Disagreement and Capital Structure Complexity

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Abstract

The post-financial crisis period, many corporate bankruptcies involve complicated, fragmented capital structures characterized by many layers of debt and complex legal entity structures with many subsidiaries. Why do capital structures evolve this way, given that they make distress more costly to resolve? I suggest an answer based on the notion that investors may disagree about the value of assets that can be used as collateral for loans. When such disagreement exists, firms have the incentive to exploit it by issuing claims that are targeted to subsets of the assets that investors are more optimistic about. This can create zero-sum disputes about entitlements to the firm's value when distress occurs. These disagreements minimize the borrower's cost of funds ex-ante by maximizing perceived recoveries, but they can be inefficient ex-post, because resolving disputes is socially costly. The model predicts greater capital structure complexity when financial distress is more likely, and when disagreements about asset values are larger, as in a bubble.

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1 Introduction

Many recent bankrupcy cases involve complicated negotiations exacerbated by complex capital structures. Consider the case of Energy Futures Holdings. Following its LBO in 2007, the company was set up as a parent company with hundreds of subsidiaries, arranged into groups. One subsidiary group's (called the "E side") main asset was a regulated utility company. Another subsidiary group (called the "T side") held unregulated retail and wholesale power providers. Each subsidiary group was financed by first and second lien secured debt, and unsecured debt. The parent corporation, EFH, also had its own classes of unsecured debt. According to its CFO, all parties were in agreement that the best course of action was to keep the companies alive and convert debt into equity. But due to the complex nature of the capital structure and the persistent disagreements about the valuation of the two sides[1], the company could not agree with its creditors about how to divide the equity in the reorganized company. EFH was forced to file for bankruptcy after more than a year of unsuccessful negotiations. After three years and millions of dollars in professional fees, a final deal remains elusive.

EFH is one of many recent examples involving complex capital structures and prolonged, expensive disputes involving valuation[2]. In this paper, I suggest that capital structures

[1] As the CFO, Paul Keglevic, said in his affidavit to the Bankruptcy Court explaining the circumstances behind the bankruptcy filing: "The Debtors' initial preference was to achieve a consensual, consolidated reorganization. There were advantages to such an outcome: EFH's current corporate form offers cost synergies, there would be no risk of triggering deconsolidation-related tax liabilities, and potential disruption to EFH's businesses would be minimized. Under a consolidated framework, however, a significant portion of EFIH, TCEH, and potentially EFH Corp. debt would have been converted into EFH Corp. equity, necessitating a need for a high degree of consensus among multiple creditor groups with claims to distinct asset classes... it became clear that a consolidated transaction was not possible because the Debtors and their stakeholders were unable to bridge fundamental differences in opinion on valuation and tax related issues. As a result, the Debtors turned their attention to developing a deconsolidation strategy."

[2] Caesars, Extended Stay, Radio Shack, and SunEdison are all recent examples of high-profile bankruptcies involving complicated capital structures. Noteworthy examples of costly valuation disputes include Mirant, which involved an 11 week trial to resolve a valuation dispute (Huebner and Schaible 2009), and Adelphia Cable, which took 4.5 years to resolve complicated disputes between creditor groups across 250 legal entities, which nearly derailed a sale to Time Warner that all parties wanted (Baird 2016).

like EFH's, and the valuation disputes they often produce, do not arise accidentally. On the contrary, I show that when valuation disagreements arise, firms have the incentive to engineer fragmented capital structures to exploit valuation disagreements, because it can minimize their cost of capital.

As the EFH example illustrates, two types of fragmentation can arise. One type is *vertical fragmentation*, in which debt is issued in tranches with different levels of seniority. Another type is *horizontal fragmentation*, in which different subsets of assets are separated and pledged to separate investor groups. Some recent examples of this kind of fragmentation include yieldcos and master limited parnerships in the energy industry, and real estate spinoffs in the retail industry. Tellingly, these deals are often explained in industry parlance as lowering cost of capital by "unlocking the value" in a subset of the firm's assets that are currently undervalued by the market for shares in the parent company[3].

I show that both types of fragmentation can be social welfare destroying[4], because they create zero-sum disputes that are socially costly to resolve[5]. A simple numerical example can illustrate how excessive horizontal and vertical fragmentation can occur:

Horizontal Fragmentation

Suppose the firm uses two assets, A and B, and must borrow 200 from creditors to begin operating. After it begins operating, the firm may succeed or go bankrupt. If it goes bankrupt, the lenders can either liquidate it, or reorganize it by exchanging their debts for equity in the reorganized company. All lenders agree that the company will be worth 100 in

[3]As an example of this kind of justification, the hedge fund Starboard Value recently proposed that Macy's spin its real estate into two separate joint ventures to "unlock" the value in its real estate, which is being "underappreciated" by the stock market. They propose one JV to hold its iconic properties and one to hold its mall properties:

"Macy's could partner with different parties for each JV, therefore maximizing the value of each JV, as certain parties may be willing to pay more for the iconic properties versus the mall locations, or vice versa."

[4]In this paper I apply the belief-neutral welfare criterion in Brunnermeier, Simsek and Xiong (2014), which suggests that an allocation is inefficient if total welfare is lower under any convex combination of the agents' beliefs.

[5]In effect, the bankruptcy valuation game is very similar to the motivating example in Brunnermeier, Simsek and Xiong (2014) of the two economists who make a bet on the type of fiber in a pillow, and destroy the pillow in order to determine who wins the bet.

the bankruptcy state if they reorganize it, and that reorganizing the company produces more value than liquidating it. But lenders disagree about the value of these assets in liquidation: Type A lenders believe that asset A would be worth 60 in liquidation and asset B would be worth only 30, while Type B beliefs are the reverse: asset A will be worth 30 and asset B will be worth 60. Both parties also believe they can convince a third party that their valuation is the correct one.

