Online Appendix

A Model Extension

A.a. Optimal Interior θ^*

In our formulation above, we have assumed that pledging a fraction θ of the assets to borrow short term from lenders who are protected by safe harbor provisions, does not impose any additional costs on long-term lenders and equity holders, other than the unavailability of the collateral that was pledged. This is clear from the specifications of Equation (3), (4) and (5).

It may be more realistic to specify that the payoffs to long-term lenders and equity holders may be adversely impacted by the roll risk of repo cash lenders, leading to a bankruptcy outcome. To allow for this possibility, we can modify the payoff functions $(1-\theta)$ in Equation (4) and (5) to an arbitrary $f(\theta)$ as follows.

When a fraction θ is pledged, the costs are reflected in what the remaining creditors and equity holders will get under restructuring.

$$\begin{aligned} D(V_B) &= f(\theta) \cdot \psi_D V_B \\ E(V_B) &= f(\theta) \cdot \psi_E V_B \end{aligned}$$

where, we place the following restrictions on the $f(\cdot)$ function: $f' < 0$, $f(\bar{\theta}) = 0$, and $f(0) = 1$. Intuitively, we are saying that as higher amounts are pledged to issue short-term debt with safe harbor privileges, there may be additional costs imposed on the remaining creditors of the issuing firm. For example, if a run by short-term lenders were to occur, the ensuing panic may cause the recovery for the remaining claimants in the resulting bankruptcy to be far lower.

It turns out, that our analysis can be derived with this more general specification. With a more general specification sketched in this section, we can prove the following results:

$$S^\star = V\theta(1-\beta)\left[\frac{\tau}{(1+x)(\tau-\hat{\lambda}\theta(1-\beta)+\hat{\lambda}\{1-f(\theta)(\psi_D+\psi_E)\})}\right]^{\frac{1}{x}} \tag{A.15}$$

$$C^\star = rV\frac{1-\hat{\lambda}\theta(1-\beta)}{\hat{\lambda}}\left[\frac{\tau}{(1+x)(\tau-\hat{\lambda}\theta(1-\beta)+\hat{\lambda}\{1-f(\theta)(\psi_D+\psi_E)\})}\right]^{\frac{1}{x}} \tag{A.16}$$

$$v(V) = V+\frac{S\tau}{\hat{\lambda}\theta(1-\beta)}-pS\left[\frac{\tau}{\hat{\lambda}\theta(1-\beta)}-1+\frac{\{1-f(\theta)(\psi_D+\psi_E)\}}{\theta(1-\beta)}\right] \tag{A.17}$$

where,

$$\hat{\lambda}=(1-\tau)\left(\frac{x}{1+x}\right)\frac{1}{1-f(\theta)\psi_E}>0$$

With the results above, it is straightforward to characterize the value-maximizing choice of θ^*. We had earlier chosen the simple specification $f(\theta)=1-\theta$ to get tractable solutions, but the main qualitative implications carry through for the more general functional form $f(\theta)$.

However, in this subsection, we showcase that the interior θ can be obtained with a specific functional form of $f(\theta)$. Let us consider the following specification:

$$f(\theta)=\frac{\log(1+\bar{\theta}-\theta)}{\log(1+\bar{\theta})} \tag{A.18}$$

The function satisfies the conditions above: $f'=\frac{-1}{(1+\bar{\theta}-\theta)\log(1+\bar{\theta})}$ and $f(\bar{\theta})=0$. Note that $f''=\frac{f'}{(1+\bar{\theta}-\theta)}<0$. This indicates that the cost of pledging imposed on the recovery is *convex* in θ. Using Equation (A.15), (A.16) and this function $f(\theta)$, we express the firm value v in Equation (A.17) in θ. The equity holder optimizes the $\theta\in(0,\bar{\theta})$ by maximizing the firm value v. With a standard set of parameters, the following figure illustrates that v is hump-shaped in θ. $\theta^\star$ is found at the maximum level of v.

[Insert Figure A.1 here.]

We summarize the most relevant results here:

1. With higher degree of APR violations, keeping total bankruptcy loss fixed, firms pledge more assets and avoid the costs of APR violations.

