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 back 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 capital structure fragmentation can minimize the borrower's cost of funds ex-ante by maximizing creditors' perceived recoveries, but it can be socially inefficient, because it creates costly valuation disputes in bankruptcy. I show that disagreement about collateral values can cause inefficient liquidations. I also find that reorganizations, in which pre-bankruptcy creditors receive securities in the ongoing firm, allows parties to continue "agreeing to disagree" about the value of their entitlements. This can promote settlement and reduce costly litigation over valuation, relative to selling the firm as a going concern for cash.

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1 Introduction

Many recent bankrupcy cases involve complicated negotiations exacerbated by complex capital structures. Consider the case of Energy Future Holdings. Following its leveraged buyout 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. A reorganization plan was confirmed after four years in bankruptcy and over $500 million in professional fees.

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] See the Appendix for the organizational charts of Energy Future Holdings and Toys R' Us. Caesars, Extended Stay, Radio Shack, and SunEdison are other 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

like EFH's, and the valuation disputes they often produce, do not arise accidentally. On the contrary, I show that 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, and the focus of this paper, is *horizontal fragmentation*, in which subsets of assets are separated and pledged to a subset of the firm's investors. A standard example of horizontal fragmentation is a secured lender taking a subset of the firm's assets as collateral, while other investors finance the firm's remaining assets. More sophisticated examples of this kind of fragmentation include yieldcos and master limited parnerships in the energy industry, and real estate spinoffs in the retail industry. The common elements of these deals are the creation of a subsidiary, the transfer of a subset of the assets into the sub, with different investors financing the sub and the parent.

Why do managers believe that selling assets to an entity they control can create value for shareholders? Tellingly, yieldco and related deals are often justified as lowering cost of capital by "unlocking value"[3] in a subset of the firm's assets that are currently undervalued by the parent company's shareholders. Another commonly-used term is "multiple arbitrage"[4], since the segment is predicted to trade at a higher multiple of earnings than the parent

nearly derailed a sale to Time Warner that all parties wanted (Baird 2016).

[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." Starboard Value, "Unlocking Value at Macy's", January 11, 2016.

[4]As an example, the plan to split off the real estate in the Caesars reorganization was justified this way: "The REIT plan potentially could make the company more valuable," said Alex Bumazhny, Fitch Ratings Director for Gaming, Lodging & Leisure. The cash flow at a REIT can be valued higher because it's less volatile–it receives a stable lease payment whereas operating company cash flow fluctuates on casino business, said Mr. Bumazhny. "You'd be creating multiple arbitrage based on how these REITs trade." See Matt Jarzemsky and Kate O'Keeffe, "Caesars Proposes Splitting Into REIT and Operating Company" Wall Street Journal, Nov 19, 2014.

company, without affecting the multiple attached to the parent company's earnings. In a Miller-Modigliani world of homogeneous expectations and perfect capital markets, arguments of this kind are fallacies. But if the marginal investors disagree about the values of the respective segments, these motivations can justify fragmentation.

The goal of this paper is to understand the causes and consequences of disagreement-driven fragmentation and the potential implications for bankruptcy law. I show that capital structure fragmentation can be social welfare destroying[5], because it can create zero-sum disputes that are socially costly to resolve[6]. A simple numerical example can illustrate how excessive horizontal 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 piecemeal, or sell the company as a going-concern to a third party. All lenders agree that the company will be worth 100 in a going-concern sale, and that the going-concern value of the company clearly exceeds the liquidation value. Creditors disagree, however, about the value of asset A: Creditor 1 believes that asset A would be worth 60 in liquidation, while Creditor 2 believes that A's liquidation value is only 30. Should bankruptcy occur, both parties also believe they can convince a judge that their valuation of asset A is the correct one.

First, suppose the firm borrows from only one creditor. In bankruptcy, that creditor expects to sell the company for 100, so the single creditor expects a 50% recovery on its loan of 200.

Now suppose the firm borrows 100 from Creditor 1 and gives this lender a non-recourse[7]

[5] 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.

[6] 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.

[7] Non-recourse means that if a default occurs, and the creditor is owed more than the value of the collateral, the creditor is entitled to only the collateral value and nothing more. A recourse secured loan, by contrast, would entitle the creditor to an unsecured claim for the deficiency (the difference between the amount owed

secured loan backed by asset A. It also borrows 100 from Creditor 2, who takes unsecured debt. In bankruptcy, if the company is sold as a going concern, the non-recourse secured lender would be entitled to the value of her collateral, while the unsecured creditor is entitled to the remaining company value. Thus, Creditor 1 believes she is entitled to 60 in bankruptcy, while Creditor 2 believes he is entitled to $100 - 30 = 70$, the remaining value after Creditor 1 is satisfied. Creditors are mutually aware of the disagreement, so if bankruptcy occurs, they do not expect the other creditor to agree to accept less than her perceived entitlement. Instead, the valuation dispute will be determined in a hearing by the bankruptcy judge when bargaining breaks down. To make a case to the judge that her valuation is correct, suppose that each creditor must spend 10 in professional fees. If both parties believe they can convince the judge about their valuations, then Creditor 1 expects $60 - 10 = 50$, while Creditor 2 expects $70 - 10 = 60$. Thus, the total perceived creditor recovery is 110/200 = 55%, and the firm can borrow at a commensurately lower rate ex-ante[8].

Note that the two creditor outcome is socially less efficient than the one creditor outcome under either creditor's beliefs about the collateral values. Both creditors believe that the creditors will collectively recover 80 (the sale value of 100 less 20 in attorney fees) no matter what the judge decides. But the dispute to decide how the value is divided is socially wasteful.

Reorganization Versus Sale

Another option in bankruptcy is a reorganization, whereby the parties can allocate themselves securities in the ongoing company instead of selling the company for cash. Suppose that after emerging from bankruptcy, the company will produce a cash flow of 150 if it re-

and the collateral value). Though the result is sharper (and the math simpler) with a non-recourse loan, a traditional (recourse) secured loan creates the same effects. Subsidiaries are necessary to create a true non-recourse loan, as will be discussed below.

[8]For the sake of concreteness and simplicity, this example assumes that the creditors have complete foresight about how the bankruptcy valuation dispute will play out when they lend, and that collateral values are always determined by the bankruptcy judge. These assumptions are not essential to generate incentives to fragment the capital structure ex-ante. Creditors need only have different beliefs about the assets they lend against, and a belief they will receive their perceived entitlement somehow in default (whether by a sale, reorganization, or liquidation). I discuss the sale/reorganization/liquidation decision under disagreement in Section 5.

covers, and only asset A if it fails (suppose that asset B has zero liquidation value in failure). Recovery and failure occur with equal probability. Both parties expect the value of A to decline by 10: Creditor 1 believes it will decline to $60 - 10 = 50$, while Creditor 2 believes it will decline to $30 - 10 = 20$.

