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Creditors' holdup, releveraging and the setting of private appropriation in a control contract between shareholders

Hubert de La Bruslerie¹

Simon Gueguen

Abstract

Debt is analyzed in relation to the conflict between three parties, a controlling shareholder, outside investors and creditors. We follow Jensen and Meckling's (1976) and Myers' (1977) intuitions that leverage may result in excess value appropriation by creditors while at the same time acting to discipline private benefits appropriation. Creditors' holdup refers to the appropriation by the incumbent debtholders of a large part of the additional value created by an incentivized controlling shareholder. This paper introduces a negotiation framework between controlling and outside shareholders in which releveraging and private benefits are decided while the process of value creation initiates a transfer of value to the creditors. The admissible contracts of control involve a minimum jump in leverage. This result gives a theoretical foundation for the leveraged recap decisions observed in the market and one-off variations of the capital structure.

JEL: G30/ G32 / G34

Keywords: creditors' holdup, private benefits, controlling shareholder, debt leverage, releveraging, corporate governance

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Introduction

Leveraged recapitalizations are observed and well-identified corporate decisions. Typically, a firm decides to releverage its capital structure in a one-off change, and the debt proceeds are distributed to the current shareholders through exceptional dividends or share buybacks. In 2013, KKR received an exceptional dividend from the British retailer Pets at Home, which it bought two years earlier for £955 million, by adding £135 million in new debt. As a consequence of this operation, the ratio of total debt to EBITDA reached the high level of 5.² Shivdasani and Zak (2007) analyze public firms' leveraged recap decisions in the 2003-2007 period. Because of the releveraging decision, the S&P credit rating score dropped one "notch", while the firm's stock exhibited an average abnormal return of 6.8%.

Releveraging is frequently analyzed as a univocal transfer of value funded by creditors that is unfavorable to them. However, in the context of value-enhancing events, releveraging should not be highlighted without first identifying a creditors' holdup mechanism. Here, holdup describes the appropriation by the incumbent debtholders of a large part of the additional value created by an incentivized controlling shareholder. This is particularly true when one-off events such as unexpected acquisition announcements occur and disclose possible gains. This paper introduces a negotiation framework between controlling and outside shareholders in which releveraging and incentivization through private benefits are jointly decided. In the context of value-enhancing events, we show the existence of a nonempty space of contracts of control between the controlling and outside shareholders.

A pure capital structure model focusing only on the conflict between creditors and shareholders considered as a whole would ignore that debt is also the source of a disagreement between the controlling and outside shareholders. This paper introduces private benefits and agency conflict among shareholders to explain jumps in leverage. Our framework considers that the releveraging decision develops in connection with the process of creating economic value in the firm and is not a simple discretionary decision by an incentivized manager. Therefore, we do not build on frameworks that are pegged on exogenous

² Financial Times, ft.com - companies 13th April 2013

commitments (DeMarzo and He 2016, Dangl et Zechner 2016). This study belongs to the literature that analyzes agency conflicts between managers and outside investors as a key determinant of capital structure. Among others, DeMarzo and Sannikov (2006) and DeMarzo and Fishman (2007) investigate the effects of agency conflicts on capital structure with risk-neutral agents and complete contracting. In their seminal paper, Jensen and Meckling (1976) focus on the one-way wealth transfer from bondholders to shareholders. In a footnote, they explain that they do not consider the opposite symmetric case, in which “*bondholders (...) can force management to take actions which would transfer wealth from the equity holder to the bondholders*” (footnote 49, page 339). In our framework, bondholders benefit from the controlling shareholder’s effort to create value, and we follow Jensen and Meckling’s (1976) intuition of a two-way transfer of wealth between shareholders and debtholders.

In this paper, we consider that the conflict between shareholders involves two key mechanisms: incentivization and releveraging. Myers (1977) show that shareholders will not finance a valuable investment if such an investment will result in a large increase in the value of existing debt. This “debt overhang” problem has been revisited and extended to “effort” as opposed to “underinvestment” problems (He 2011): the increase in the value of existing debt acts as a tax and thus reduces incentives for shareholders to make an effort. We explicitly introduce the releveraging decision. In our framework, the issuance of new debt leads to a transfer of value from creditors to shareholders that partly offsets this creditors’ holdup. In that sense, our paper is also in the spirit of the leverage ratchet effect of Admati et al. (2018), who show that shareholders always gain from a one-time debt issuance in case the debt capacity is not exhausted. In the context of value-enhancing events, controlling shareholders and outside shareholders agree on the principle of releveraging since they share the objective of limiting the creditors’ holdup. However, they disagree about the optimal ex post debt level; a higher debt will reduce the after-interest cash flows from which the controlling shareholder may capture private benefits. In our framework, these two categories of shareholders bargain upon releveraging together with the incentive contract. We show that a space of negotiation between both categories of shareholders could result in joint feasible releveraging and incentivizing choices.