2. If the firm has more volatile assets (i.e., σ is high), the firm pledges less collateral. This result can be interpreted as follows. As σ increases, the default boundary would go down. This is because the equity holder would not want to give up the firm sooner when the asset value of the firm increases. This gives the equity holder an incentive to delay the run by the short-term lender. As a result, the firm takes less short-term debt by pledging fewer asset.

3. With an interior solution of $\theta^\star$, the minimum required liquidity $\underline{\beta}$ shown in Equation (10) can be analyzed in a similar context but with slightly different definition: $\underline{\beta}$ is such that $\theta^\star = 0$. In other words, when the collateral asset does not satisfy the minimum liquidity constraints, that is $\beta > \underline{\beta}$, the firm optimally pledges nothing. As in the simpler case, with more severe APR violation, the admissible set of collateral is larger in terms of the required liquidity (higher $\underline{\beta}$).

In this subsection, we have used a non-linear function, $f(\theta)$, to obtain an interior solution for $\theta^\star$, which is the optimal level of assets that the borrower will pledge. The use of a non-linear function $f(\theta)$, however, reduces the tractability of the model, which is the reason why we have used a linear function $f(\theta)$ for the main results.

A.b. Micro-founding Restructuring and Sharing Rules

In the formulation above, we operated in a reduced-form setting and did not establish a direct link between the sharing rules proposed in the restructuring rules in Equation (4) and (5) and the provisions of the underlying code as discussed by Mella-Barral (1999), François and Morellec (2004), and in Broadie et al. (2007).

We establish the micro foundations in two ways. First, we demonstrate the link between the sharing rules and the parameters of the bankruptcy code, by using the approach of François and Morellec (2004). This approach illustrates how the provisions of the bankruptcy code influence the choice of the restructuring boundary and the payoffs to borrowers and lenders at the boundary. Second, we formulate a simple bargaining game to show that the sharing rules can be derived endogenously.

A.b.1. Sharing Rules and the Bankruptcy Code

Two key parameters of the bankruptcy code that are modeled by François and Morellec (2004), and Broadie et al. (2007) are the following: (a) the length of the automatic stay, denoted as d, and (b) the flow rate of costs, ϕ, associated with the firm being in the Chapter 11 process, attempting to restructure its loans. The parameter ϕ captures the rate at which the Chapter 11 process is dissipating the resources of the firm per unit time. Using the approach of François and Morellec (2004), we can also link the parameter ψ_E to these parameters and the bargaining power η of the borrowers as implied by the provisions of the bankruptcy code as in Fan and Sundaresan (2000).

In Figure A.2, we plot the implied ψ_E for different values of d in years, and for different bargaining powers η (top panel) and for different flow rate of costs (dissipative dead-weight losses of being in the Chapter 11 process) ϕ (bottom panel). Note that if the bankruptcy code allows the borrower to remain in the Chapter 11 process for a long period with automatic stay in effect, then the implied deviations from APR can be rather high. As seen in the top panel, for greater bargaining power of the borrower, the implied violations of APR are higher. The bottom panel shows that, as the costs associated with the Chapter 11 process decrease, there is more room for a shareholder's strategic behavior, hence the APR violations increase. These are fairly intuitive conclusions.

[Insert Figure A.2 here.]

Thus, Figure A.2 illustrates the manner in which the length of the automatic stay (d) and frictional costs in the Chapter 11 process (ϕ) manifest themselves in our model through ψ_E.

A.b.2. A Simple Bargaining Game to Endogenize Sharing Rules

Beyond mapping our results to the existing literature, we provide a micro-foundation for our sharing rule in this subsection under the feature of the Chapter 7 provision. For simplicity. we do not consider a restructuring game in which the sharing rules are tied to the value of the firm under a new reorganization plan (we believe that such a formulation will complicate the analysis, without necessarily altering the major results).