Since Creditor 1 is more optimistic about asset A, a natural way to allocate securities in the ongoing firm is for Creditor 2 to give Creditor 1 a debt contract backed by asset A, and keep the equity (the residual claim on the company) for himself. If this debt contract has a face value (F) of 55, then Creditor 1 values her debt at the expected payoff to the debt claim: $\frac{1}{2}(55) + \frac{1}{2}(50) = 52.5$[9]. Creditor 2 is paid only in recovery, and values his equity at $\frac{1}{2}(150 - 55) + \frac{1}{2}(0) = 47.5$. The parties could contest the value of A to get a more favorable F. But neither has an incentive to spend the 10 in litigation costs as they did under a sale: if Creditor 1 establishes that asset A's value is 60, the face value of the debt must increase to $F = 70$, so that this new debt claim is worth $\frac{1}{2}(70) + \frac{1}{2}(50) = 60$ to her. But this produces an increase in value of only $60 - 52.5 = 7.5$. Similary, if Creditor 2 establishes that A is worth 30, then F can be reduced to 40, since $\frac{1}{2}(40) + \frac{1}{2}(20) = 30$. Creditor 2's residual claim is worth $\frac{1}{2}(150 - 40) = 55$, an increase of only $55 - 47.5 = 7.5$.

Reorganization reduces the incentive of parties to fight over valuation because they can continue "agreeing to disagree" about the value of the securities they receive. Notice that Creditor 1 values her debt claim at 52.5, but Creditor 2 believes it is worth only $\frac{1}{2}(55) + \frac{1}{2}(20) = 37.5$. From Creditor 2's perspective, then, Creditor 1 is accepting a low-valued claim in bankruptcy. Issuing securities in the presence of disagreement has the effect of making the parties appear more forgiving to each other when they bargain, and this increases the incentive to settle instead of litigating. These effects are not present when the company's value is reduced to cash, which has a commonly known value. Unfortunately, the parties themselves may not always choose reorganization on their own when it is efficient: in this example, the parties believe that a sale, inclusive of litigation costs, will produce a total perceived payoff of $70 + 60 - 20 = 110$, while reorganization produces a perceived total perceived payoff of only $52.5 + 47.5 = 100$.

[9] The debt value is an expected value, where Creditor 1 receives the full face value (55) if the firm recovers, and the collateral value (50) if the firm fails, with the payoffs weighted by the probability of each outcome.

From a theoretical perspective, one advantage of modeling disagreement in bankruptcy is that it endogenizes deadweight costs of bankruptcy. Most bankruptcy models focus only on the asset allocation decision (continuation or liquidation) or assume that bankruptcy costs are exogenous. As the numerical example suggests, reorganization can be valuable because it can reduce litigation costs, even when the decision to keep the company alive is uncontroversial. These costs can be substantial in practice: the valuation trial in the Mirant bankruptcy consumed 11 weeks and 27 days of trial (Huebner and Schiable 2009). Litigation over the ownership of the $7 billion sale proceeds in the Nortel bankruptcy has consumed nearly $2 billion in professional fees[10]. The model shows that an optimal capital structure, from the firm's point of view, will not necessarily be set up to minimize these deadweight costs.

The model thus predicts that more horizontally fragmented capital structures will result in greater bankruptcy costs. The model also 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 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 horizontally fragmented as companies approach bankruptcy. The model also predicts more fragmentation when the underlying assets are subject to greater disagreement, as would pertain in an asset bubble.

2 Related Literature

To my knowledge, this is the first theoretical paper to analyze capital structure complexity and its effects in financial distress. 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, standard theory

[10] See Daniel Fisher, "Nortel Bankruptcy Fees Near $2 Billion As Creditors, Pensioners Fight Over Assets" Forbes, April 5, 2016.

suggests 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 large public firms.

There is a large and growing finance literature using disagreement[11] 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. Simsek (2013) shows that the nature of disagreement matters for asset prices and margins. I find a qualitatively similar result related to law: the nature of disagreement can affect whether too much reorganization or liquidation occurs in bankruptcy. Ortner and Schmalz (2016) considers capital structure design in the presence of disagreement and generates vertical fragmentation (tranching) when investors have different beliefs. Ortner and Schmalz (2016) does not generate excess horizontal fragmentation, and it does not focus on the effects of disagreement on the costs of resolving financial distress, 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 2017), the diversity of corporate ownership and control structures (Goshen and Hamdani 2016) and settlement contracting in the shadow of litigation (Spier and Prescott 2016). Similar to Spier and Prescott, disagreement in my model gives rise to excessive costly litigation in equilibrium.

The paper also relates to the literature on subsidiary legal entities. Most of the law and economics explanations focus on efficiency reasons for subsidiaries, such as creditor monitoring economies (Hansmann and Kraakman 2000), limiting adverse selection (Hill 1996, Iacobucci and Winter 2005), transferability (Ayotte and Hansmann 2013) or agency costs (Baird and Casey 2014, Casey 2015, Iacobucci and Triantis 2007). This paper is unlike the preceding papers in that it gives a rationale for the socially excessive use of subsidiaries. Examples of the latter include Squire (2011) and Ayotte (2017). But these theories explain excessive subsidiaries by arguing that they can redistribute value from the firm's other cred-

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

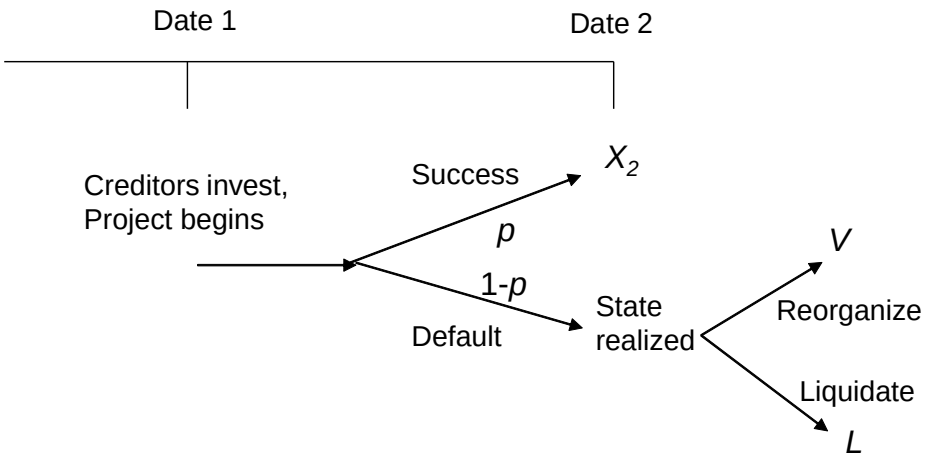

Figure 1: Timeline

itors, who are not part of the bargain. Thus, they rely on an assumption of contractual incompleteness; the disfavored creditors would contract with the debtor ex-ante to prevent inefficient subsidiaries if they could monitor and enforce covenants perfectly, and it is in the debtor's interest to commit to protecting them if possible (Adler and Kahan 2013). By contrast, contractual incompleteness is not required to generate excessive fragmentation in the presence of disagreement: the creditors and the debtor are fully aware that they are betting against each other's asset valuations, and enter these contracts voluntarily, notwithstanding their social inefficiency.

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 continue as a going-concern, or liquidate. Let V and L represent the going-concern 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 going concern 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[12]. 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 and $\bar{M}$ is the total amount raised from 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:

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

[12] 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.