Our main result is that the determination of private benefits interferes with the current capital structure of the firm. The paper considers the two rationales ensuing from the shareholder-creditor conflict and the controlling-outside shareholder conflict in a single

framework.³ This makes the regulation story more complex, as the game involves three parties rather than two. Indebtedness curbs controlling shareholders' private appropriation, and at the same time, the private benefit incentive initiates a holdup for creditors. This creditors' holdup is an opportunity cost for any shareholder, but we show that it is asymmetrically shared between outside and controlling shareholders. The releveraging decision and private benefits choices both depend on determinants identified in the capital structure literature (for instance, Myers, 1977, Myers and Majluf 1984, Harris and Raviv 1988,1990, Leland 1994). We identify a specific effect based on a three-party interaction, as we explicitly introduce a difference between controlling and outside shareholders.

This paper refers to two agency issues. The first is the existence of private benefits as an implicit compensation scheme for the controlling shareholder, and the second is the choice of a debt structure with senior standard debt and equity. These two issues are linked since they are based on the change in the economic process of value creation and are addressed within a financial governance framework. We do not question the theoretical issue of the optimal design of the incentive contract (Dewatripont and Tirole 1994, Lambrecht and Myers 2008). We do not follow the "EBIT pie" approach, which states that the value of the firm is continuously shared between financial claimants and nonfinancial claimants (i.e., government) and that the capital structure choice is explained by friction costs such as taxes, bankruptcy costs, and restructuring costs (Fisher et al. 1989, Goldstein et al 2001). Following the M-M avenue, the latter assumes that the firm's cash flows are invariant to debt choices. Our framework of an event creating a perpetual cash flow increase due to incentivization and a joint change in leverage refers to Jensen and Meckling's (1976) agency approach to the capital structure choice.

We analyze the process of bargaining between controlling and outside shareholders when both the incentive scheme and the level of releveraging are addressed in the same negotiation. We explicitly identify the creditors' holdup problem, which should be integrated into a three-party equilibrium scheme based on incentivization, and we provide an additional explanation for jumps in leverage.

³ We focus on the controlling shareholder's private benefits scheme with outside shareholders (La Porta et al. 1998, 2002). The managers' perquisite conflict with dispersed shareholders appears to be a special case of controlling/outsider shareholders with a null investment in the firm's equity.

Our study contributes to the literature on the relationship between private benefits and the dynamics of capital structure in several ways. First, we develop a model using the option valuation framework. This justifies referring to a risk-neutral hypothesis, as in Leland (1994), Leland (1998), DeMarzo and Fishman (2007), Morellec et al. (2012), Admati et al. (2018), or Morellec et al. (2018). Second, we emphasize the role of debt leverage in agency conflicts because controlling shareholders often find it easier to modify the leverage ratio than to modify their share of capital. This provides a theoretical foundation for the releveraging decisions observed in the market. Outside shareholders will implicitly accept a trade-off because of the incentive characteristics of private benefits and prospect of additional value creation. Our model is set in continuous time but introduces leverage adjustments in a static two-period timeline. Therefore, it focuses on leverage jumps, which is the key outcome variable. It differs from He (2011)'s dynamic continuous revision of the compensation scheme and the literature on dynamic capital structure trade-offs (Goldstein et al. 2001, Dangl and Zechner 2016, Admati et al. 2018).

We also add to the literature by explicitly introducing the creditors' holdup in the setting of the contract of control. Aside from the standard Merton case, which uses the simple framework of zero-coupon debt with a fixed nominal value and maturity, we follow Leland (1994), He (2011), Barsotti et al. (2012), Morellec et al. (2012), Attaoui and Poncet (2013), and Morellec et al. (2018), with bankruptcy risk defined with regard to the continuous coupon payment of a perpetual debt. We contribute to the literature analyzing both private benefits and debt leverage changes. It is limited with the exception of He (2011) and Morellec et al. (2018), who aim to jointly analyze the two types of conflicts of interest among shareholders and creditors. Contrary to those articles, we consider private benefit appropriation by controlling shareholders as endogenous.

Our analysis provides an additional governance explanation for the ratchet effect in capital structure that relies on the creditors' holdup mechanism. Our framework justifies a bias toward releveraging, as in Goldstein et al. (2001) or Admati et al. (2018), and differs from the contributions of recent dynamic capital structure literature leading to deleveraging (DeMarzo and He, 2016, Dangl and Zechner, 2016). Contrary to He (2011), we show that *a rise in indebtedness* is a way to avoid the creditors' holdup problem and give a theoretical explanation for one-off dividend recapitalization decisions. Moreover, releveraging influences the solution to the controlling-outside shareholder conflict and applies enhanced disciplinary

pressure on the controlling shareholder. A self-regulation mechanism is identified that constrains the appropriation of private benefits. This self-regulation mechanism will develop differently according to the contractual frameworks of incentivizing benefits. We derive practical and testable implications.⁴

1. Review of the literature

Empirical studies on corporate governance show the prevalence of firms with a dominant shareholder (La Porta et al. 1997, 1998, 2002; Faccio et al. 2002, 2003). Since the dominant shareholder may extract private benefits of control at the expense of outside shareholders, controlling and outside shareholders face an agency problem (Bebchuk and Neeman 2010). Private benefits are at the same time the symptom, the goal, and the regulating variable of an implicit contract between them. The characteristics of private benefits appropriation are empirically studied by Leuz et al. (2003) and Bhattacharya et al. (2003). The empirical relation between private benefits and leverage is analyzed by Kang and Kim (2006), Faccio et al. (2010), He (2011), Liu and Tian (2012), or Morellec et al. (2018).