First, suppose the firm borrows from only one creditor. In bankruptcy, that creditor will reorganize the company by taking 100% of the equity in the reorganized company. This is worth 100, so the single creditor expects a 50% recovery on its loan of 200.

Now suppose the lender borrows 100 from a Type A lender and pledges asset A as collateral, and 100 from a Type B lender, pledging asset B. Bankruptcy law entitles lenders to at least their judicially-determined collateral value when the company reorganizes. Thus, if bankruptcy occurs, each creditor believes it is entitled to a claim on the reorganized firm that is worth at least 60. Creditors are mutually aware of the disagreement, so they do not expect the other creditor to agree to accept less than 60% of the firm value voluntarily. Instead, each creditor expects the valuation dispute to be determined in a hearing by the bankrutpcy judge. To make a case to the judge that his valuation is correct, suppose that each creditor must spend 5 in professional fees. If both parties believe they can convince the judge about their valuations, then each creditor expects a recovery of at least 55 = 60 - 5. Thus, the total perceived creditor recovery is at least 110/200 = 55%, and the firm can borrow at a commensurately lower rate ex-ante.

Note that the two creditor outcome is socially less efficient than the one creditor outcome under any belief about the collateral values. Under either belief, creditors will collectively recover 90 (the reorganization value of 100 less 10 in fees) no matter what the judge decides. But the valuation hearing to decide how the value is divided is socially wasteful.

Vertical fragmentation

Next, let's consider how disagreement about reorganization value can cause excessive vertical fragmentation. One reason this can occur is when parties disagree about which creditor will hold the "fulcrum security" (the most junior security entitled to a recovery),

and the added formal and informal control rights that accompany the fulcrum position[6]. Suppose, as in the horizontal example, that all parties agree that the total collateral value is 90 in liquidation. But they disagree about the reorganization value (V) of the company. Lender S believes that $V = 80$, while lender J believes that $V = 120$. Suppose that liquidation can occur immediately, but reorganization takes time to achieve, and hence adds volatility. Suppose the reorganization value will either increase to $1.5V$ or decrease to $.5V$ by the end of the bankruptcy case, with equal probability.

At first glance, it would seem sensible for the firm to borrow the entire 200 from lender J, who is most optimistic about V. If it does, lender J will always choose to reorganize the company and will expect a recovery of $120/200 = 60\%$. But the firm can reduce its total cost of capital further if it issues a senior claim of 90 to lender S and a junior claim of 110 to lender J. If it does so, lender S will anticipate that it will be the fulcrum security (since it is owed 90 and, according to its belief, the firm is worth at most 90 if it liquidates). Because S believes it will be the fulcrum security holder, it expects to choose the certain liquidation payoff of 90. But lender J also believes he will be the fulcrum security holder, since $120 > 90$. S prefers reorganization to liquidation, because in reorganization it will receive an expected payoff of $\frac{1}{2}(1.5(120)-90) = 45$. If the valuation dispute to determine the fulcrum holder costs each party 5, then the total perceived creditor recovery is $\frac{90+45-10}{200} = 62.5\% > 60\%$. The disagreement about valuation leads creditors to have different beliefs about reorganization outcomes. The firm chooses the cut points in the capital structure optimally (90 in senior debt) to maximize this disagreement, and thus minimize its cost of capital.

The theory suggests some comparative statics that drive the creation of excessively fragmented capital structures. The model predicts that these capital structures are more likely when they are created in distress situations (i.e. when the probability of bankruptcy is

[6]The fulcrum security is the most junior security that is "in the money", and generally has more informal control over the reorganization process because it expects to hold the equity after reorganization. It also has more formal control rights. For example, a second lien creditor can assert rights of a secured creditor if it has the fulcrum position in the collateral. If the first lien creditor is the fulcrum creditor, then the second lien is considered unsecured and cannot demand adequate protection or a lifting of the automatic stay. In a plan of reorganization, if a senior claim can be reinstated, it can be deemed unimpaired and thus have no voting rights over a plan, while the fulcrum security will have voting rights.

higher), as the disagreement matters more when default states are realized, thus justifying the up-front transaction costs of issuing additional securities. This suggests a testable empirical prediction that debt structures should become more fragmented–with more subsidiaries and layers of debt–as companies approach bankruptcy. The model also predicts more fragmentation when the underlying assets are subject to greater disagreement, as would pertain in a bubble. The model also predicts that vertical fragmentation, caused in my model by differences of opinion about control, is more likely when the optimal reorganization/liquidation decision is a close call, and when company value in reorganization is more volatile.

2 Related Literature

To my knowledge, this is the first theoretical paper to analyze the causes and consequences of capital structure complexity. In a standard trade-off theory of corporate finance, firms choose capital structure to balance the tax advantage of debt against deadweight costs of financial distress. To the extent that complexity increases distress costs, firms should choose simple capital structures to minimize these costs, but this does not seem to square with the increasingly complicated capital structures we observe in reality.

There is a large and growing finance literature using disagreement[7] to explain bubbles. An early example is Scheinkman and Xiong (2003), and Bolton Scheinkman and Xiong (2006) analyze the creation of management incentives in this context. Some existing literature uses disagreement to explain excessive leverage and/or tranching of cash flows to fuel asset price bubbles, including Fostel and Geanakoplos (2012), and many others. This literature does not discuss capital structure complexity, horizontal fragmentation, or the costs of resolving financial distress at the corporation level, as I do here.

In the law and economics literature, disagreement has been used to motivate contract terms such as purchase price adjustments in merger agreements (Choi 2016) and settlement contracting in the shadow of litigation (Spier and Prescott 2016). Similar to Spier and Prescott, disagreement gives rise to excessive costly litigation in equilibrium.

[7]See Morris (2005) for a general discussion about the common prior assumption, from which this and other papers depart.