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 value of the firm as a going-concern (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 $a_h > a_l, b_h > b_l$. Without loss of generality, let asset A be the asset with stronger disagreement: $a_h - a_l \geq b_h - b_l$. I suppose for now that $V > a_h + b_h$: to focus on asset valuation disputes within the firm, I assume that keeping the firm alive is commonly known to be the best course for the company. I relax this assumption later in the paper.

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 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 bankruptcy 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 to litigate over the value of the claim:

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

where $\tilde{U}_i = V - \tilde{k}_{ii} - \sum_{j \neq i} \tilde{k}_{ij}$, is 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.

Litigation over valuation will occur if and only if the parties believe they are collectively better off litigating; 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 litigation; i.e. whenever $\sum_i \tilde{k}_{ii} + \tilde{\theta}_{ii}\tilde{U}_i - V > \delta$.[13]Otherwise, the parties will bargain to a division of the value in the shadow of the valuation fight, and the total perceived recovery will be the going-concern value V.

The optimal capital structure will depend on the set of available creditor beliefs. First, consider the case in which there are two creditor types with different beliefs about one of the two assets. This leads to a capital structure in which the asset with value disagreement is split off and financed through a non-recourse loan:

Proposition 1 *Suppose there is disagreement only about asset A. If $a_h - a_l > \delta$, and the incremental financing cost Δ_2 is below a cutoff value Δ_2^*, then an optimal capital structure for E is a 2 creditor capital structure such that:*

[13]I assume Coasean bargaining here, so that agreement is reached whenever it is mutually beneficial. The distribution of surplus is not particularly important here, since only the total payoffs matter for a discussion of efficiency.

a) The creditor who values asset A more makes a non-recourse secured loan backed by asset A with $F \geq a_h$*;*

b) The other creditor makes a recourse loan against the remaining firm value, with $F \geq V - a_l$*.*

Otherwise, the optimal capital structure is a one creditor capital structure and the creditor type is irrelevant.

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 the asset values to the lenders who value them most highly. Less intuitively, it also requires giving the more optimistic creditor a non-recourse claim backed by that asset[14]. The non-recourse claim allows the other (recourse) creditor to capture all of the remaining firm value. This is optimal for E because the recourse creditor values the remaining firm value at $V - a_l$, while the non-recourse creditor values it at $V - a_h$.

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[15]. This means that creating a true non-recourse structure requires placing the non-recourse collateral into a separate subsidiary. (There are many equivalent ways to design the recourse claim–one way is for the recourse creditor to take an unsecured claim against the parent company, which holds asset B). 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

[14] 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 $\min\{F, k\}$.

[15] 11 U.S.C. 1111(b)(1)

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.

Corollary 2 *Suppose there are two creditor groups who disagree about the value of both assets.*

a) If the creditor who is more optimistic about A is more pessimistic about B, then the optimal capital structure is the same as in Proposition 1.

b) If the same creditor is more optimistic about both assets, $a_h + b_h - a_l - b_l > \delta$*, and* Δ_2 *is sufficiently low, then that creditor makes a non-recourse loan against both assets, and the other creditor makes a recourse loan against the remaining firm value.*

If a third creditor exists who is pessimistic about both assets, then a three creditor capital structure can be optimal:

Proposition 3 *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 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* $F \geq a_h$ *(*b_h*) against asset A (B).*

b) The creditor with belief $\{L, L\}$ *makes a recourse loan against the remaining firm value, with* $F \geq V - a_l - b_l$*.*

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 up-front 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 unsecured debt 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 4 *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 crested in 2013 when oil prices were high and interest rates were low, allowing for the creation of high yielding securities. SunEdison created two publicly traded subsidiaries (Terraform Power and Terraform Global) 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. To optimists, the yieldcos provided a carve-out of safe assets from an otherwise risky company, because they involve existing projects backed by long-term power contracts. 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[16].

[16]See e.g., "Hedge Funds Biggest Losers in SunEdison's Magic Money Machine": "It was a magic money

When oil prices and the prices of yieldco stocks fell dramatically in 2015, the creation of new yieldcos stopped, and practitioners refer to this episode as the bursting of a "yieldco bubble"[17]. The SunEdison bankruptcy has proven complex and rife with litigation due to its complicated financial structure and the uncertain cash flow and control rights as between the parent company and its yieldcos.[18]

5 Asset Allocation in Bankruptcy

The previous section assumed that the going concern value is known to exceed liquidation value by enough that keeping the assets together is always preferred by the parties, and we supposed that V was realized instantaneously, as if the firm were sold as a going concern for cash. In this section, I consider the asset allocation decision in bankruptcy–whether to sell the company as a going-concern, liquidate it, or reorganize it by issuing securities against the reorganized firm to the pre-bankruptcy creditors. This section yields two additional important insights. First, it highlights a new benefit to corporate reorganization in the presence of horizontal fragmentation: the ability to distribute securities instead of cash can mitigate the tendency to fight over valuation. Second, it demonstrates that disagreement can lead to socially excessive liquidation when investors disagree about a firm's component assets.

5.1 Project and bargaining game setup

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."

"My Yieldco Raised Its Dividend With This Weird Trick", Tom Konrad, available at www.altenergystocks.com: "The key to NRG Yield's massive dividend per share growth is not better investment opportunities. The key to its dividend per share growth is selling stock to the public at ever increasing prices. Many other yieldcos are projecting per share dividend growth based on similar share price growth."

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

[18] 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.

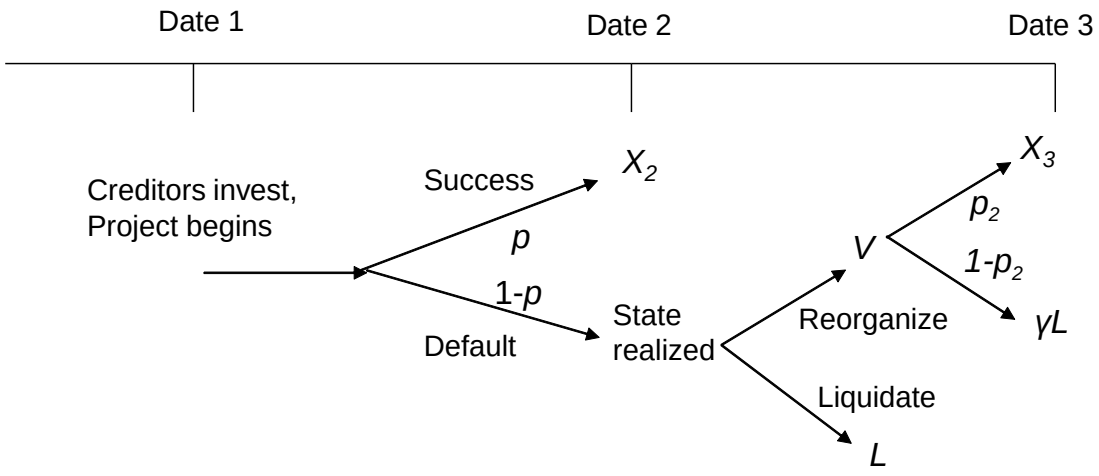

Figure 2: Continuation Timeline

To make a discussion of a reorganization option nontrivial, I allow the parties to distribute securities in the ongoing firm at date 2, with a final random payoff that is realized at Date 3. In the recovery state at Date 3, the firm produces a high cash flow X_3 with probability p_2. The failure state occurs with probability $(1 - p_2)$ and produces only the collateral, which falls in value by a commonly known multiplicative factor $\gamma < 1$, so the total payoff in failure is $\gamma(a + b)$. The parameters p_2, X_3, and γ are assumed to be common knowledge, but the collateral values a and b are subject to disagreement, as before.