We start by noting that short-term lenders under safe harbor provision are not subject to any APR violations because they have the collateral. Moreover they can stop the lending before the equity holder tries to renegotiate. Therefore, as in our main model in Equation (4) and (5), the sharing rule is only relevant to the equity holder and long-term lender, after the short-term lenders first take θ fraction of the asset. As a credible threat, if long-term creditors do not negotiate, the equity holder can take the firm to the court, and there will be a recovery cost associated with the Chapter 7 provision for long-term lenders. Specifically, we assume that a fraction $\gamma \in (0,1)$ is lost. Hence, the recovery for long-term debt holder is only $(1-\gamma)(1-\theta)V_B$. In the presence of this threat, we show how the sharing between the equity holder, and long-term creditors arises from the following game.

First, upon a successful renegotiation, a fraction μ goes to the equity holder and a fraction $1-\mu$ goes to the long-term creditor out of the available firm's asset $(1-\theta)V_B$. The renegotiation is however costly: there is a fixed cost of renegotiation, K. Therefore, the continuation value is $\mu((1-\theta)V_B - K)$ for the equity holder and $(1-\mu)((1-\theta)V_B - K)$ for the long-term creditor. Therefore incremental value upon a renegotiation is $\mu((1-\theta)V_B - K)$ for the equity holder and $(1-\mu)((1-\theta)V_B - K) - (1-\gamma)(1-\theta)V_B$ for the long-term creditors.

The equity holder and long-term creditor now enter into a Nash bargaining game, determining the shares to the equity holder, μ. For a given bargaining power of the equity holder over the long-term creditor $\eta \in (0,1)$, the game is specified as below:

$$\mu^{\star} = \text{arg max}_{\mu} \left[\mu((1-\theta)V_B - K)\right]^{\eta} \cdot \left[(1-\mu)((1-\theta)V_B - K) - (1-\gamma)(1-\theta)V_B\right]^{1-\eta}$$

The solution for the above problem is:

$$\mu^{\star} = \eta \left[1 - (1-\gamma) \frac{(1-\theta)V_B}{(1-\theta)V_B - K} \right]$$

The degree of APR violation is measured by the value of $\mu^{\star}$. If the equity holder can extract larger economic rent from the long-term creditor (higher $\mu^{\star}$), it precisely implies a more severe APR violation. In order to provide a mapping from this micro-founded result to our simplified specification in Equation (4) and (5), we express ψ_D and ψ_E with the deep parameters in this game.

$$\psi_D = \left[\frac{(1-\theta)V_B - K}{(1-\theta)V_B} \right] - \eta \left[\frac{(1-\theta)V_B - K}{(1-\theta)V_B} - (1-\gamma) \right] \tag{A.19}$$

$$\psi_E = \eta \left[\frac{(1-\theta)V_B - K}{(1-\theta)V_B} - (1-\gamma) \right] \tag{A.20}$$

Since we operate in a general context where renegotiation is considered as a credit event, we can also provide an expression for the bankruptcy loss parameter $\alpha = 1 - (\psi_D + \psi_E)$ in our main model.

$$\alpha = \frac{K}{(1-\theta)V_B}$$

Note that the necessary assumption to justify the feasibility of this game is the loss from renegotiation is smaller than the loss incurred by the Chapter 7 provision: $\gamma > \alpha$. This implies that ψ_E in Equation (A.20) and the second term of ψ_D in Equation (A.19) are positive.

Observation of ψ_E in Equation (A.20) provides several implications: the degree of APR violation increases as the threat of Chapter 7 (higher γ) is larger, as the equity holder's negotiation power is higher (larger η), and it decreases as renegotiation is more costly (higher K). These implications are compatible with ones in the previous subsection where we use features of the Chapter 11.

Figure A.1: **Firm value with respect to θ with $f(\theta)$ in Equation (A.18):** This plot showcases that an interior solution for θ can be found with a specific functional form of $f(\theta)$ as in Equation (A.18). The following parameters are used: $V_0 = 1$, $r = 0.04$, $\delta = 0.02$, $\sigma = 0.25$, $\tau = 0.35$, $\beta = 0.01$, $\psi_E = 0.2$, $\psi_D = 0.5$ and $\bar{\theta} = 1$.