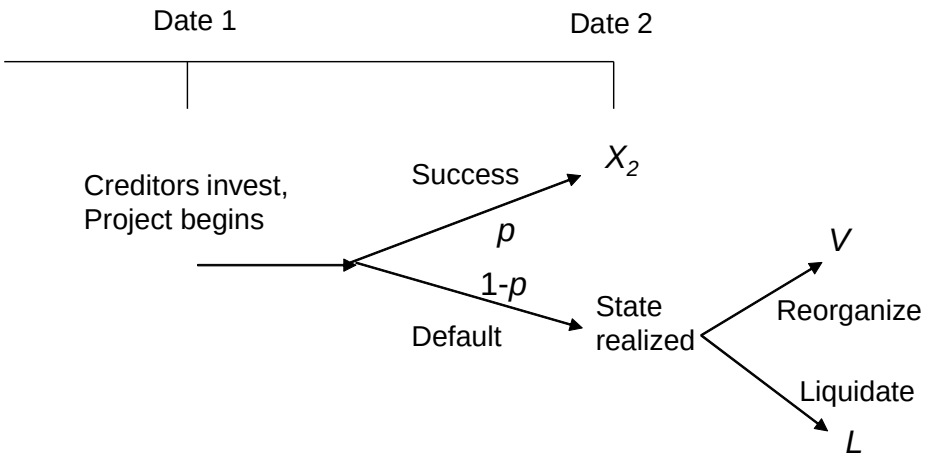

Figure 1: Timeline

3 Setup

Suppose that the model takes place over two dates, 1 and 2. At date 1, the owner (E) starts a project requiring the use of assets A and B. The owner has no personal wealth, so at date 1 she must raise enough to cover the cost of acquiring the assets and the transaction cost of issuing claims on the firm. Let $I(n)$ denote the total required up-front financing need, which is increasing in n, the number of claims issued. At date 2, success or default is realized. The probability of success is p and success pays $X_2 > I(1)$. Let Δ_n denote the incremental cost of issuing n claims instead of $n-1$. I suppose that Δ_n is non-decreasing in n.

In default, the company must decide whether to reorganize or liquidate. Let V and L represent the reorganization and liquidation values of the company, respectively. The liquidation value is comprised solely of assets A and B: $L = a + b$. Both the liquidation and reorganization values may be subject to disagreement among investors. I will use tildas and subscripts to denote beliefs where valuations may disagree, i.e. $\tilde{a}_i$ denotes party i's belief about the value of asset A.

To abstract away from ex-ante financing constraints, I assume the project is always positive NPV under any course of action in default under 1 creditor and any belief: $pX_2 + (1-p)\min\{\tilde{L}_i, \tilde{V}_i\} > I(1)$ for all i. Also, assume the recovery is never enough to cover the

financing cost: $\max\{\tilde{L}_i, \tilde{V}_i\} < I(1)$. A timeline is provided in Figure 1.

I restrict consideration to capital structures where the outside funding is in the form of debt, since it is well known that debt is the optimal contract in a variety of settings[8]. With outside debt and the parameter assumptions above, E always gets 0 in the default state, so E's objective is to maximize the equity payoff in success plus any excess funds raised at date 1:

$$p(X_2 - \bar{F}) + \bar{M} - I(n)$$

where $\bar{F}$ is the total payoff to all creditors. Suppose all creditors are competitive so they will lend as long as they break even in expectation according to their beliefs. The creditor break-even constraint for any creditor i is given by

$$M_i = pF_i + (1-p)\tilde{R}_i$$

where $\tilde{R}_i$ is creditor i's perceived total recovery, and $\bar{M} = \sum_i M_i$.

It is easy to show that maximizing the debtor's objective subject to the creditor participation constraints is equivalent to maximizing the creditors' perceived total recovery given their beliefs, less the cost of financing:

$$(1-p)\sum_i \tilde{R}_i - I(n)$$

4 Horizontal Fragmentation

In this section, I consider a simple setup that illustrates the potential for excess horizontal fragmentation and generates some comparative statics. Suppose for this section that the reorganization value V is commonly known to all parties. Beliefs about the liquidation values of assets A and B can take two values: $\tilde{a}_i \in \{a_h, a_l\}, \tilde{b}_i \in \{b_h, b_l\}$ with $a_h > a_l, b_h > b_l$. I suppose for now that $V > a_h + b_h$: to focus on asset valuation disputes within the firm, I assume that all parties agree that reorganization is the best course for the company. The

[8] Adding an ex-ante unobservable effort choice by E that increases p will result in E receiving zero in an optimal contract with creditors under these assumptions.

possibility that V is stochastic and may be less than liquidation value is considered in the vertical fragmentation section below.

A creditor's belief is a pair $\{\tilde{a}_i, \tilde{b}_i\}$. I will use the notation $\{L, H\}$ to represent a creditor with belief $\tilde{a}_i = a_l, \tilde{b}_i = b_h$.

I allow for the possibility that some beliefs may not be held by any creditor. But if a creditor holds a particular belief, then the supply of credit is perfectly elastic for that belief; i.e the creditor is willing to lend any amount that allows him to break even in expectation given his belief. I assume that creditors' beliefs are common knowledge when they bargain.

4.1 Bargaining and Recoveries in Default

Suppose that the parties have an opportunity to bargain in distress or invoke a costly hearing, called a *cramdown,* to value the assets in dispute. The hearing costs δ_i for creditor i; this represents the legal costs of hiring experts to argue for the creditor's preferred value. Let $\delta = \sum_i \delta_i$. Let $\tilde{k}_{ij}$ denote creditor i's belief about creditor j's collateral value.