Suppose that parameter values are such that the optimal capital structure involves a full recourse creditor and a non-recourse creditor who lends against asset A, as in Propositions 1 and 2. Let creditor i be the recourse creditor and creditor j be the non-recourse creditor. To focus on interesting cases, suppose that i weakly values asset B more, and j strictly values A more; i.e. $\tilde{b}_i \geq \tilde{b}_j$, and $\tilde{a}_i < \tilde{a}_j$. Thus, creditor j makes a non-recourse loan against asset A. The bargaining process works as follows. I assume that i (the recourse creditor) controls the bankruptcy estate, and thus makes an initial offer of a course of action (reorganization, sale, or liquidation) and a payoff. The payoff can be in the form of securities in the ongoing firm if reorganization is chosen; otherwise, it is a cash offer to divide the proceeds of the sold assets. If the offer is refused, creditor i decides whether to pursue a nonconsensual ("cramdown") reorganization, a cramdown sale, or a liquidation. In a cramdown sale or

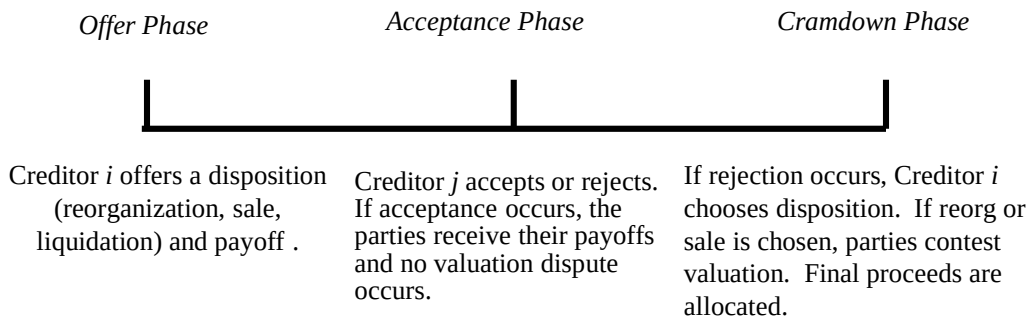

Figure 3: Bargaining game with asset allocation

cramdown reorganization, the parties first litigate over the value of a, to determine the value of the parties' entitlements. In a cramdown sale, a third party buys the firm (the date 3 payoff) for a price P (this will be discussed below), and the judge's valuation determines how P is shared.

In a cramdown reorganization, creditor i proposes a debt contract to creditor j that pays F in recovery and asset A in failure[19]. The judge's valuation will determine the value of a, which will in turn identify F. After the judge's value is set, F will be set so that creditor j's claim is worth a in expected value; that is, it will satisfy $p_2F + (1-p_2)\gamma a = a$. Creditor i will receive the remaining value of the company, $p_2(X-F) + (1-p_2)\gamma b$. A timeline of the bargaining game is provided above.

5.1.1 Cramdown Phase

Working backward, if an offer is rejected, Creditor i will choose to maximize her perceived expected payoff. In a cramdown sale, a buyer will pay some price P. The going-concern sale price may depend on many factors, such as market liquidity/illiquidity, and the transaction costs of sales versus reorganizations; to focus on the efficiency of the allocation decision from the firm's point of view, I simply assume that P is exogenous and commonly known.

[19] This simple secured debt contract offered to creditor j is without loss of generality; while there are many ways the reorganization value could be divided, any optimal contract will give the entire value of asset A to creditor j.

Creditor i expects that the judge will agree with her perceived value of asset A, $\tilde{a}_i$. Hence, in a cramdown sale, RC expects a payoff of

$$P - \tilde{a}_i - \delta_i.$$

In a cramdown reorganization, Creditor i expects her perceived value of the company after Creditor j receives a claim worth $\tilde{a}_i$. Thus, $i's$ expected payoff is $\tilde{V}_i - \tilde{a}_i - \delta_i$, where

$$\tilde{V}_i = p_2 X_3 + (1 - p_2)\gamma(\tilde{a}_i + \tilde{b}_i)$$

Finally, in a liquidation absent an agreement, both parties walk away with their assets, so Creditor i expects $\tilde{b}_i$.

To summarize, the perceived expected payoffs for Creditor i following a rejected offer under each outcome (cramdown reorganization, cramdown sale, liquidation) is

$$\{CR, CS, L\} = \{\tilde{V}_i - \tilde{a}_i - \delta_i, P - \tilde{a}_i - \delta_i, \tilde{b}_i\}$$

and creditor i will choose the maximum of these payoffs.

5.1.2 Acceptance Phase

In the acceptance phase, the lowest possible offer that creditor j will accept depends on creditor i's expected decision at the cramdown phase. If j expects that i will choose a cramdown (either sale or reorganization), then j will accept any offer with a perceived payoff of at least $\tilde{a}_j - \delta_j$. If a liquidation is expected, then j will demand at least $\tilde{a}_j$. For economy of notation, let Φ be an indicator that equals 1 if a cramdown sale or cramdown reorganization is expected in that phase and 0 otherwise. Hence, creditor j expects a payoff of $\tilde{a}_j - \Phi\delta_j$.

5.1.3 Offer Phase

Anticipating the acceptance phase, creditor i will consider each action by calculating the highest settlement payoff that j will accept under each action. Then creditor i will choose an action by comparing the three settlement payoffs to the three payoffs under the cramdown phase.

The best offer that creditor j will accept will give creditor i a perceived payoff of $P - \tilde{a}_j + \Phi\delta_j$ in a sale and $\tilde{b}_i + \Phi\delta_j$ in a liquidation. In a reorganization, an acceptable offer to j is an offer of a secured debt contract, backed by asset A, with face value F that provides creditor j with at least as much as j would get after a rejection:

$$p_2 F + (1 - p_2)\gamma\tilde{a}_j = \tilde{a}_j + \Phi\delta_j$$

Note that from creditor $i's$ perspective, creditor j overvalues his default payoff $\gamma\tilde{a}_j$. This results in more favorable terms in the debt contract F. Solving, we get

$$F = \frac{\{1 - (1 - p_2)\gamma\}\tilde{a}_j - \Phi\delta_j}{p_2}$$

Creditor i's expected payoff is $p_2(X - F) + (1 - p_2)\gamma\tilde{b}_i$. Plugging in the expression for F above, creditor i's payoff can be expressed as

$$\tilde{V}_i + (1 - p_2)\gamma(\tilde{a}_j - \tilde{a}_i) - \tilde{a}_j + \Phi\delta_j.$$

By inspecting this expression, we can see the benefits of bargaining with securities in reorganization. From creditor i's perspective, creditor j demands less in a reorganization than in a sale. In a sale, creditor j demands a claim worth $\tilde{a}_j - \Phi\delta_j$, his payoff in the cramdown phase. But if a reorganization is offered, j will settle for a claim on the firm that i believes is worth only $\tilde{a}_j - \Phi\delta_j - (1-p_2)\gamma(\tilde{a}_j - \tilde{a}_i)$. From $i's$ perspective, j overvalues securities he receives in a reorganization offer. This has the effect of increasing the bargaining surplus between the parties and encouraging settlement. To summarize, creditor $i's$ maximum payoff under settlement for each of the three outcomes (settlement reorganization, settlement sale and settlement liquidation) is

$$\{SR, SS, SL\} = \{\tilde{V}_i + (1 - p_2)\gamma(\tilde{a}_j - \tilde{a}_i) - \tilde{a}_j + \Phi\delta_j, P - \tilde{a}_j + \Phi\delta_j, \tilde{b}_i + \Phi\delta_j\}$$

The outcome will be the outcome that generates the largest payoff for creditor i under the six options above, $\{SR, SS, SL\}$ and $\{CR, CS, L\}$.