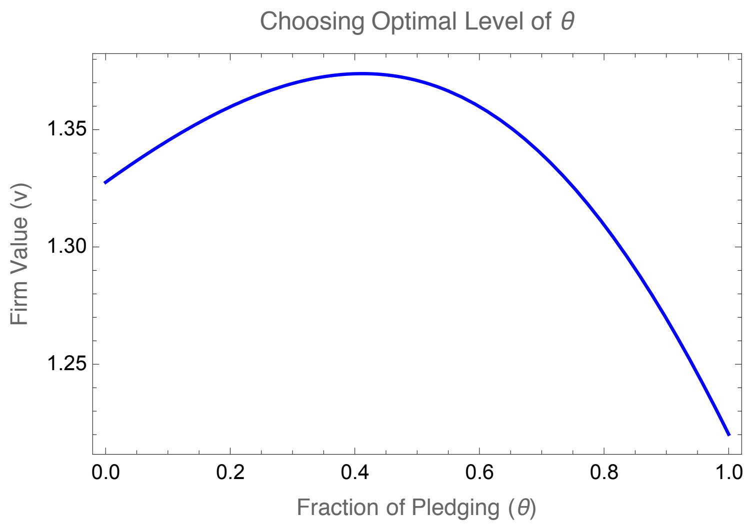
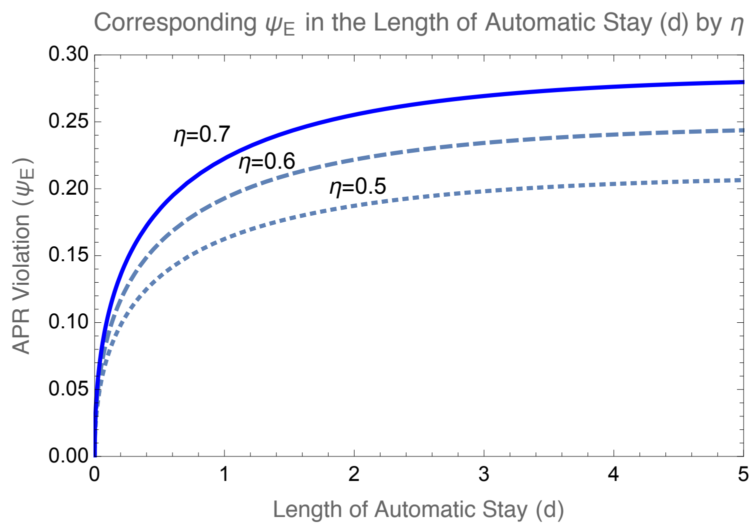
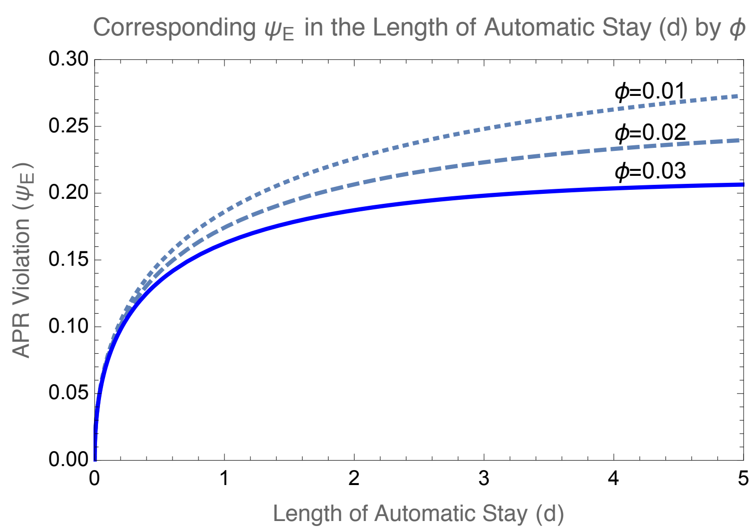