On theoretical grounds, Harris and Raviv (1990), Zhang (1998), and Almeida and Wolfenzon (2005) address the problem of debt level and controlling-outside shareholder conflict within the context of information asymmetry. The optimal claim design is analyzed in the agency contracting literature (Gale and Hellwig 1985; Bolton and Scharfein 1990; Berglof and Von Thadden 1994; Dewatripont and Tirole 1994). Papers on dynamic financial contracting, such as DeMarzo and Sannikov (2006) and DeMarzo and Fishman (2007), identify outside equity and debt as part of the optimal contract. Private benefits are featured as an asymmetry of information between the agent (manager or controlling shareholder) who knows the true cash flow and outside investors. In the DeMarzo and Fishman (2007) paper, the agent is incentivized to provide efforts with a share of equity and some private benefits. They demonstrate that the incentive compatibility constraint leads to a “*commitment effect of private benefits*” (p. 2709). The dynamic capital structure literature has developed a setting of continuous leverage adjustments, generally using a cash-flow state variable. Heterogeneous debts will raise the issue of optimal debt structure and optimal debt maturity (Goldstein et al. 2001, DeMarzo and Fishman 2007, DeMarzo and He 2016, Dangl and Zechner 2016). A debt

⁴ This paper brings different and complementary contributions to La Bruslerie (2016), where private benefits are expropriated upstream before debt repayment at the maturity date. The former framework does not include the creditors' holdup problem and the management of debt leverage, which is addressed here.

overhang effect of long-term debtholders is identified when a firm decides to issue equity. This approach focuses on decisions with regard to heterogeneous debt, for instance, by restructuring it or replacing it with short-term debt. It mainly outlines leverage reduction.

The interaction between debt and ownership structure is analyzed in a global governance framework by Morellec (2004), John and Khedia (2006) and Lambrecht and Myers (2008). At et al. (2006) identify an optimal compensation contract using private benefits for the controlling shareholder. It is shown that the level of investor protection plays an important role in funding an acquisition.

More closely related to our paper, He (2011) analyzes leverage in a contingent claims framework when managers are disciplined by outside equity holders, developing an analysis of the link between optimal contracting and capital structure. A debt overhang situation generates a negative relationship between leverage and the agent's incentive to create value. Using calibration, He's model yields an optimal leverage of 39% compared to 63% in Leland's model. Introducing joint debt overhang and agent incentives allows simulations that are more coherent with observed data. It justifies still considering static modeling: referring to dynamic capital structure modeling is not the only way to obtain simulations in line with empirically observed data (Goldstein et al. 2001).

In another framework, Admati et al. (2018) identify a leverage ratchet effect due to wealth appropriation by creditors in the case of deleveraging. Shareholders resist value-improving debt reductions since creditors will capture the benefit of the change in capital structure and implement asymmetric releveraging decisions. Recently, Rivera (2019) refers to events, such as profitability shocks, that will condition the optimal contract between managers and shareholders. We also consider profitability shocks, but our focus is on the releveraging decision associated with profitability increases endogenously driven by incentivizing private benefits.

2. Modeling debt and private benefits contracts

In the following, the incentive contract is negotiated between a controlling shareholder and outside shareholders. Wealth creation induced by the incentive contract creates creditors' holdup, and our framework opens the way to simultaneously analyze the conflicts between a controlling shareholder, outside shareholders and creditors.

While Goldstein et al. (2001) develop an Ebit-based model in which the dynamic is invariant to the capital structure and to the way the “Ebit pie” is shared, in our framework, the firm value depends on incentives. A shock in the drift governing asset value is well suited, as it defines endogenous bankruptcy without referring to covenants or commitments. Leland’s (1994) model identifies resistance to leverage reductions in the context of homogeneous and presumed fixed perpetual debt. Bankruptcy costs are proportional to asset value, and changes in debt are statically considered. Therefore, we use a continuous model in a static two-period framework as in Leland (1994), Leland and Toft (1996) and Leland (1998).

2.1. Valuation framework

Creditors, the controlling shareholder, and outside investors have claims on the firm’s assets. At time $t = 0$, the drift δ ruling the asset’s growth is inflated with value creation resulting from the controller’s action. We adopt a risk-neutral framework in which the firm’s assets are tradable and contractible. The firm uses debt and equity to finance them. However, the incentive contract resulting from the controlling shareholder’s activity is implicit and is not a tradable asset. It results in an additional drift η to the asset value because of extra profitability drawn from the economic environment or resulting from cost savings. The controlling shareholder implements a one-time action that perpetually increases the drift of assets. The firm value A follows the process shown by formula (1):

$$\frac{dA}{A} = (\delta + \eta)dt + \sigma dW \quad (1)$$

The previous formula differs from the literature, which usually refers to a negative cash outflow, which is considered a dividend payment to shareholders or a coupon payment to bondholders. The assumption of a possible positive cash inflow η is explicitly mentioned in the seminal articles of Merton (1974) or Black and Cox (1976).⁵ This additional value creation drift adds to the initial historical drift δ .

At inception, before setting an implicit contract of control that introduces appropriation, the firm comprises equity, E , and debt, D , belonging to shareholders and creditors, respectively. Just before the setting at time 0, $A = E + D$. The initial asset value A_0 moves to $A = A_0 \left(\frac{r-\delta}{r-\delta-\eta} \right)$.⁶ The controlling shareholder owns an initial stake, α , in the equity.