Under U.S. bankruptcy law, a secured creditor in a reorganization who is owed F and has collateral worth k is entitled to a secured claim equal to $\min\{F, k\}$ and an unsecured claim for the deficiency $(\max\{F-k, 0\})$. Secured claims are entitled to receive full payment based on the appraised collateral value, while unsecured claims share pro-rata over the remaining firm value after the secured claims are satisfied. If the firm is insolvent, i.e. if $\bar{F} > V$, then a creditor who believes she will be undersecured (if $F_i > \tilde{k}_{ii}$) will expect the following recovery if she expects cramdown to occur:

$$\tilde{R}_i = \tilde{k}_{ii} + \tilde{\theta}_{ii}\tilde{U}_i - \delta_i$$

where $\tilde{U}_i = V - \tilde{k}_{ii} - \sum_{j \neq i} \tilde{k}_{ij}$, creditor i's belief about the unsecured value (the total firm value available to satisfy unsecured claims after secured claims are paid), and $\tilde{\theta}_{ii} = \frac{F_i - \tilde{k}_{ii}}{\bar{F} - \tilde{k}_{ii} - \sum_{j \neq i} \tilde{k}_{ij}}$ is creditor i's belief about the pro-rata fraction of the unsecured value it will receive.

It is easy to show that $\tilde{R}_i$ is increasing in $\tilde{k}_{ii}$. Intuitively, a creditor's recovery is increasing

in her own perceived collateral value, since she is entitled to 100 cents on the dollar for collateralized value and less than 100 cents on the dollar for the unsecured deficiency claim. For similar reasons, it is decreasing in her beliefs about the value of the other creditors' collateral $\sum_{j \neq i} \tilde{k}_{ij}$, since the other creditors' collateralized value reduces the pool of money available to satisfy unsecured claims.

Cramdown will be invoked if and only if the parties believe they are collectively better off under a cramdown; that is, whenever $\sum_i \tilde{R}_i > V$. This will occur whenever the parties' collective overvaluation of the bankruptcy recovery exceeds the total deadweight cost of cramdown; i.e. whenever $\sum_i \tilde{k}_{ii} + \tilde{\theta}_{ii}\tilde{U}_i - V > \delta$.[9]Otherwise, the parties will bargain to a division of the value in the shadow of cramdown, and the total perceived recovery will be the reorganization value V.

The optimal capital structure will depend on the set of available creditor beliefs. First, consider the case in which creditors have opposing views on the two assets. This leads to a capital structure in which both creditors are secured, but only one of the two has recourse to the firm's remaining value:

Proposition 1 *Suppose the set of available creditors is* $\{H, L\}, \{L, H\}\}$ *and* $\max\{a_h - a_l, b_h - b_l\} > \delta$. *Then, if the incremental financing cost* Δ_2 *is below a cutoff value* Δ_2^*, *an optimal capital structure for E is a 2 creditor capital structure such that:*

a) The creditor with belief $\{H, L\}$ $(\{L, H\})$ *lends against asset A (B).*

b) The creditor who believes the total collateral value $\tilde{K} = \tilde{a} + \tilde{b}$ *is larger makes a non-recourse secured loan against the collateral it is more optimistic about, with* $F \geq \tilde{k}_{ii}$;

c) The creditor who believes $\tilde{K}$ *is smaller makes a recourse secured loan against the collateral it is more optimistic about, with* $F \geq V - \tilde{k}_{ij}$.

E can not achieve a higher payoff if $\{H, H\}$ *is also available.*

All proofs are located in the Appendix.

The idea behind the proposition is that E can minimize its cost of funds by giving creditors the largest perceived total recovery. Intuitively, this involves pledging collateral

[9]I do not model the bargaining game or the division of surplus, but this is largely irrelevant, as only the total perceived creditor recovery matters for efficiency.

to the lenders who value the collateral most highly. Less intuitively, it also requires giving one of the two creditors a non-recourse claim[10]. This enables the creditor with recourse to be certain he will capture all of the unsecured value. The reason it is suboptimal for two creditors to share the unsecured value is that the creditors disagree about each others' collateral values, and hence, the size of each others' deficiency claims. If creditor 1 is more pessimistic about creditor 2's collateral value, then creditor 2's deficiency claim will seem larger to creditor 1 than to creditor 2, and cut into creditor 1's perceived recovery. The non-recourse claim enables E to borrow against the most optimistic assessment of unsecured value by giving it all to the creditor who values it most highly.

If the most optimistic creditor is available ($\{H, H\}$), another optimal capital structure is to offer this creditor a non-recourse claim against the entire collateral base. But E will also make this debt non-recourse and issue unsecured debt to the creditor who is most pessimistic about the total collateral value.

Remark 1. U.S. law makes it difficult to create non-recourse debt in a reorganization; the Bankruptcy Code automatically converts non-recourse debt to recourse when the debtor keeps the collateral in a reorganization[11]. This means that creating a true non-recourse structure requires placing the non-recourse collateral into a separate subsidiary. Hence, the model explains why legal separation of assets into clusters of subsidiaries can result from disagreement.

Remark 2. In a world where separate entities are not possible, this model may give an efficiency rationale for the conversion of non-recourse debt into recourse. It minimizes the sort of zero-sum valuation bets that the debtor tries to create by weakening the relationship between the court's valuation of the collateral and the parties' payoffs. Hence, it reduces the gains from fragmenting the capital structure ex-ante. Of course, where separate entities are possible, this provision is irrelevant at best, and at worst harmful, as it has the unintended consequence of giving the debtor incentive to create too many subsidiaries.

If a third creditor exists who is pessimistic about both assets, then a three creditor capital

[10] A non-recourse claim is a claim against only the collateral and not to the rest of the balance sheet; thus, a creditor owed F backed by collateral worth k is entitled to only $\min\{F, k\}$.

[11] 11 U.S.C. 1111(b)(1)

structure can be optimal:

Proposition 2 *Suppose the set of available creditors is* $\{H, L\}, \{L, H\}, \{L, L\}\}$. *Then if* Δ_3 *is below a cutoff value* Δ_3^*, *the unique optimal capital structure is a 3 creditor capital structure such that:*

a) The creditor with belief $\{H, L\}$ $(\{L, H\})$ *lends non-recourse secured debt with face value* $F = a_h$ (b_h) *against asset A (B).*

b) The creditor with belief $\{L, L\}$ *lends unsecured debt of* $F = V - a_l - b_l$.