Figure A.2: **Illustrations of APR violations arising from the provisions of the bankruptcy code:** These plots depict how our reduced form of APR violation parameter, ψ_E, is linked to the characteristics of the bankruptcy code at a more fundamental level, using the framework of Francois and Morellec (2004). Both figures map the length of automatic stay of the code to the parameter ψ_E, which captures APR violations. Panal (a) varies the bargaining power of share holder by using $\eta = 0.7$ (solid), 0.6 (dashed) and 0.5 (dotted), keeping $\phi = 0.03$. Panel (b) varies the cost of being in the Chapter 11 by using $\phi = 0.03$ (solid), 0.02 (dashed) and 0.01 (dotted), keeping $\eta = 0.5$. For both figures, total bankruptcy loss is fixed at 0.2 and other parameters are used as follows: $V_0 = 1$, $r = 0.04$, $\delta = 0.02$, $\tau = 0.35$, $\sigma = 0.25$, $\beta = 0.05$.



(a) APR, stay period (d) and bargaining power (η)



(b) APR, stay period (d) and Ch.11 cost (ϕ)

B Why are Short-term Debt Safe Harbored?

The decision to make short-term debt (specifically, repo) was made by the Congress, as noted earlier. In this section, we motivate why typically only short-term debt with a few days to maturity are issued with the safe harbor protection in real life, from the perspective of the borrower. The reasoning is formalized below.

The borrower can issue short-term debt and pledge collateral outside the automatic stay. The short-term creditor can refuse to roll over at each instant unless two conditions are satisfied. First, the borrower must make the contractual interest payments. Second, the borrower must post sufficient collateral so that the loan is always risk-free. If either of these conditions fails, the lender can refuse to roll over the debt. This is a powerful/credible threat that the short-term creditor has which will then incentivize the borrower to honor the contractual commitments.

We can now imagine the borrower issuing long-term debt with safe harbor provision. In this case the borrower must pay at each instant the contractual coupon and ensure that the collateral is always adequate to make the long-term debt risk-free. In view of the fact that the long-term debt holder has already committed to provide a loan for a long maturity, he lacks the ability of the short-term debt holder who can refuse to roll over the loan. Of course, the long-term debt holder can write covenants which can stipulate that they have the right to "walk free" with the collateral at any time to render their debt risk-free, and without joining the other creditors in the bankruptcy process. Such covenants would require the borrower to "top up" the collateral at each instant to make the long-term contract essentially risk-free. If such contracts can be written and enforced without any costs, then long-term debt may also be issued with safe harbor provisions. We formalize this economic intuition in the next proposition.

Proposition 3. *When financial covenants can be enforced instantaneously without any costs to ensure that the value of the collateral is always equal to par, than the borrower is indifferent between issuing short-term debt or long-term debt with safe harbor protection.*

Two points are worth making in this context: with these additional covenants, the long-term debt tends to look more like short-term debt in states of the world where the borrower will have to top up the collateral. In a sense, these states are the ones that really matter as the likelihood of a loss is present only in these states. Since the thereat of refusing to roll over the loan is much more powerful than enforcing financial covenants, short-term debt becomes a more natural candidate for being issued with safe harbor provisions. With costly enforcement of covenants, short-term debt with safe harbor will be generally preferred over long-term debt with safe harbor.

Proof for Proposition 3

In order for the short-term or long-term debt to be protected by safe harbors, the borrower must move some assets outside the automatic stay provisions of the Code. We will formulate the problem for long-term debt, although the arguments are identical for short-term debt. Let us denote F to be the par value of long-term debt, which we assume to have infinite maturity. Let the coupon rate per unit time be c. At time $t = 0$ the borrower can set aside a fraction θ of assets into the safe harbor. The value of the sheltered assets at $t = 0$ is $\theta V_0(1 - \beta) \geq F$. Since the option to default rests with the borrower, as long as the coupon payments are met, the long-term creditor will not be able to seize the assets held in safe harbor. In addition, as the asset value declines, the creditor is exposed to default risk. In order to protect the creditor from default risk, it is necessary that the assets are always held at a level F . This would imply that in states of the world when $V_t < F\theta(1 - \beta)$. The long-term bond covenants must require the borrower to move additional assets to "top up" levels of the safe harbored collateral to F. We will model below this requirement, which would imply that the borrower will have to issue additional equity in states where $V_t < F\theta(1 - \beta)$ to top up the collateral so that the value of always equal to F. In contrast, with short-term debt, (instantaneous maturity), the lender can always enforce the contract by refusing to lend, when $V_t \downarrow F$, and refuse to roll over the loan. This is the key difference between short-term and long-term debt in our model. It follows then that as long as covenants are enforced promptly and without costs, the long-term debt is also viable for safe harbor provisions. We formalize these ideas below and derive the optimal default boundary.