We are now ready to discuss a few key properties of the equilibria of the bargaining game.

Proposition 5 *Inefficient liquidations can occur if there is sufficient disagreement about both assets ($\tilde{a}_i > \tilde{a}_j$, $\tilde{b}_i < \tilde{b}_j$) and δ is sufficiently high.*

This Proposition shows that horizontal fragmentation can lead to socially excessive liquidation. When there is disagreement about both assets, it is possible to have $\tilde{a}_j + \tilde{b}_i > \max\{\tilde{V}_i, \tilde{V}_j, P\} > \max\{\tilde{a}_i + \tilde{b}_i, \tilde{a}_j + \tilde{b}_j\}$. Under these parameters, if δ is high enough, the parties prefer to walk away with their collateral than fight for their perceived entitlement in a cramdown reorganization or sale, and they disagree too much about the value of their asset to settle. Yet, they may both believe that the liquidation outcome is inefficient, and was caused by the other creditor's overvaluation of her asset.

Lemma 6 *(Reorganization encourages settlement.) There exist $\delta > 0$ for which $SR > CR$ but $CS > SS$: the parties would prefer to settle under a reorganization but would litigate valuation under a going concern sale. The measure of δ for which these conditions hold is larger when failure following reorganization is more likely (lower p_2) and when asset A depreciates less (lower γ).*

To see this, note that reorganization with settlement is preferred to cramdown reorganization ($SR > CR$) if and only if

$$\tilde{V}_i + (1 - p_2)\gamma(\tilde{a}_j - \tilde{a}_i) - \tilde{a}_j + \delta_j > \tilde{V}_i - \tilde{a}_i - \delta_i,$$

which reduces to

$$\delta > (1 - (1 - p_2)\gamma)(\tilde{a}_j - \tilde{a}_i). \tag{1}$$

At the same time, a cramdown sale is preferred by the parties to a sale with settlement ($CS > SS$) if and only if

$$P - \tilde{a}_i - \delta_i > P - \tilde{a}_j + \delta_j,$$

which reduces to

$$\tilde{a}_j - \tilde{a}_i > \delta. \tag{2}$$

The lemma holds when (1) and (2) hold simultaneously:

$$\tilde{a}_j - \tilde{a}_i > \delta > (1 - (1 - p_2)\gamma)(\tilde{a}_j - \tilde{a}_i). \quad (3)$$

Note that the increase in the parties' perceived total payoffs from litigating are greater in a sale $(\tilde{a}_j - \tilde{a}_i)$ than in a reorganization $((1 - (1 - p_2)\gamma)(\tilde{a}_j - \tilde{a}_i))$. This occurs because the reorganization bargain gives creditor j a payoff in the failure state that she values more than creditor i. Parties litigate when the total perceived payoff under litigation exceeds the total perceived payoff under settlement by more than the total litigation cost. The more likely is the failure state $(1 - p_2)$, and the less asset A depreciates (γ), the greater is the disagreement between creditors i and j about the value of j's claim under settlement, and hence the greater is the total perceived payoff under settlement.

The lemma leads directly into a discussion on the efficiency consequences of sale versus reorganization in the presence of disagreement and horizontal fragmentation:

Proposition 7 *(Efficiency and inefficiency in the reorganization versus sale decision).*

a) A reorganization can potentially increase efficiency by preventing a valuation fight that would occur under a sale;

b) Nevertheless, the parties may choose an inefficient sale with valuation fight over a reorganization with settlement.

Part (a) of the Proposition says that even when $\tilde{V}_k \leq P$ for $k = \{i, j\}$ (reorganization does not produce greater value than sale, before litigation costs), it can increase efficiency through litigation cost savings. This occurs when the inequalities underlying Lemma 6, (3) are satisfied, and reorganization is efficient, inclusive of litigation costs, under the beliefs of both creditors:

$$\max\{\tilde{V}_i, \tilde{V}_j\} > P - \delta.$$

But Part (b) of the Proposition makes clear that these conditions do not necessarily mean that the parties will choose reorganization when it is efficient. Specifically, when $CS > SR$:

$$P - \tilde{a}_i - \delta_i > \tilde{V}_i + (1 - p_2)\gamma(\tilde{a}_j - \tilde{a}_i) - \tilde{a}_j + \delta_j$$

which reduces to

$$P - \tilde{V}_i > \delta - (1 - (1 - p_2)\gamma)(\tilde{a}_j - \tilde{a}_i)$$

the parties will choose the cramdown sale over the consensual reorganization. Since the right hand side is positive whenever $SR > CR$, an inefficient sale occurs only if $P - \tilde{V}_i > 0$. For $\tilde{V}_i$ sufficiently close to P, the efficient reorganization will be chosen by the parties. Part (b) of the Proposition suggests that an optimal bankruptcy law may need to tip the balance toward reorganizations over sales in a horizontal fragmentation context due to the litigation that a sale may produce.

Turning the firm into cash creates proceeds to which the parties attach a common value. Hence, there is no potential for allocating securities that the recipient values more than the issuer. This hardens the parties' bargaining positions, and may lead the parties to choose an inefficient going-concern sale combined with a valuation dispute, rather than a consensual reorganization. Another way to characterize the benefits of reorganization is that reorganization facilitates agreement over a plan by allowing the parties to continue "agreeing to disagree" about the values of their claims. By postponing the resolution of their dispute on asset valuation, the parties may save themselves an unnecessary costly fight if the company recovers, while continuing to believe they have received their legal entitlements when the company exits bankruptcy.

Bankruptcy lawyers often use this insight in practice to forestall valuation fights by allocating securities to the parties whose value depends on subsequent realizations of asset values about which the parties disagree (Huebner and Schiable 2009)[20]. Moreover, the Bankruptcy Code in many places guides the parties toward securities that are backed by the same assets the parties financed before the bankruptcy. For example, in a cramdown reorganization, a secured creditor must receive not only a new note whose present value is the value of the secured creditor's claim, but also the new note must be secured and backed

[20] Huebner and Schiable (2009) discuss the Conseco bankruptcy reorganization, in which the senior creditors were given convertible securities and the junior creditors were given equity. After a future date, if the junior creditors were not able to redeem the senior creditors' claims at par, the convertibles would effectively wipe out the juniors' claims. Though this disagreement was about firm value V in a senior/junior capital structure, the same principle applies in this model.

by the same collateral the creditor financed before bankruptcy. One benefit of channeling the bargaining in this way is to tie payoffs to the assets the creditors value more highly. Another is the 1111(b)(2) election[21], which allows a creditor the option to treat its entire claim as secured. If the creditor makes this election, it gives up a potentially valuable deficiency claim on the firm, but allows the creditor a greater upside value in the collateral that may be realized after bankruptcy.