⁵ The condition to get a finite value in a risk-neutral world using the risk-free discount rate $\delta + \eta < r$. We assume this condition holds. We thank an anonymous referee for noting this condition.

⁶ If the asset payout is qA_t , the initial risk-neutral value of the firm is $qA_0/(r - \delta)$, where the expected return is the risk-free rate. Introducing a change in the drift equal to η , we obtain the new value of assets using the limited

Once the control contract is agreed upon, she will be awarded some part of the additional flow by receiving additional equity shares. Considered from the creditors' point of view, these benefits are appropriated within the shareholders group. Their situation will be affected only by the resulting value creation.

D_0 is the amount of debt at inception, and we do not refer to it to define bankruptcy as no reimbursement is scheduled.⁷ We assume, as in Leland (1994), that solvency depends on the possibility of financing a coupon payment with the issue of equity. By default, the firm cannot raise capital to pay its creditors. This defines an optimal default rule for shareholders (Leland 1994, Goldstein et al. 2001). The asset value motion in Eq (1) and a similar cash flow dynamic motion are economically equivalent when the payout to the claimants is proportional to the asset value. Both give the same unlevered firm value⁸. What is crucial is the way default rules are stated; cash flow state variable models often use exogeneous default conditions (Leland 1998, Attaoui and Poncet 2013, Morellec et al. 2018). We think optimal default rules are better suited to analyze a situation in which the state variable is the asset motion.

In a risk-neutral framework, the value of a perpetual claim, F , based on asset value A and continuously paying coupon C follows the differential equation:

$$\frac{1}{2}\sigma^2 A^2 F_{AA} + (\delta + \eta)AF_A - rF + C = 0 \quad (2)$$

where the assets' drift is inflated by a proportional cash inflow η according to (1). As mentioned in Merton (1974) and Black and Cox (1976), this equation holds for positive or negative cash flows inflating or diminishing asset drift. This equation has a general solution subject to boundary conditions (Leland 1994):

$$F = X_0 + X_1 A^{-y} + X_2 A^{-z} \quad (3)$$

with

$$z = \frac{\left\{ (\delta + \eta - 0.5\sigma^2) + [(\delta + \eta - 0.5\sigma^2)^2 + 2\sigma^2 r]^{\frac{1}{2}} \right\}}{\sigma^2}$$

development formula around δ . It converges toward $A = A_0(r - \delta)/(r - \delta - \eta)$ when the technical condition $\delta < r - \eta$ is verified.

⁷ We do not address here the issue of a capital structure with debt priority (e.g., Attaoui and Poncet 2013).

⁸ In a risk-neutral world, we obtain $v(A) = v(EBIT) = \frac{\delta A_0}{r - \delta} = \frac{EBIT_0}{r - \delta}$.

$$y = \frac{\left\{ (\delta + \eta - 0.5\sigma^2) - [(\delta + \eta - 0.5\sigma^2)^2 + 2\sigma^2r]^{\frac{1}{2}} \right\}}{\sigma^2}$$

Default occurs when the assets value reaches A_b . At that time, the assets are liquidated, and the creditors suffer liquidation costs calculated as a percentage, l , of the remaining assets. The other binding condition for debt is that it converges to a perpetual cash flow valued at the risk-free rate when the asset value converges to infinity. The debt value is

$$D(A) = \frac{c}{r} + \left[(1-l)A_b - \frac{c}{r} \right] \left(\frac{A}{A_b} \right)^{-z} \quad (4)$$

The value of assets at time $t=1$, A , depends on the additional drift η . Rearranging produces the well-known result that the debt value is a weighted average between a pure risk-free perpetuity and the current liquidation value of the firm when bankrupt. The weight $\left(\frac{A}{A_b} \right)^{-z}$ is the present value of 1 dollar of liquidated assets in case of default. It is also the risk-neutral probability of default.

Since z is a positive function of η , the current creditors will capture (at least) a part of the additional drift resulting from the controlling managers' incentivization. As interest is tax deductible, the present value of tax savings will add to the equity and debt value. We denote τ as the tax rate. The present value of tax shield $TS(A)$ in a continuous and risk-free setting is $\frac{\tau c}{r}$. When A is high, the tax shield value tends toward that value. For low values of A near the default threshold, the tax shield value is null. The tax shield claim is valued using Equation (3):

$$TS(A) = \frac{\tau c}{r} - \frac{\tau c}{r} \left(\frac{A}{A_b} \right)^{-z} \quad (5)$$

This setup follows Leland's (1994) analysis and opposes the EBIT-based model developed by Goldstein et al. (2001), in which the tax shield claim is modeled as a perpetuity and still has value after bankruptcy. In our model, the tax advantage of debt stops at bankruptcy since the firm disappears as an economic entity and its assets are liquidated. We will follow the same approach to model the private benefits component of the controlling shareholder's wealth.