When a creditor appears with a more pessimistic valuation of the collateral (i.e. a larger estimate of the unsecured value), E will concentrate the unsecured value in that creditor. This can result in a 3 creditor capital structure if the financing costs are sufficiently low.

Remark 3. Again, as a legal matter, since non-recourse debt can not be created by contract, this would require creating a parent company and two subsidiaries, one to hold each asset. The parent company issues bonds to creditor $\{L, L\}$, and each subsidiary issues (secured) debt backed by the asset in that sub. This resembles the EFH capital structure discussed in the introduction–the regulated and unregulated electricity units were held in subsidiaries with their own non-recourse debt under a parent company that had its own debt. The parent debt is structurally junior to the debt at the subsidiary units and hence captures the unsecured value.

The Corollary suggests comparative statics that drive the horizontal fragmentation decision:

Corollary 3 *The cutoff values* Δ_2^*, Δ_3^* *are*

a) weakly increasing in $a_h - a_l$ *and* $b_h - b_l$ *and*

b) strictly decreasing in p.

Firms optimally choose more fragmented capital structures when there is greater disagreement about asset values, and when the probability of bankruptcy is higher.

The Corollary tells us that fragmented capital structures are more likely when the potential for disagreement about asset values is high and the probability of bankruptcy is high. Thus, we might expect to see more fragmentation following highly leveraged transactions

and when the firm owns the types of assets that are likely to generate asset bubbles. The recent wave of bankruptcies in the energy sector provide a recent example consistent with these motivations. SunEdison was one of many energy producers to create separate subsidiaries called "yieldcos". This practice boomed in 2013 when oil prices were high and interest rates were low, prompting demand for high yielding assets. The parent company created two publicly traded subsidiaries that were set up to purchase power projects from the parent company after they were up and running and had secured long-term contracts from utilities to provide power. The subsidiaries financed themselves with debt and stock that promised a high dividend yield. The parent retained majority voting rights over the subs and management duties with respect to the power projects. Different stories emerged about the value of the two pieces. On one side, some investors took the belief that the yieldcos were the safe bet, because they involve existing projects backed by long-term power contracts. Under this story, the risky side of SunEdison's business is the development of future projects, which depends on future power prices. Others argued that these structures were set up to feed a bubble in higher-yielding investments by engineering securities with high current interest payments and dividend yields that were ultimately not sustainable[12].

Whether one side or the other had a better argument ex-ante is unclear, but it is clear that as oil prices and the prices of yieldco stocks fell dramatically in 2015, the creation of new yieldcos has stopped, and practitioners refer to this episode as the bursting of a "yieldco bubble"[13]. The SunEdison bankruptcy, currently underway, is expected to be complex due to its complicated financial structure and the uncertain cash flow and control rights as between the parent company and its yieldcos.[14]

[12]See , "Hedge Funds Biggest Losers in SunEdison's Magic Money Machine": "It was a magic money machine," said Gordon Johnson, an analyst at Axiom Capital Management... "If you were investing in SunEdison, you were betting that the thirst for yield was going to be good for a while. They had vehicles – yieldcos – that could deliver growth and buy SunEdison's projects."

[13]See, e.g. "Is the Yieldco Bubble in Trouble? ETF In Focus" Zack's Investment Research, October 22, 2015, available at www.nasdaq.com.

[14]For example, see Brian Eckhouse, "SunEdison's Complex Finances Make Potential Bankruptcy 'Messy'". Bloomberg Technology, April 18, 2016, available at www.bloomberg.com, and David Niklaus, "Complexity and Debt Led to the Fall of SunEdison" St. Louis Post Dispatch, April 1, 2016.

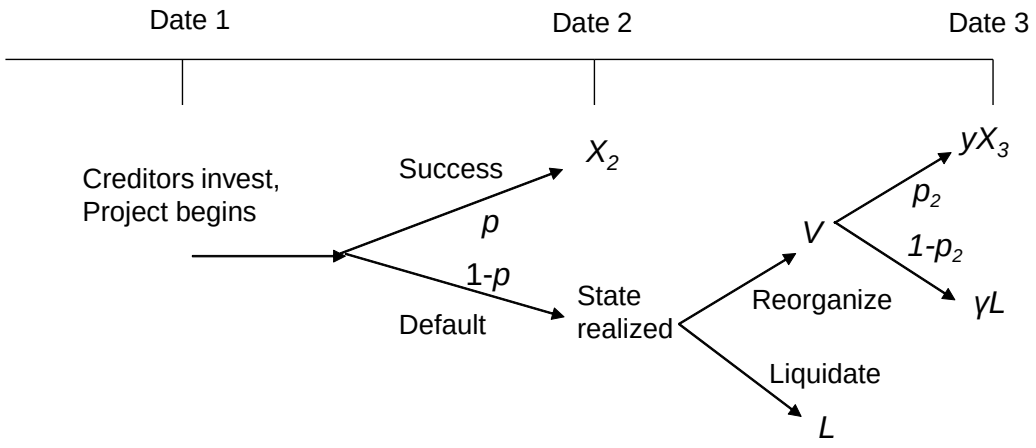

Figure 2: Revised Timeline

5 Disagreement About Control Rights

Another potential source of disagreement concerns the legal entitlements that accompany a security. These entitlements are often unclear, particularly when a company's capital structure is made of many legal entities. A common example is intercompany claims between subsidiaries in a firm–because companies often report financial statements on a consolidated basis, intercompany claims can be poorly documented, giving rise to disputes about their validity. Another example is intercompany transfers of assets from one subsidiary to another. When one of the units becomes insolvent (which depends on the disputable value of the company relative to the value of debt), it may be able to claw back the transfer from another subsidiary if it did not receive a fair value in return for the transfer.