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 keep the firm alive or liquidate it). 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

[21] In the 1111(b)(2) election, the secured creditor has the option to treat its entire claim as secured. In doing so, it gives up any deficiency claim on the firm, but keeps a lien equal to its total pre-bankruptcy claim; this means that if the collateral is later sold or the company is liquidated for more than the value of the collateral as determined at bankruptcy, the secured creditor can keep the full realized value of the collateral.

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. excessive subsidiaries and other forms of asset-based financing.

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.)[22]. Ayotte and Morrison (2018) find that disputes over these inputs are common, and that judges can be persuaded to adopt assumptions that have no basis in finance theory or evidence. 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

[22] 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."

Proposition 1:

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 two mutually exclusive parts: the collateral value of asset A, and the value of the difference between the firm's reorganization value (V) 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 for that partitioning. Further, it is clear that no finer partition can increase perceived firm value given that the only source of disagreement is over the value of asset A.

Clearly, the maximum perceived value of asset A is a_h, which is achieved by giving a non-recourse debt claim backed by asset A with $F > a_h$. And the perceived unsecured value is $V - \tilde{a}$ is maximized by placing it with the creditor who values it at $V - a_l$.

If $a_h - a_l > \delta$, which is the necessary condition for cramdown to occur, then under this capital structure, the perceived total recovery, net of restructuring costs is $\sum_i \tilde{R}_i = a_h + (V - a_l) - \delta = V + a_h - a_l - \delta > V$. If this holds, then the two creditor capital structure is optimal if and only if $(1-p)(a_h - a_l - \delta) > \Delta_2$. If $a_h - a_l < \delta$ then the parties settle in bargaining and the value of the firm is V under any capital structure, so a 1 creditor capital structure is optimal and since all parties agree on V, the creditor's beliefs are irrelevant.

Corollary 2:

Part (a): Consider a partitioning into three parts: the collateral values of A and B, and the remaining unsecured value $V - a - b$. Clearly, the highest value of a (b) is a_h (b_h). And the highest perceived value of the unsecured value given the available beliefs $\{H, L\}, \{L, H\}$ is $\max\{V - a_h - b_l, V - a_l - b_h\}$. Since A is the asset with greater disagreement. i.e. $a_h - a_l \geq b_h - b_l$, $\max\{V - a_h - b_l, V - a_l - b_h\} = V - a_l - b_h$. Thus, the perceived value is maximized by giving the $\{H, L\}$ type a non-recourse claim to asset A, while the $\{L, H\}$ type takes a non-recourse claim to asset B plus the unsecured value. But this is equivalent to

giving the $\{L, H\}$ type the entire firm value less the value of A. The total perceived recovery is $\sum_i \tilde{R}_i = a_h + b_h + (V - a_l - b_h) - \delta = V + a_h - a_l - \delta$.

Part (b): Using the same logic in part (a), the highest perceived value is achieved by giving the $\{H, H\}$ type a non-recourse claim to A and B, and the $\{L, L\}$ type the remaining unsecured value. The parties will litigate rather than settle if and only if $a_h + b_h + (V - a_l - b_l) - \delta > V$, which reduces to the inequality in the Corollary.

Proposition 3:

Similar to Corollary 2, except that the unsecured value is maximized by allocating it to the $\{L, L\}$ creditor, who values it at $V - a_l - b_l$. The total perceived recovery is $\sum_i \tilde{R}_i = a_h + b_h + (V - a_l - b_l) - \delta = V + (a_h - a_l) + (b_h - b_l) - \delta$. The highest possible two-creditor recovery is $V + a_h - a_l - \delta$, so a three-creditor capital structure will be preferred to a two creditor structure if and only if $(1 - p)(b_h - b_l) > \Delta_3$.

Corollary 4:

(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 $a_h - a_l > \delta$,the total recoveries are $\sum_i \tilde{R}_i = V + a_h - a_l - \delta$ 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 3.

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

Proposition 5:

Sufficient conditions for liquidation to occur are that $SL \geq \max\{SR, SS, CR, CS\}$. These conditions can be reduced down to

$$\begin{aligned} \tilde{a}_j + \tilde{b}_i &\geq \max\{\tilde{V}_i + (1 - p_2)\gamma(\tilde{a}_j - \tilde{a}_i), P\}, \\ \tilde{a}_i + \tilde{b}_i &\geq \max\{\tilde{V}_i, P\} - \delta. \end{aligned}$$

For liquidation to be inefficient, it must be that both parties believe that at least one of the alternative outcomes (sale or reorganization) increases aggregate utility:

$$\begin{aligned} \max\{P, \tilde{V}_j\} &\geq \tilde{a}_j + \tilde{b}_j \\ \max\{P, \tilde{V}_i\} &\geq \tilde{a}_i + \tilde{b}_i \end{aligned}$$

Combining these conditions,

$$\begin{aligned} \tilde{a}_j + \tilde{b}_i &\geq \max\{\tilde{V}_i + (1-p_2)\gamma(\tilde{a}_j - \tilde{a}_i), P\} \geq \max\{P, \tilde{V}_i\} \geq \tilde{a}_i + \tilde{b}_i \\ \tilde{a}_j + \tilde{b}_i &\geq \max\{\tilde{V}_i + (1-p_2)\gamma(\tilde{a}_j - \tilde{a}_i), P\} \geq \max\{P, \tilde{V}_j\} \geq \tilde{a}_j + \tilde{b}_j \\ \max\{P, \tilde{V}_i\} &\geq \tilde{a}_i + \tilde{b}_i \geq \max\{\tilde{V}_i, P\} - \delta \end{aligned}$$

Parameter values exist such that these inequalities can hold, but the first (second) inequality can hold only if $\tilde{a}_j - \tilde{a}_i$ ($\tilde{b}_i - \tilde{b}_j$) is sufficiently high, and the third inequality can hold only if δ is sufficiently high.

For Lemma 6 and Proposition 7, a sketch of the proofs is provided in the text.