Bankruptcy costs are one-off claims due to third parties when default occurs. They are estimated using a percentage, l , of the assets at default:

$$BC(A) = lA_b \left(\frac{A}{A_b}\right)^{-z} \quad (6)$$

The total market value, $v(A)$, adds the tax shield and the bankruptcy cost to the asset value. We derive the equity market value, $E(A)$, by subtracting the debt value from the total market value.

$$v(A) = A + TS(A) - BC(A) = A + \frac{\tau C}{r} - \frac{\tau C}{r} \left(\frac{A}{A_b}\right)^{-z} - lA_b \left(\frac{A}{A_b}\right)^{-z} \quad (7)$$

$$E(A) = v(A) - D(A) = A - \frac{(1-\tau)C}{r} + \left[\frac{(1-\tau)C}{r} - A_b\right] \left(\frac{A}{A_b}\right)^{-z} \quad (8)$$

The firm's equity market value does not depend on parameter l because the loss rate is the creditors' problem. From (8), we derive the threshold value, A_b , which triggers the default as the one when the equity value is null $E(A_b) = 0$ because when $v \rightarrow D$, then it is no longer possible to issue equity to finance any interest payments. This "smooth-pasting" condition gives the optimal default value A_b :

$$A_b = \frac{z}{1+z} \frac{(1-\tau)C}{r} \quad (9)$$

As z is positive, we obtain $A_b < (1-\tau)\frac{C}{r}$. The right side of the inequality is the after-tax risk-free value of the debt. Looking at Equation (8), the equity value increases with the asset value but is a convex function of the firm's assets since part of the additional value is captured by the debtholders.

2.2. Design of private appropriation

Private benefits are designed as an additional share of the net worth given to the controlling shareholder. They have a contingent claim feature. Here, private benefits present contingent claim features that incentivize the controlling shareholder. This appropriation scheme is not opaque but known and legal. It stands equally with the existing equity and does not introduce any priority within the shareholder group. Equity globally considered remains a call option on the firm's assets. Still ranking after the creditors, the controlling shareholder will be paid a larger share of equity capital. She is legitimately compensated, as she is the one implementing the value-enhancing decisions. We denote α' as her new stake in equity, which is larger than her initial ownership, α . This compensation is similar to a stock option-like

scheme (hereafter SO contract), where the controlling shareholder is granted zero exercise price stock options.⁹ Private benefits are jointly determined with releveraging within the negotiation process.

The incentive, as an extra share of equity capital awarded to the controlling shareholder, is $\gamma = (\alpha' - \alpha)$. Wealth appropriation from private benefits is as follows:

$$PB(A, C) = \gamma E(A, C) = \gamma \left\{ A - \frac{(1-\tau)C}{r} + \left[\frac{(1-\tau)C}{r} - A_b \right] \left(\frac{A}{A_b} \right)^{-z} \right\} \quad (10)$$

Equation (10) states that private benefits will last only during the life of the firm as a corporation. Shareholders lose all their claims on the firm at bankruptcy. Those private benefits are strictly parallel to the equity valuation formula. The controlling shareholder who leaves the firm at default cannot sell any future tax shields or private benefits. Under the absolute priority rule, creditors receive economic assets and support liquidation and restructuring costs.

A key characteristic of the implicit control contract is that the value drift η depends on the incentive choice γ : $\eta = \eta(PB_t) = \eta(\gamma)$. We assume that this function has a positive first derivative and a negative second derivative, as efforts to increase value creation drift will entail some costs, and we assume that additional profitable opportunities are decreasing.¹⁰

3. Analysis and role of debt

3.1. Initial debt and creditors' holdup

Jointly with the incentivization decision γ , the initial debt value D_I will change, and the creditors will benefit from a transfer of value. Equation (4a) shows a second term in the right-side member that has a negative sign since it results from Equation (9) that $A_b < (1 - \tau) \frac{C}{r}$. The $(1 - \tau) \frac{C}{r}$ value is the theoretical debt value in a risk-free context, taking into account the tax shield profit. The impact of releveraging on the existing debt value D_1 is complex since A_b is increasing in z , and any increase in A_b will also result in a better

⁹ The issue that this contract is optimal is not addressed here. The new claim awarded to the controller has an equal rank as existing equity. As a robustness check, we have used another type of incentive contract where private benefits rank after debt but before equity. We obtain similar results (available from the authors).

¹⁰ Our formulation of γ is independent of leverage. This can be interpreted to mean that increasing leverage makes the equity riskier. We account for leverage and incentives in a bargaining process with releveraging influencing the shareholders' wealth functions directly through new debt proceeds and indirectly by modifying the probability of default.

liquidation value for creditors in the event of default. To assess the net effect, we need to further examine the strategic determinants of default channeled through the manageable variable z . Therefore, we analyze the derivative of debt with respect to z (Annex 1, Equation A2), as we know that z is positively linked to the value creation drift η . As the derivative of the debt value with respect to z is strictly positive, the higher drift in value creation is partly or totally captured by the existing creditors.

As a result, the value of debt increases when a value creation incentivization scheme is implemented through a private benefit contract with the controlling shareholder. This value is a transfer from shareholders to debtholders and is not justified by any action or wealth creation from the latter. Outside shareholders suffer from this wealth transfer, as they have to finance the incentive device. The appropriation of a part of the firm's value creation by the current debtholders depends on the characteristics of the firm, mainly its debt level (debt overhang, Myers 1977) and the drift η resulting from value creation opportunities (investment effort, He 2011). This is the *creditors' holdup* mechanism.