The equity holders' (the borrower) problem can be divided into two regions. In the first region we have: $V_t \geq \frac{F}{\theta(1-\beta)}$. Here, the collateral has sufficient assets to protect the long-term debt investors. In this region (region 1), equity value satisfies the following ODE:

$$\delta V - Fc(1-\tau) - rG + G_V(r-\delta)V + \frac{1}{2}G_{VV}\sigma^2V^2 = 0$$

In the second region we have: $V_t < \frac{F}{\theta(1-\beta)}$. Here, the collateral is insufficient to protect the long-term debt investors. In this region (region 2), equity value satisfies the following ODE, reflecting the additional equity issuance to top up the collateral:

$$\delta V - Fc(1-\tau) - [F - V\theta(1-\beta)] - rE + E_V(r-\delta)V + \frac{1}{2}E_{VV}\sigma^2V^2 = 0$$

.

In moving from region 1 to region 2 we note that distinction between short-term debt and long-term debt. In the case of short-term debt, the onus is upon the borrower to top up the collateral: in the absence of such an action, the short-term creditor will simply refuse to roll over the loan. On the other hand, in the case of long-term debt, the creditors will have to rely on enforcing the loan covenants to ensure that the collateral is topped up. In its absence, the covenants should allow the long-term creditors to accelerate the payment of principal. If such enforcements are costly, then there will be dead-weight losses in moving from region 1 to region 2, which will be reflected in the ODE, and the option of issuing long-term debt will become suboptimal.

We need enforce the following boundary conditions to solve for the value of the borrower in issuing safe harbored long-term or short-term debt. $E(V_B) = 0$, $E_V(V_B) = 0$, $G(\frac{F}{\theta(1-\beta)}) = E(\frac{F}{\theta(1-\beta)})$, $G_V(\frac{F}{\theta(1-\beta)}) = E_V(\frac{F}{\theta(1-\beta)})$, and $G(V \uparrow \infty) = V - \frac{Fc(1-\tau)}{r}$.

It is the enforcement mechanism that is different. Let $\lambda_1 > 0$ and $\lambda_2 < 0$ be the two roots of the following characteristic equation:

$$-r-(r-\delta)\lambda+\frac{1}{2}\lambda(1+\lambda)\sigma^2=0$$

We can show that the solution to the above problem takes the following form.

$$\begin{aligned} G(V;V_B) &= V-\frac{Fc(1-\tau)}{r}+a_1V^{-\lambda_1} \\ E(V;V_B) &= \frac{F+Fc(1-\tau)}{r}+\frac{\delta+\theta(1-\beta)}{\delta}V+b_1V^{-\lambda_1}+b_2V^{-\lambda_2} \end{aligned}$$

where a_1, b_1 and b_2 are constants that are as shown below.

$$\begin{aligned} a_1 &= \frac{F}{r\delta}\left(\frac{\delta}{\lambda_1}+(r-\delta)\right)\left[\frac{F}{\theta(1-\beta)}\right]+\frac{1}{\lambda_1}V_B^{\lambda_1}\left(1+\frac{\theta(1-\beta)}{\delta}\right) \\ b_1 &= \frac{1}{\lambda_1}V_B^{\lambda_1}\left(1+\frac{\theta(1-\beta)}{\delta}\right)-\frac{\theta(1-\beta)}{r}\frac{\lambda_2}{\lambda_1}\frac{1}{\lambda_1-\lambda_2}\left[\frac{F}{\theta(1-\beta)}\right]^{1+\lambda_1} \\ b_2 &= \frac{\theta(1-\beta)}{r}\frac{1}{\lambda_1-\lambda_2}\left[\frac{F}{\theta(1-\beta)}\right]^{1+\lambda_1} \end{aligned}$$