In this section, I consider a prominent source of uncertainty about entitlements–the control rights that accompany a security. I add some additional structure to the model by supposing that the firm's choice of actions at the restructuring phase affects the volatility of the firm's cash flows. This can lead to a value for control rights, as some security holders may value safety while others value greater volatility.

For simplicity, suppose that liquidation values are random and non-contractible as before, but not subject to disagreement. The total liquidation value is $a + b = L$. Only the

upside value of the company in reorganization is subject to disagreement. Specifically, suppose that if the company chooses reorganization, the company will either recover or fail by date 3. Failure produces only the collateral, which falls in value by a commonly known multiplicative factor $\gamma < 1$. Recovery produces a cash flow yX_3, where the factor y is subject to disagreement: $y \in \{h, l\}, h > l$ and X_3 is commonly known. The recovery payoff always exceeds the liquidation payoff: $lX_3 > L$. A revised timeline is provided in Figure 2.

The total reorganization value of the firm, as a function of the beliefs about the payoff from recovery, is $V(y) = p_2 y X_3 + (1 - p_2)\gamma L$.

5.0.1 Exogenous Disagreement About Control

In this section, I start with the simplest case, in which potential disagreement about control rights is independent of the amount of debt. This kind of disagreement might arise because of an ambiguous clause in the debt contract or in underlying law. When parents and subsidiaries contract with each other, the terms and conditions of these contracts are often subject to challenge due to the inherent conflict of interest between parent and sub. In the SunEdison case, for example, a primary source of disagreement and confusion flows from the relationship between SunEdison and its yieldcos. Specifically, the conditions under which the subsidiaries were obligated to purchase new projects from the parent was unclear. As the company slid toward bankruptcy, SunEdison replaced directors in its Terraform Global yieldco in order to sell a partially completed project to it. Shareholders of the subsidiary then sued the directors for breaching their fiduciary duties.

To represent this formally, let the space of potential investor beliefs be a pair $\{y, \kappa\}$ where $y \in \{h, l\}$ is the degree of optimism about the recovery value, as described above, and $\kappa \in \{s, j\}$ is the belief about whether the senior ($\kappa = s$) or the junior ($\kappa = j$) creditor will control the reorganization/liquidation decision. Suppose, for now, that all $\{y, \kappa\}$ types are available in elastic supply.

I now consider the choice of the optimal number of creditors. As above, I suppose that parties can bargain, but if they do not reach an agreement, they invoke a costly litigation process to determine which party has control.

One Creditor

The optimal one creditor capital structure will maximize the perceived total creditor recovery. This requires issuing debt to the creditor who is most optimistic about y, so $y = h$. That creditor will choose reorganization if and only if $V(h) \geq L$. The total perceived recovery will then be $\max\{V(h), L\}$.

Two Creditors

Next, consider a two creditor capital structure with a senior and a junior creditor. In the two creditor case, a senior creditor's payoff will be $\min\{F, Z\}$ and the junior creditor's payoff is $\max\{0, Z - F\}$ where Z is the firm's final cash flow. As is well-known, because of the senior creditor's concave payoff and the junior creditor's convex payoff, the senior creditor has a relative preference for actions that result in lower volatility, while the junior creditor prefers higher volatility. First, it is clear that if two creditors is optimal, the senior (junior) claim will be purchased by a creditor who believes that $\kappa = s$ ($\kappa = j$). It is also clear that the junior creditor with $y = h$ will purchase the junior claim.

If E prefers two creditors to one, an optimal F will always fall in the range $hX_3 > F > \gamma L$.[15] For F in this range, a senior creditor will prefer liquidation to reorganization when $\min\{F, L\} > p_2 F + (1 - p_2)\gamma L$. This inequality is always satisfied for $F \leq L$. The junior creditor will prefer reorganization when $\min\{L - F, 0\} < p_2(hX_3 - F)$. This is always true for $F \geq L$.

Disagreement can only raise the perceived total recovery if senior and junior creditors prefer different actions. When they have different preferences, the senior claim will prefer liquidation and the junior will prefer reorganization. Thus, if the two parties expect to litigate rather than settle their dispute, the perceived total recovery in bankruptcy is given by

$$\min\{L, F\} + p_2(hX_3 - F) - \delta$$

[15] $F > \gamma L$ implies that the senior debt is not risk-free. If it were, control is irrelevant to the senior creditor and thus it control disagreement can not be used to increase the total perceived recovery. $y_o X_3 > F$ implies that the junior claim expects a chance of a positive recovery so that the capital structure is not a de-facto 1 creditor structure.

where the first term is the liquidation payoff of the senior creditor and the second term is the reorganization payoff of the junior creditor. The next lemma gives an intuitive result regarding the optimal level of senior debt.

Lemma 4 *In a two creditor senior/junior capital structure, it is optimal for E to set $F = L$.*

The lemma is intuitive: when $F = L$, the junior claim would receive 0 in liquidation and hence has only upside from reorganization. Conversely, the senior claim has only downside from reorganization, as it would be paid in full in liquidation. When creditors disagree about control rights, the firm's goal in setting the amount of senior debt is to maximize the extent to which control matters. This requires maximizing the divergence of interests between the two parties about the optimal action to choose. Junior debt is akin to a call option on the firm with strike price equal to the senior debt F and senior debt is equivalent to the firm's value less the call option value. The time value of the option is maximized when the option is at the money; i.e. at $F = L$. At this level, the divergence of interests between senior and junior about the expiration date of the option–whether to liquidate now or wait and reorganize–is maximized.

Because setting $F = L$ is an optimal strategy for E, the perceived total recovery when the parties litigate rather than settle can be rewritten as

$$p_2 h X_3 + (1 - p_2)L - \delta.$$

When the parties bargain in the shadow of litigation, they will settle if and only if the perceived maximum payoff from settlement exceeds the perceived total payoff from litigating. The perceived maximum payoff from settlement is $\max\{V(h), L\}$.[16] Thus, rearranging, the disagreement payoff will be the creditors' perceived total payoff if and only if

$$\begin{aligned} \delta &< p_2(hX_3 - L) \text{ for } L > V(h) \\ &< (1 - p_2)(L - \gamma L) \text{ for } V(h) > L \end{aligned}$$

[16] If the parties bargain to a reorganization outcome, the surplus maximizing bargain will involve the junior creditor taking the firm's cash flows and the more senior creditor taking a cash payment.