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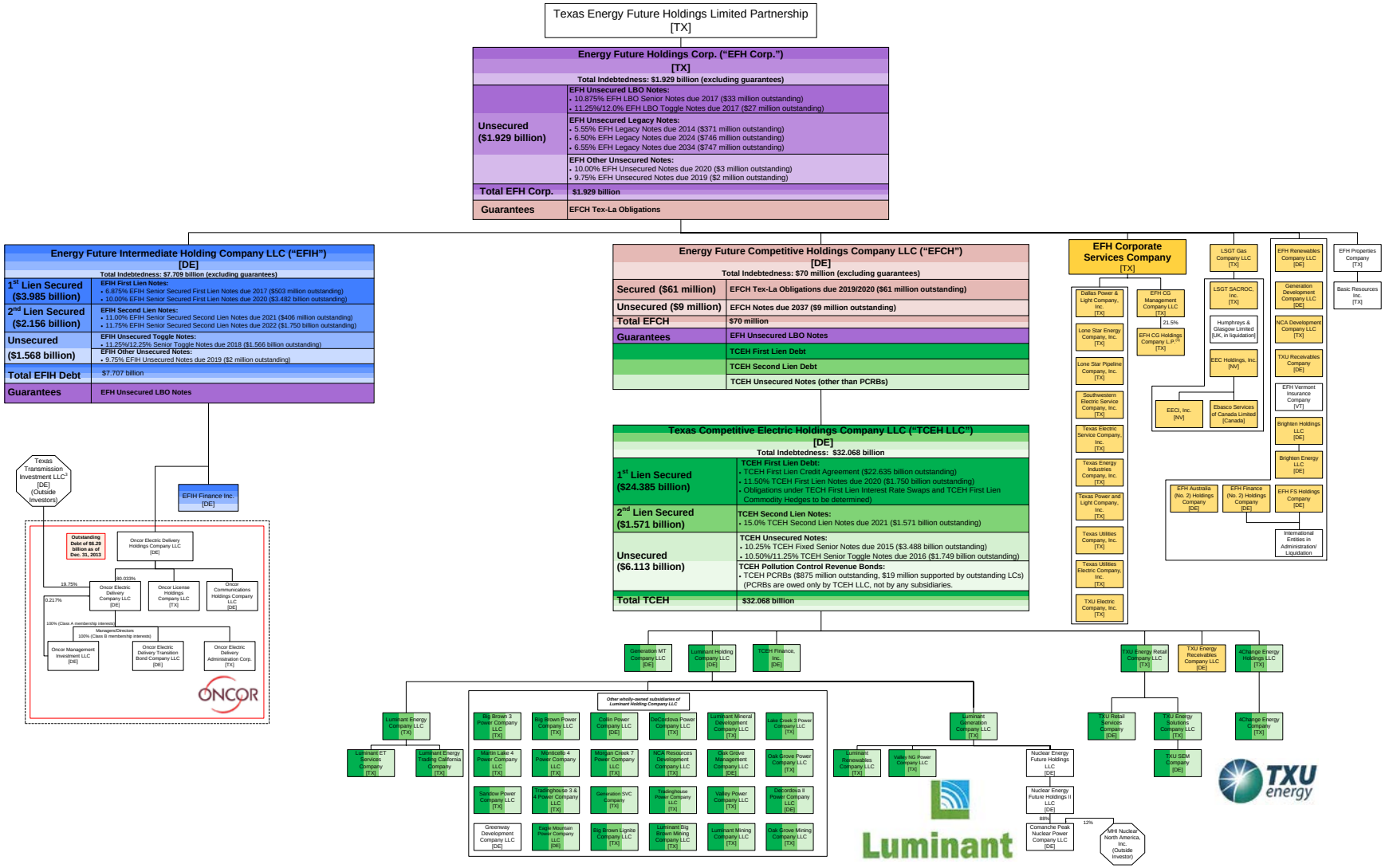
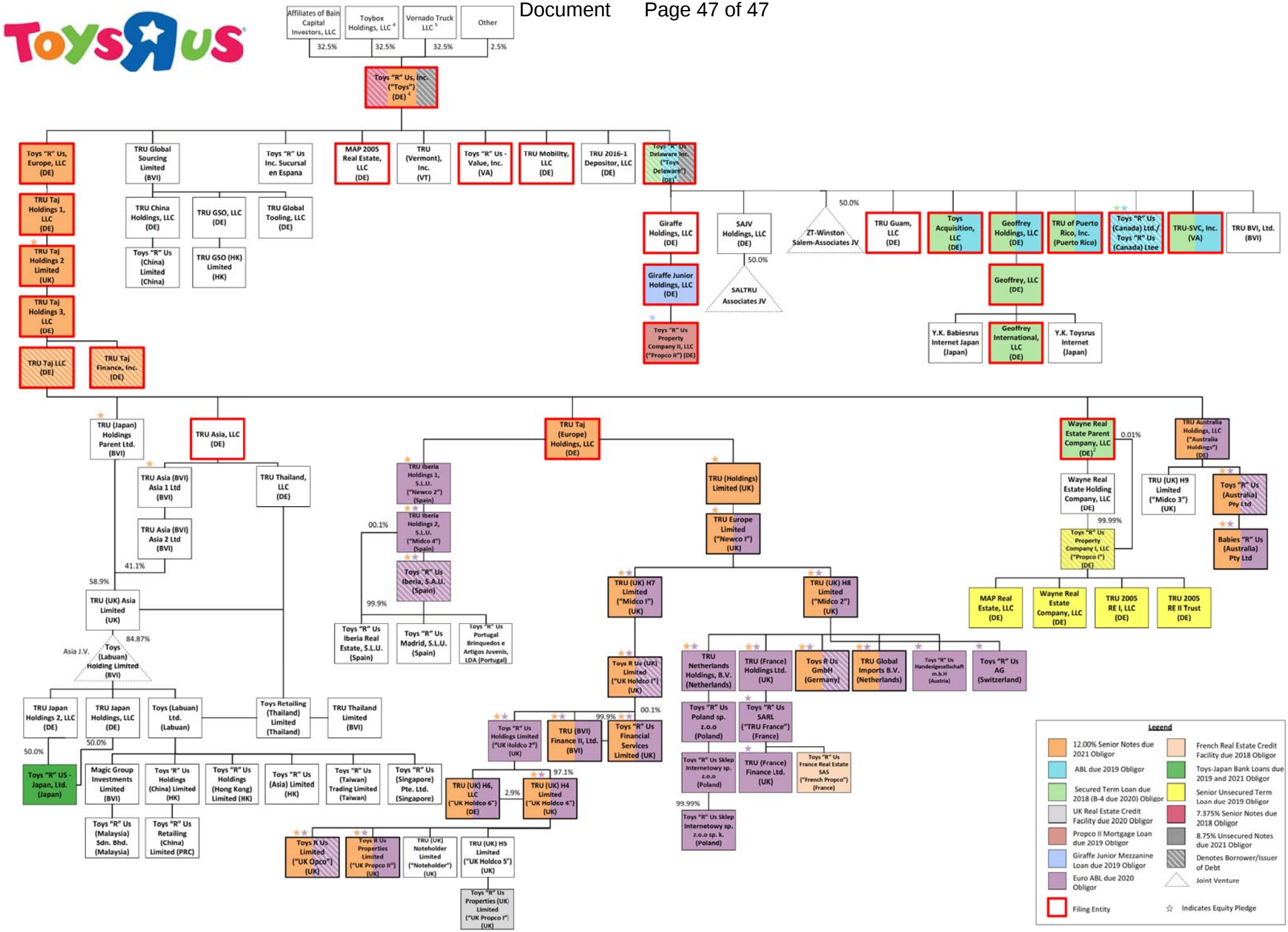
Appendix: Examples of Complex Capital Structures in Recent Bankruptcies