This effect depends on the private benefits appropriation rate. We assume positive incentivization, with $\frac{d\eta}{dy} > 0$. The debt value increases with the growth rate of the firm's assets, and creditors benefit from value-creative incentivization. The way to balance creditors is to substitute assets and/or to increase the firm's leverage.

The first tool to limit the transfer of value is σ , that is, the choice of assets' volatility, which has been thoroughly analyzed in the literature since Leland (1994). Without value creation and private benefits, we obtain $z = 2r/\sigma^2$. The only usable determinant available in this case is asset volatility through an asset substitution policy (Bigus 2002; Garvey and Mawani 2005; Tarentino 2013). For instance, an increase in volatility, substituting less risky assets with more risky assets, will decrease z and consequently decrease the debt value.

The key tool considered in this paper is releveraging. As identified in Equation (4), the debt value first increases with the size of the coupon flow. Above the maximum leverage, the debt value decreases as the bankruptcy fear overcomes the payment effect. When introducing incentivization and the three parties' agency conflict, the asset substitution and the releveraging mechanisms can be reinterpreted not as a device to extract value from creditors but as a device to limit the creditors' holdup. In a private benefits appropriation scheme, the contract between the controlling shareholder and outside investors is grounded in the common

goal of avoiding a side value transfer to creditors. This justifies private appropriation to raise debt and limit creditors' holdup.

The initial creditors should not be made worse off due to the issue of new debt.¹¹ The new debt will be fairly priced so that new creditors will not benefit from value creation or suffer from wealth transfer. Initial creditors are strictly better off before releveraging when η is strictly positive. Note that the derivative of the total value of debt $\frac{dD}{dc}$ is positive up to a point where the negative effect of default risk surpasses the appropriation of value by creditors based on a positive η .

The feasibility of releveraging raises the issue of existing debt covenants. In practice, covenants such as selling at par and exiting will rarely be used by incumbent debtholders when their situation is improved by an increased value of the firm's assets. This point is mentioned by Goldstein et al. (2001).

3.2. The choice of debt for outside and controlling shareholders

The releveraging decision is part of the implicit control contract. We need to integrate the use of cash raised by the debt issue in the setting. The new issue of debt is D_2 ; it cumulates with D_1 , which is the market value of the historical debt after the inception of the incentivization plan. The issued D_2 amount replaces equity financing and is given back to shareholders as an exceptional dividend. We denote by k the share of new debt in the total debt: $D = D_1 + D_2$ and $k = D_2/D$. After releveraging, the shareholders' wealth consists of their stake in equity and their share of the newly raised debt paid as an exceptional dividend or a share buyback.

The joint decision setting is privileged in a bargaining scheme. In our two-period setting, releveraging is jointly decided with incentivization. We can imagine that the controller may dynamically time leverage adjustments (as in Goldstein et al. 2001). We can also introduce another use of the proceeds drawn from the releveraging, for instance, by investing them. We do not consider this in our model because the sequential timing of debt adjustments will affect the wedge between the maximization of the controlling versus outside shareholders (see Equations 11a and 11b below), as the proceeds will be allocated according

¹¹ This is their participation constraint.

to the new future number of shares and favor the controller. As a result, the optimum for the minor shareholders is the immediate releveraging and allocation of funds at $t=1$.

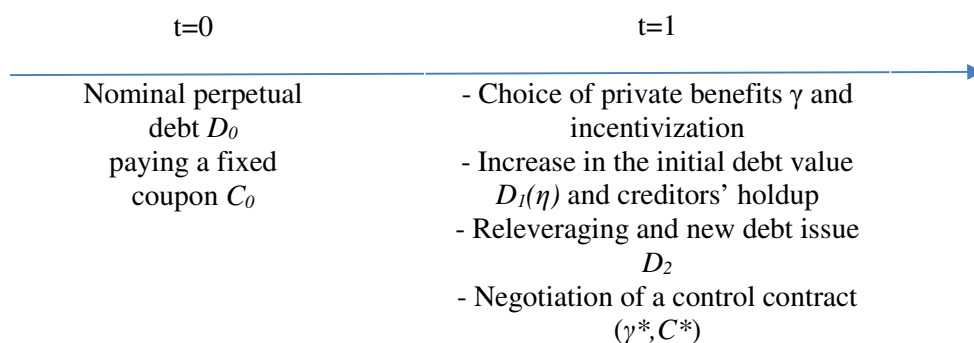


Figure 1 Decision timeline

To set the new debt amount, we maximize shareholders' wealth with regard to the total amount of coupon perpetually paid after the issue, $C=C_0+C_2$. We first need to maximize the outside shareholders' wealth with regard to C . This wealth comprises the new share of equity after awarding a part of it to the controlling shareholder and a part of the proceeds of the debt issue:

$$\text{Max } w_o = (1 - \alpha')E(C) + k(1 - \alpha)D(C) \quad (11a)$$

The controlling shareholder's wealth includes the market equity value, the cash flow resulting from the debt issue and private benefits as an additional share of equity ($\alpha' > \alpha$).

$$\text{Max } w_c = \alpha'E(C) + k\alpha D(C) \quad (11b)$$

Considering the global shareholders' wealth, we sum the two:

$$\text{Max } w_{o+c} = E(C) + kD(C) \quad (11c)$$

In the latter case, we demonstrate that an optimal coupon C^* solution exists for a given value of γ (see Annex 2). However, in the general case, we do not find a closed-form formula for the optimal coupon C^* for global shareholders' wealth maximization. We show (see Annex 2) that a function $C^* = f(\tau)$ exists with $f'(\tau) > 0$ and $C^* > C_1$ for any $\tau > 0$. Shareholders' wealth maximization commands a univocal increase in indebtedness, and the debt issuance increases as the tax rate increases.