Intuitively, when the single creditor would choose liquidation ($L > V(h)$), the perceived increase in the total recovery from two creditors is the upside payoff that the junior creditor expects to gain. Conversely, when the single creditor would choose reorganization, the perceived increase is the downside that the senior creditor expects to avoid. This expression can be condensed and rewritten as

$$\delta < \max\{p_2(hX_3 - L), (1 - p_2)(L - \gamma L)\} - |V(h) - L|$$

We can now discuss comparative statics on the vertical fragmentation decision:

Proposition 5 *There exists a cutoff value Δ_2^* such that E will prefer a two-creditor senior/junior capital structure over a one-creditor capital structure for $\Delta_2 < \Delta_2^*$. The cutoff value Δ_2^* is larger when:*

a) The variance of the reorganization payoff rises, holding $V(h)$ constant;

b) $|V(h)-L|$ declines, holding constant the maximum risk in reorganization $\max\{p_2(hX_3 - L), (1 - p_2)(L - \gamma L)\}$

Part (a) of the Proposition says that volatility of reorganization value creates incentives for a more fragmented capital structure. This is intuitive, as a larger risk differential between reorganization and liquidation increases the value of control and thus the increase in perceived recoveries when there are differences of opinion about control. Part (b) says that, holding the relevant measure of risk constant, capital structure is more likely to be fragmented when the reorganization/liquidation decision is expcted to be a close call–that is, when R is close to L.

5.0.2 Endogenous Disagreement: Control Shifts at Fulcrum (incomplete)

In this section, I suppose that control rights always belong to the party who holds the "fulcrum security." The fulcrum security is the most senior claim that will not be paid in full. In practice, the fulcrum security possesses more formal and informal control rights in reorganization. Informally, management is more likely to attend to the wishes of the fulcrum holder, because this is the security that is likely to hold the equity after a reorganization.

Formally, there are also tools that affect control rights based on the fulcrum position. For example, a secured creditor with a fulcrum position in collateral has the right to lift the automatic stay if not provided with adequate protection payments[17]. Formally, then, in a two creditor senior/junior structure in which equity is always out of the money, the fulcrum security holder is the junior creditor if and only if $\max\{V(y), L\} - F > 0$, where F is the face value of the senior debt. In this case, disagreement about control rights can arise due to disagreement about y. In particular, if $V(h) > F \geq \max\{V(l), L\}$, then a creditor who believes that $y = h$ ($y = l$) will believe the junior (senior) claim is the fulcrum security.

If E chooses a two creditor structure, she will always choose to set F in this range. The senior claim will be acquired by the more pessimistic creditor ($y = l$) and the more optimistic creditor ($y = h$) will take the junior claim.

Recall that the perceived total creditor recovery under disagreement about control is

$$\min\{L, F\} + p_2(hX_3 - F) - \delta$$

The exogenous disagreement section above shows that, conditional on each party believing he has control, the perceived total recovery is maximized by setting $F = L$. If $\max\{V(l), L\} = L$, then, it continues to be optimal to set $F = L$, since disagreement about the fulcrum position will occur at $F = L$. If, by contrast, $\max\{V(l), L\} = V(l)$, then at $F = L$, both parties would believe that the junior creditor has control. If a senior/junior structure is optimal, the optimal level of senior debt will be set at $F = V(l)$. This is the level of debt closest to L that generates disagreement about control.

The two-creditor structure will generate litigation rather than settlement if and only if

$$\delta < (1 - p_2)(L - \gamma L) - p_2(F - L)$$

As $V(l)$ rises, the optimal F rises, and hence the net gains from a two creditor structure are falling in l for $V(l) > L$. Thus, the same intuition as in the exogenous control section

[17] 11 U.S.C. 362(d)(2). An oversecured creditor's equity cushion is typically considered adequate protection, and an out of the money secured creditor is typically considered unsecured and thus cannot use 362(d) to have the stay lifted.

holds: the benefits of two creditors are larger when the reorganization/liquidation decision is a close call.

6 Conclusion

Existing theories in corporate finance have difficulty explaining the complexity of the capital structures we observe in large firms. Large public company capital structures are often characterized by corporate groups, with assets spread across numerous legal entities (horizontal fragmentation) and many layers of debt arranged according to seniority (vertical fragmentation). At the same time, theories about corporate bankruptcy are typically about the tension between capital structure and asset allocation (i.e. whether to reorganize or liquidate the firm). They have difficulty explaining that the key source of bankruptcy costs in many promiment cases is resolving valuation disputes when all parties agree on what to do with the firm.

This paper takes a first step toward explaining some of these patterns. My theory argues that complex capital structures can be a deliberate product of financial engineering by owners to take advantage of differences in beliefs among investors. Bankruptcy law confers both priority and control rights based on the value of individual assets that make up a firm. These values are not always easily verifiable and often require costly, contested valuation hearings to establish. Firms in the model have incentive to fragment the capital structure by creating targeted claims to subsets of the firm's assets that some investors are more optimistic about than others. These strategies are often described as "unlocking value" in assets that are underappreciated by the firm's current investors. This strategy can minimize a firm's all-in cost of debt financing and thus maximize the value of equity. But when distress occurs, the disagreement about the firm's asset values leads to valuation disputes that are socially costly. Hence, the model gives a reason for socially excessive horizontal fragmentation, i.e. too many subsidiaries.

Disagreement about the entitlements attached to the firm's securities can also lead to excessive fragmentation. I show that disagreement about control rights can cause excessive vertical fragmentation. When multiple investors believe they will be able to exercise control

in default, The firm has an incentive to create securities that are control-sensitive; i.e. creating a senior/junior structure whose payoffs depend maximally on which party controls the outcome.