(AS OF THE PETITION DATE)

Energy Future Holdings ("EFH")




Affiliates of Bain Capital Investors, LLC
Toybox Holdings, LLC [4]
Vornado Truck LLC [5]
Other
32.5%
32.5%
32.5%
2.5%
Toys "R" Us, Inc. ("Toys") (DE) [6]
Toys "R" Us, Europe, LLC (DE)
TRU Global Sourcing Limited (BVI)
Toys "R" Us Inc. Sucursal en Espana
MAP 2005 Real Estate, LLC (DE)
TRU (Vermont), Inc. (VT)
Toys "R" Us - Value, Inc. (VA)
TRU Mobility, LLC (DE)
TRU 2016-1 Depositor, LLC (DE)
Toys "R" Us Delaware Inc. ("Toys Delaware") (DE) [4]
TRU Taj Holdings 1, LLC (DE)
TRU China Holdings, LLC (DE)
TRU GSO, LLC (DE)
TRU Global Tooling, LLC (DE)
TRU Taj Holdings 2 Limited (UK)
Toys "R" Us (China) Limited (China)
TRU GSO (HK) Limited (HK)
TRU Taj Holdings 3, LLC (DE)
TRU Taj LLC (DE)
TRU Taj Finance, Inc. (DE)
Giraffe Holdings, LLC (DE)
SAJV Holdings, LLC (DE)
50.0%
ZT-Winston Salem-Associates JV
TRU Guam, LLC (DE)
Toys Acquisition, LLC (DE)
Geoffrey Holdings, LLC (DE)
TRU of Puerto Rico, Inc. (Puerto Rico)
Toys "R" Us (Canada) Ltd./ Toys "R" Us (Canada) Ltee
TRU-SVC, Inc. (VA)
TRU BVI, Ltd. (BVI)
Giraffe Junior Holdings, LLC (DE)
50.0%
SALTRU Associates JV
Geoffrey, LLC (DE)
Toys "R" Us Property Company II, LLC ("Propco II") (DE)
Y.K. Babiesrus Internet Japan (Japan)
Geoffrey International, LLC (DE)
Y.K. Toysrus Internet (Japan)
TRU (Japan) Holdings Parent Ltd. (BVI)
TRU Asia, LLC (DE)
TRU Taj (Europe) Holdings, LLC (DE)
Wayne Real Estate Parent Company, LLC (DE) [7]
0.01%
TRU Australia Holdings, LLC ("Australia Holdings") (DE)
TRU Asia (BVI) Asia 1 Ltd (BVI)
TRU Thailand, LLC (DE)
TRU Iberia Holdings 1, S.L.U. ("Newco 2") (Spain)
TRU (Holdings) Limited (UK)
Wayne Real Estate Holding Company, LLC (DE)
TRU (UK) H9 Limited ("Midco 3") (UK)
Toys "R" Us (Australia) Pty Ltd
TRU Asia (BVI) Asia 2 Ltd (BVI)
00.1%
TRU Iberia Holdings 2, S.L.U. ("Midco 4") (Spain)
TRU Europe Limited ("Newco 1") (UK)
99.99%
Toys "R" Us Property Company I, LLC ("Propco I") (DE)
Babies "R" Us (Australia) Pty Ltd
41.1%
58.9%
Toys "R" Us Iberia, S.A.U. (Spain)
TRU (UK) H7 Limited ("Midco 1") (UK)
TRU (UK) H8 Limited ("Midco 2") (UK)
MAP Real Estate, LLC (DE)
Wayne Real Estate Company, LLC (DE)
TRU 2005 RE I, LLC (DE)
TRU 2005 RE II Trust (DE)
99.9%
TRU (UK) Asia Limited (UK)
Toys "R" Us Iberia Real Estate, S.L.U. (Spain)
Toys "R" Us Madrid, S.L.U. (Spain)
Toys "R" Us Portugal Brinquedos e Artigos Juvenis, LDA (Portugal)
84.87%
Asia J.V.
Toys (Labuan) Holding Limited (BVI)
Toys R Us (UK) Limited ("UK Holdco 1") (UK)
TRU Netherlands Holdings, B.V. (Netherlands)
TRU (France) Holdings Ltd. (UK)
Toys R Us GmbH (Germany)
TRU Global Imports B.V. (Netherlands)
Toys "R" Us Handelsgesellschaft m.b.H (Austria)
Toys "R" Us AG (Switzerland)
TRU Japan Holdings 2, LLC (DE)
TRU Japan Holdings, LLC (DE)
Toys (Labuan) Ltd. (Labuan)
Toys Retailing (Thailand) Limited (Thailand)
TRU Thailand Limited (BVI)
00.1%
99.9%
Toys "R" Us Holdings Limited ("UK Holdco 2") (UK)
TRU (BVI) Finance II, Ltd. (BVI)
Toys "R" Us Financial Services Limited (UK)
Toys "R" Us Poland sp. z.o.o (Poland)
Toys "R" Us SARL ("TRU France") (France)
50.0%
50.0%
Toys "R" US - Japan, Ltd. (Japan)
Magic Group Investments Limited (BVI)
Toys "R" Us Holdings (China) Limited (HK)
Toys "R" Us Holdings (Hong Kong) Limited (HK)
Toys "R" Us (Asia) Limited (HK)
Toys "R" Us (Taiwan) Trading Limited (Taiwan)
Toys "R" Us (Singapore) Pte. Ltd. (Singapore)
97.1%
TRU (UK) H6, LLC ("UK Holdco 6") (DE)
2.9%
TRU (UK) H4 Limited ("UK Holdco 4") (UK)
Toys "R" Us Sklep Internetowy sp. z.o.o (Poland)
TRU (France) Finance Ltd. (UK)
Toys "R" Us France Real Estate SAS ("French Propco") (France)
99.99%
Toys "R" Us Sklep Internetowy sp. z.o.o sp. k. (Poland)
Toys "R" Us (Malaysia) Sdn. Bhd. (Malaysia)
Toys "R" Us Retailing (China) Limited (PRC)
Toys R Us Limited ("UK Opco") (UK)
Toys R Us Properties Limited ("UK Propco II") (UK)
TRU (UK) Noteholder Limited ("Noteholder") (UK)
TRU (UK) H5 Limited ("UK Holdco 5") (UK)
Toys "R" Us Properties (UK) Limited ("UK Propco I") (UK)
Legend
12.00% Senior Notes due 2021 Obligor
ABL due 2019 Obligor
Secured Term Loan due 2018 (B-4 due 2020) Obligor
UK Real Estate Credit Facility due 2020 Obligor
Propco II Mortgage Loan due 2019 Obligor
Giraffe Junior Mezzanine Loan due 2019 Obligor
Euro ABL due 2020 Obligor
Filing Entity
French Real Estate Credit Facility due 2018 Obligor
Toys-Japan Bank Loans due 2019 and 2021 Obligor
Senior Unsecured Term Loan due 2019 Obligor
7.375% Senior Notes due 2018 Obligor
8.75% Unsecured Notes due 2021 Obligor
Denotes Borrower/Issuer of Debt
Joint Venture
Indicates Equity Pledge