The optimal default boundary V_B is found by maximizing the equity value and is presented below:

$$\frac{F}{r}\frac{1+\lambda_2}{\lambda_1-\lambda_2}\left(\frac{F}{V_B\theta(1-\beta)}\right)^{\lambda_2}-\frac{F}{r}\frac{\lambda_2}{\lambda_1}\frac{1+\lambda_1}{\lambda_1-\lambda_2}\left(\frac{F}{V_B\theta(1-\beta)}\right)^{\lambda_1} = \frac{F+Fc(1-\tau)}{r}-\frac{1+\lambda_1}{\lambda_1}\left(1+\frac{\theta(1-\beta)}{\delta}\right)$$

Since the debt is risk-free, $c=r$, in equilibrium. It follows that the topping up of the collateral will occur until the equity value goes to zero, at which point the creditors will walk free with the collateral, rendering the debt risk-free. This proves that with prompt and costless enforcement of covenants, long-term debt can also be issued with safe harbor provisions.

Note that if the enforcement of covenants is costly, equity holders will prefer to issue short term debt with safe harbor rights and save costly negotiations.

□

C Setting Total Recovery Constant

We now explore a possibility that differential total recovery value with respect to firms' choice of pledging may drive our main result. First, we obtain the total recovery value R, we add up all the recovery value given by Equation (3)-(5). At the equilibrium, we have that

$$R(\theta) = [(1-\theta)\cdot(\psi_D + \psi_E) + \theta\cdot(1-\beta)]\cdot V_B$$

For a given range of θ between [0,1] and with a standard parameter set, we plot the total recovery value with different levels of APR violation (ψ_E) while keeping $\alpha = \beta$.

Panel (a) of Figure C.3 shows that the total recovery in our model is, in fact, endogenous. As a firm endogenously chooses θ, the total recovery given default will be determined. This illustration suggests that $R'(\theta) \geq 0$ and it is also easy to show analytically using results in Lemma 1 and Proposition 2: as long as $\beta \leq \alpha$, the equilibrium total recovery rate increases in θ. As a special case, when $\psi_E = 0$ the total recovery value is irrelevant to securing exercises: for every value of θ, R is a constant. However, as $\psi_E > 0$, total recovery is increasing in θ, indicating that a firm can enjoy higher recovery value as it pledges more asset.

In order to verify that differential recovery value is not driving our main results, we construct the recovery-neutral benchmark. In particular, we make the total recovery rate fixed across θ by finding $\beta(\theta)$ such that $\frac{\partial}{\partial\theta}[(1-\theta)\cdot(\psi_D + \psi_E) + \theta\cdot(1-\beta(\theta))] = 0$.[30] This condition implies that

$$\beta'(\theta) = \frac{\alpha - \beta(\theta)}{\theta}.$$

With a boundary condition $\beta(1) = 0$, the above differential equation yields:

$$\beta(\theta) = -\frac{(1-\theta)}{\theta}\alpha.$$

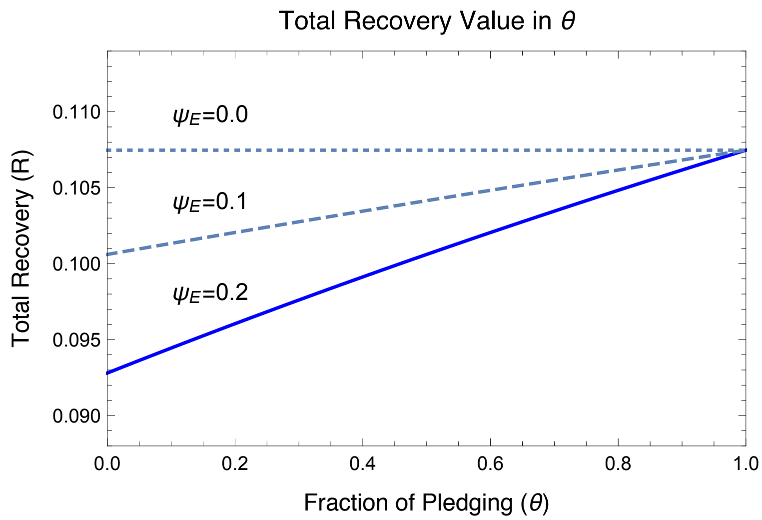
We substitute our parametric liquidity cost β with the above function $\beta(\theta)$, and produce our

[30] A more general version $R(\theta) = [(1-\theta)\cdot(\psi_D(\theta) + \psi_E(\theta)) + \theta\cdot(1-\beta(\theta))]$ is reduced to this specification based on the assumption that ψ_D and ψ_E are given by the underlying bankruptcy code, which are independent of firms' choice for θ. We thank the referee for the general specification.