I have not yet explored the normative consequences of the theory for bankruptcy law design. The model suggests that capital structures that create zero-sum valuation disputes, particularly when the value is unclear and costly to establish, should be discouraged. For example, the value of a a full-recourse secured loan is less sensitive to the judicial valuation of collateral than a non-recourse loan because the deficiency claim increases as the collateral value falls. The model may suggest that the time is ripe for rethinking valuation methods in bankruptcy. The current state of affairs allows for competing experts to argue not only about inputs to valuations (discount rates, etc) but also valuation methods (discounted cash flow, transaction multiples, etc.)[18]. More standardized, and perhaps more "quick and dirty" valuation processes that are also more predictable may be superior to costly valuations that are more subject to disagreement and dispute. Of course, the benefits of avoiding costly disputes ex-post need to be traded off against the ex-ante benefits of targeting claims to the true value of assets, such as the avoidance of asset substitution problems and the like.

7 Appendix

Proofs

Proposition 1:

(sketch) As noted above, an optimal capital structure maximizes $(1-p)\sum_i \tilde{R}_i - I(n)$.

Consider a partitioning of the company's asset value upon bankruptcy into three mutually exclusive parts: the collateral value of asset A, the collateral value of asset B, and the value

[18] For example, see Judge Peck's confirmation opinion in the bankruptcy case of Charter Communications, a cable company, which involved a valuation dispute: "Experts in corporate valuation are often required to weigh multiple valuation methodologies that are not always congruent or consistent. These methodologies include comparable companies, precedent transactions, publicly available market data (including the views of Wall Street analysts) and the use of a discounted cash flow analysis that depends on projections of future free cash flows and mathematical calculations."

of the difference between the firm's total value and the sum of the collateral values. If each piece has a perceived value to its holder(s) that is maximal given set of the available beliefs, then the total perceived firm value (equivalently, the perceived total recovery), gross of restructuring costs, is maximized. Clearly, the maximum perceived value of asset A (B) is a_h (b_h) which is achieved by giving a non-recourse debt claim backed by asset A (B). And the unsecured value is $V - \tilde{a} - \tilde{b}$ is maximized by placing it with the creditor who values $\tilde{a} + \tilde{b}$ the least. The combination of a non-recourse secured loan combined with the entire unsecured value is equivalent to a recourse secured loan if the other creditor takes a non-recourse secured loan.

If $\max\{a_h - a_l, b_h - b_l\} > \delta$, which is the necessary condition for cramdown to occur, then under this capital structure, the perceived total recovery, net of restructuring costs is $\sum_i \tilde{R}_i = a_h + b_h + (V - \min\{a_h + b_l, a_l + b_h\}) - \delta = V + \max\{a_h - a_l, b_h - b_l\} - \delta > V$. If $\max\{a_h - a_l, b_h - b_l\} < \delta$ then cramdown never occurs and the value of the firm is V under any capital structure, so a 1 creditor capital structure is optimal because it minimizes $I(n)$.

If $\{H, H\}$ is also available, then the same recovery value $\sum_i \tilde{R}_i = V + \max\{a_h - a_l, b_h - b_l\} - \delta$ can also be achieved by giving the $\{H, H\}$ creditor a non-recourse secured claim backed by both assets. The party who values $\tilde{a} + \tilde{b}$ less will be given an unsecured claim.

Proposition 2:

Similar to Proposition 1, but the net recovery is higher, since the unsecured creditor values the unsecured debt at $V - a_l - b_l$. The total perceived recovery is $\sum_i \tilde{R}_i = a_h + b_h + (V - a_l - b_l) - \delta = V + (a_h - a_l) + (b_h - b_l)\} - \delta > V$.

Corollary 3:

(rough sketch) An optimal capital structure maximizes $(1 - p)\sum_i \tilde{R}_i - I(n)$. Hence, the cutoff value can be expressed as the difference in financing cost that makes the firm indifferent between n creditors and $n - 1$: $\Delta_n^* = (1 - p)(\sum_i \tilde{R}_i^n - \tilde{R}_i^{n-1})$. Under a 1 creditor capital structure, $\sum_i \tilde{R}_i = V$. Following the sketch of the proofs above, when $\max\{a_h - a_l, b_h - b_l\} > \delta$,the total recoveries are $\sum_i \tilde{R}_i = V + \max\{a_h - a_l, b_h - b_l\} - \delta$ under the two creditor capital structure in Proposition 1 and $V + (a_h - a_l) + (b_h - b_l)\} - \delta$ under the 3 creditor structure in Proposition 2.

Part (b) of the Proposition follows immediately from inspection: $\Delta_n^* = (1-p)(\sum_i \tilde{R}_i^n - \tilde{R}_i^{n-1})$.

Lemma 4:

The proof follows immediately from inspection of $\min\{L, F\}+p_2(hX_3-F)-\delta$, which is the perceived total recovery when the senior prefers liquidation, the junior prefers reorganization, and the parties expect to litigate rather than settle. $F = L$ maximizes this expression. (The settlement payoff is unaffected by F and this payoff is always higher than the settlement payoff when it is chosen. Hence, maximizing this expression is sufficient.)

$$\min\{L, F\} + p_2(hX_3 - F) - \delta$$

Proposition 5

The condition for litigation rather than settlement is the following:

$$\delta < \max\{p_2(hX_3 - L), (1-p_2)(L-\gamma L)\} - |V(h) - L|$$

The net benefit from a two creditor structure over a one creditor structure, then, conditional on disagreement and litigation under two creditors, is $\max\{p_2(hX_3 - L), (1-p_2)(L-\gamma L)\} - |V(h) - L| - \delta$. Since two creditors will be chosen when this ex-post benefit is compared to the ex-ante incremental financing cost Δ_2, the result follows from inspection of this term.

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