Assuming that the tax rate is null, we obtain an analytical solution for the new debt issue resulting from the incentivization and the first step transfer of value to the creditors (see Annex 2, Equation A7). In this case, the new optimal debt from global shareholders' point of view is the following:

$$C^* = \frac{C_0 \cdot [1+lz]}{(1+z)l} \quad (12a)$$

Because of its tractability, we consider hereafter the null tax rate case, knowing that optimal solutions exist in any other cases and that these optimal debt values are unique and increasing with τ .

Alternatively, we define a ratio specifying the relative increase in debt compared to the initial debt value before holdup situation D_l , which corresponds to the initial coupon flow C_0 :

$$\frac{C^*}{C_0} = \frac{1+lz}{(1+z)l} \quad (12b)$$

Since $l < 1$, we verify that $C^* > C_0$. The ratio C^*/C_0 is also lower with z . As the value creation process is high, the increase in debt is capped by the rise in the probability of default (see Annex 2, Equation A8). The variation in indebtedness is linked to incentivization γ and to its consequence, the value creation drift η . This justifies analyzing the two dimensions of incentivization and leverage decisions jointly. However, this result is demonstrated in a situation in which all shareholders are homogeneous and share the same information set and there is no difference between a controlling shareholder who is incentivized and outside shareholders, allowing the former to receive an additional portion of equity.

This result holds in the general case of a positive tax rate. Even if we do not yield a closed-form solution for the optimal debt value for the global shareholders, we show in Annex 2 that this optimal value exists and that it is increasing with the tax rate and has a negative second derivative, evidencing a maximum of shareholders' wealth (see Equation A9). This maximum is above the initial debt level and shows that globally, shareholders should react by increasing the debt level of the firm (Equation A14).

- Situation of the controlling shareholder

The controlling shareholder is incentivized to develop effort through a positive γ . This will increase both the value of the investor's initial stake and the amount of private benefits.

The former is positively influenced by the drift governing asset growth $\eta(\gamma)$. Considering the debt's choice, the controller is also incentivized to increase debt, starting from an initial given level. Releveraging will transfer value to the shareholders globally considered while also modifying the equity value, as financial risk will increase.

The increase in value is positive with asset drift $\eta(\gamma)$ and the appropriation rate γ (for a given debt coupon payment). It also has additional debt, as releveraging allows shareholders' recapitalization. Any combination of these two choices is an eligible solution. If the debt coupon goes above a given value, the controller's wealth decreases with debt as a transfer of value develops to creditors and the risk of failure increases. For this reason, we will first analyze the optimal leverage choice for each category of shareholders for a given level of private benefits. The following section will reintroduce the incentivization decision of the controller within a bargaining process among the different parties to jointly settle on an increase in the controlling shareholder's equity share and the new coupon.¹²

- Situation of outside shareholders

We now formulate the outside shareholders' wealth as a fraction of the total shareholders' wealth knowing that they abandon a share γ of total equity. We set

$$w_o = (1 - \alpha)(w_o + w_c) - \gamma E(C) \quad (13a)$$

Similarly, the controlling shareholders' wealth is

$$w_c = \alpha(w_o + w_c) + \gamma E(C) \quad (13b)$$

For a given γ , the target debt ratio is higher for the outside shareholders compared with the controlling shareholders' optimum (see Annex 3, Equation (A17)):

$$C^{*o} > C^{*c} \quad (14)$$

¹² Our model assumes that releveraging and incentivization are jointly decided at time $t=1$. Alternatively, we can imagine that the controller and outside shareholders continuously adjust the incentivization contract terms and the leverage choice. Optimal time leverage adjustment is a possible solution to a dynamic game. Our model is based on a two-period time framework, as we focus on events introducing sensible changes in the value creation process and in leverage.

This means that as outside shareholders abandon private benefits to the controller, they need to obtain relatively more releveraging to offset the creditors' holdup. Our proposition 1 is the following:

Proposition 1. When bargaining over a private benefits contract, outside shareholders and the incentivized controlling shareholder agree to increase leverage, which protects them from the creditors' holdup on value creation.

In releveraging the firm to limit the transfer of value to creditors, all shareholders will share a common goal. The leverage target value is set for a given value of the parameter z ; let us recall that z is a function of γ , as the drift in value creation η is itself a positive function γ .

The optimal leverage is larger than the initial leverage prior to setting a value creation plan, meaning that an increase in debt will benefit the outside shareholders' wealth up to $C^{*C,O}$ (see Equation 14). The optimal debt level for the controlling shareholder, C^{*C} , is lower than the C^{*O} optimal value considered by the outside shareholders. The incentivization contract improves the situation of outside shareholders, as the debt leverage target for the controller shifts up. In a no incentivization situation, both categories of shareholders would share the same releveraging decision. This is demonstrated analytically (see Annex 3, Equation A17), even if we do not obtain general analytical expressions for optimal debt leverage for outside and controlling shareholders. Later, we will use numerical simulations.