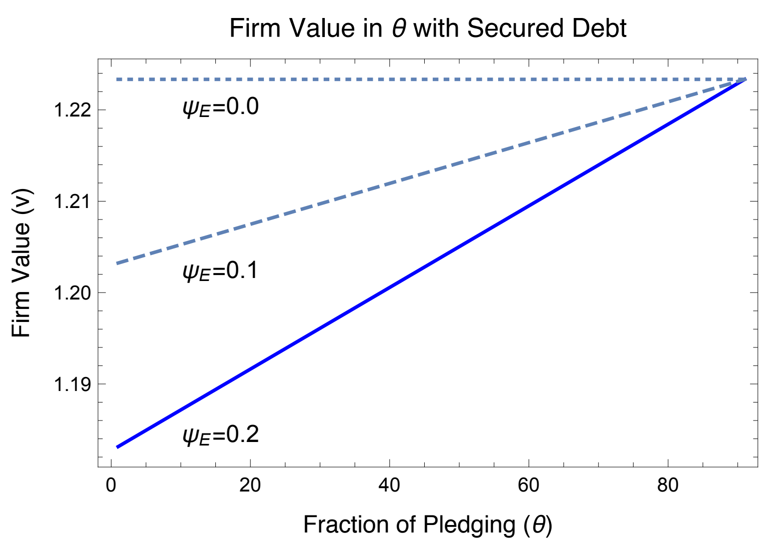
main result again: the firm value with respect to θ corresponding to Figure 8.

Panel (b) of Figure C.3 indicates that such a "recovery-neutral" benchmark delivers qualitatively identical results of the version with parametric β, ensuring our results are not driven by mechanical recovery rate change. The main implication of this exercise is that *even when we force the recovery rate to be constant across firms' choice*, when the bankruptcy code is not creditor-friendly and therefore allows APR violation, secured short-term debt provides a way to circumvent this problem and hence enhances the firm valuation. This result allows us to keep our parametric β in our main model which is simpler and better tractable.

Figure C.3: **Total recovery and firm value with constant total recovery:** The upper panel (a) shows the total recovery value with respect to a firm's choice θ, where the total recovery value $R(\theta)$ is defined by $[(1-\theta)\cdot(\psi_D+\psi_E)+\theta\cdot(1-\beta)]\cdot V_B$. In this figure, the inside bankruptcy cost and outside liquidation loss are identical (i.e., $\alpha=\beta$). The total recovery value is presented with three different levels of APR violation ($\psi_E = \{0.0\ \text{(dotted)}, 0.1\ \text{(dashed)}, 0.2\ \text{(solid)}\}$), keeping $\alpha \equiv 1-(\psi_E+\psi_D) = \beta = 0.5$ The lower panel (b) shows the firm value with respect to a firm's choice θ, keeping the total recovery value constant cross firms' choice variable θ (i.e., $\frac{\partial}{\partial\theta}[(1-\theta)\cdot(\psi_D+\psi_E)+\theta\cdot(1-\beta(\theta))]=0$). The firm value is presented with three different levels of APR violation ($\psi_E = \{0.0\ \text{(dotted)}, 0.1\ \text{(dashed)}, 0.2\ \text{(solid)}\}$), keeping $\alpha \equiv 1-(\psi_E+\psi_D) = \beta = 0.5$. For both figures, other parameters are used as follows: $V_0=1$, $r=0.04$, $\delta=0.02$, $\tau=0.35$, $\sigma=0.25$.



(a) Total recovery value



(b) Firm value with constant total recovery