consideration is to lower the size of the required derivative positions, which is achieved by making derivatives junior to debt in bankruptcy.
Case 3: Systematic Cash Flow and Idiosyncratic Basis Risk

- When derivatives are senior to debt and all firms receive $C^L_1$: the counterparty’s asset position is:

$$\zeta A + (1 - \zeta) A\Gamma + (1 - \gamma)x - \gamma X$$

- **Bottom Line:** Under idiosyncratic basis risk, seniority for derivatives allows the counterparty to offset some of the obligation $\gamma X$ through the payments $(1 - \gamma)x$ that the senior counterparty receives from defaulted firms.

- When derivatives are junior the counterparty obtains no income $(1 - \gamma)x$.

- This loss of income increases the collateral the counterparty must post, so that on net having derivatives junior to debt is inefficient.
Other Issues

Default due to derivative losses:

- overall payment $R + x$ is higher when derivatives are senior
- a higher payment $R + x$ makes it less likely that the firm can meet its payment obligations in the high cash flow state, where losses on derivative position can cause default
- inefficient collateral calls can precipitate bankruptcy

Excessively large or speculative derivative positions:

- when derivatives are senior, firm may take excessively large derivative positions
- essentially speculating at expense of creditors
- no such incentive when derivatives are junior
Default due to Derivative Losses

Up to now have assumed firm repays its obligations when $C_1 = C_1^H$

**BUT:** Required payment $R + x$ may cause default if it

- exceeds available cash $C_1^H$
- triggers strategic default

Firm meets payment obligations as long as

$$R + x \leq \min [C_1^H, C_1^L + C_2]$$

This is less likely to be satisfied when derivatives are senior
Inefficient Collateral Calls

Consider the extension with working capital $y$:

- firm raises $D = F + y$ at date 0
- firm spends $y$ before $C_1$ is realized to be able to generate $C_2$:

\[
C_2 = \begin{cases} 
V > 0 & \text{if } y \geq \kappa \\
0 & \text{otherwise}
\end{cases}
\]

Derivative counterparty learns $Z$ before realization of $C_1$

- can make immediate collateral call for $y$, but then $C_2 = 0$
- can make collateral call for $C_1$ when cash flow is realized

When $x > C_1^L$ and $Z = Z^H$

- privately optimal for counterparty to make inefficient collateral call
- $C_2 = 0$ and firm defaults strategically
Hedging or Speculation? No Basis Risk

- Up to now we have assumed that the firm picks optimal derivative position $X = F - C_1^L$

- **But is this optimal once debt is in place?**

- When the derivative has no basis risk ($\gamma = 1$) and the firm cannot commit to a derivative position when entering the debt contract then:
  1. The firm’s private incentives to hedge are strictly less than the social incentives to hedge
  2. When the firm can take short ‘speculative’ positions in the derivative, the firm may choose to take a speculative position in the derivative to dilute its creditors, when derivatives are senior.
Hedging or Speculation? Basis Risk

▸ Senior derivatives may lead to inefficiently large derivative positions.

▸ Suppose that it is privately optimal for the firm to hedge default risk via the derivative.

▸ Marginal payoff to increasing derivative position beyond $X = R - F$:

$$
\underbrace{1 - \theta} - \left[1 - \frac{1 - \theta}{\theta}(1 - \gamma)\right] \underbrace{1 - \theta + \frac{(1 - \theta)(\Gamma - 1)}{A(1 - \mathcal{P})}} \leq 1 \quad \underbrace{\text{marginal derivative payoff}} \quad \underbrace{\text{marginal cost of derivative}} \quad \geq 0
$$

▸ Then, the firm’s privately optimal derivative position ex post coincides with the optimal derivative position only if $\gamma \geq \overline{\gamma}$. When $\gamma < \overline{\gamma}$, the firm enters a derivative position that is too large.
Hedging Incentives for low $C_2$

- Up to now we focused on the case where it is privately optimal for firm to hedge ex post

- Will the firm find it optimal to hedge at all?

- Hedging is privately optimal as long as $C_2$ is sufficiently large

- There is a region $(\tilde{C}_2, \bar{C}_2)$ where hedging is only privately optimal if the derivative contract is senior.

- **Intuition:** Senior derivative results in smaller transfer to debt holders
Discussion: Financial Firms

Automatic stay exemption for derivatives may have **particular bite for financial firms**

Exemption from automatic stay particularly hard to ‘undo’:

- costly to assign cash as collateral to all creditors/depositors ex-ante
- but then **hard to shield cash from derivative counterparties**
  - initial margins
  - margin calls
- once drained of cash, financial firm ceases to operate

See, e.g., Duffie (2010): Failure mechanics of dealer banks
Conclusion

Formal analysis of seniority for derivatives in simple, standard CF model

Findings:

▶ Derivatives are value-enhancing hedging tools
▶ **Seniority** for derivatives can lower deadweight hedging costs by helping to strengthen derivative counterparties balance sheets through diversification.

**BUT**

**Seniority** for derivatives:

▶ may **reduce surplus** by raising firm’s cost of debt
▶ may lead to **excessively large derivative positions**
▶ may lead to **speculation rather than hedging**

Time to re-think special treatment of derivatives?