Proposition 2. The appropriation of private benefits as an internal transfer within the shareholder group leads to a higher demand for debt from outside shareholders than from the controlling shareholder.

The first way for outside investors to avoid creditors' holdup is to increase the coupon flow from C_0 up to their optimal value C^{*O} and seek a new value of debt $D^*=D(C^{*O})$. This illustrates the need for a value repatriation mechanism to balance creditors' holdup due to an initial debt overhang situation. Outside shareholders will ask for a stronger limitation on creditors' holdup as a counterpart to private benefits in the bargaining process.

The same story applies when the debt leverage jumps following a substantial share repurchase. In the literature, the wealth transfer hypothesis from bondholders to stockholders has been empirically documented by Maxwell and Stephens (2003) and June et al. (2009) in

the context of share repurchases. Jandik and Lallemand (2017) show that debt leverage increases after the announcement of an acquisition until its completion.

The motivation of the controlling shareholder is twofold. First, she has an incentive to protect all shareholders, limiting the creditors' holdup. Second, she is incentivized by the private benefits scheme agreed with the outside shareholders. The protection of outside shareholders is a side effect of the control contract, where the controlling shareholder will limit the creditors' holdup by raising debt leverage.

The optimal debt level from the viewpoint of shareholders as a whole, C^* , shows a negative derivative with regard to z (see Annex 2, Equation A8). As z increases with the creation of value rate η , a balancing mechanism develops in which the increase in debt to offset the creditors' holdup is moderated by the aim to not be exposed to a larger bankruptcy risk. An increase in z means a higher default threshold and a higher probability of default. Our modeling shows that, in our framework, the bankruptcy threshold value A_b is an increasing function of the drift.

The potential for a jump in leverage is capped by the liquidation cost. The higher the liquidation cost is, the smaller the relative increase in debt after the holdup, as the derivative of Equation (12a,b) with regard to l is negative. This conclusion is coherent with that found in He (2011), who identifies a negative relationship between leverage and incentive effort because a heavily indebted firm close to financial distress is particularly exposed to a strong debt overhang phenomenon. To develop an effort without being exposed to a strong creditors' holdup, managers should lower leverage. However, in our controlling/outside shareholding context, this is not true, as outside shareholders are more exposed to a creditors' holdup than the controlling shareholder, who is directly incentivized and will make specific efforts.

3.3. Optimal releveraging and numerical simulations

The existence of an optimal coupon C^* is demonstrated for a null tax rate. The introduction of positive tax rates will not change the conclusions, although we do not obtain a closed-form solution. Positive tax rates will only increase the optimal leverage levels. This results from the tax shield benefits ensuing from indebtedness. From numerical simulations of outside shareholders' wealth, the optimal debt after incentivization corresponds to a new coupon flow of 9.5% for a null tax rate (for a given additional drift of $\eta= 1\%$). The new

optimal debt increases to a 10.5% flow if the tax rate is 10%. The optimal indebtedness shows a coupon flow of 12.5% when the tax rate τ moves to 30%. Introducing the tax rate does not change the analysis but magnifies indebtedness from shareholders' point of view. The locus of the optimal debt choices increases monotonically, and we still obtain a unique optimal debt solution for a given tax rate (and appropriation rate). Numerical simulations show similar patterns for the controlling shareholder's wealth.

The optimal coupon flow C^* decreases with additional value creation drift. This result is formally demonstrated in Annex 2 Equation (A8) for $\tau = 0\%$. The optimal coupon for the controlling shareholder C^{*C} has the same derivative with regard to the drift as C^* . Numerical simulations for different tax rates show that the decreasing relation between the optimal debt level for all shareholders and the drift value is decreasing for positive tax rates. The new debt optimal leverage curve C^* increases with tax rates, as higher debt is preferable because of the tax shield effect. The negative relation shows a balancing effect when the drift resulting from incentivization increases strongly, and a lower transfer of value from creditors is needed.

In the following numerical simulations (see Graph 1), we clarify the positive incentivization between the appropriation rate γ and the additional drift η in value creation. In these numerical simulations, we set $\eta = \mu \cdot (\gamma - 2\gamma^2)$ with $\mu = 0.2$. The controller wealth benefits from two effects: first, she receives an additional share of equity, and second, she benefits from the value attributable to the increased value creation process inflated by a value η . However, the threshold of bankruptcy increases with z (i.e., η) and the event of a bankruptcy will lead to the loss of both private benefits and the initial percentage of owned equity. This situation is more severe than that of outside shareholders, as the latter will only lose their (reduced) equity shares. The increase in leverage transfers value back from creditors to shareholders. Graph 1 shows the optimal FOC equilibrium loci for the controlling and outside shareholders. For the controller, wealth maximization shows increases in debt leverage that are below the optimal increase from global shareholders' point of view; for outside shareholders, it shows higher increases in debt. The optimum solution for the controller (plain curve AB) corresponds to an increase in wealth from a mix between transfers of value from creditors, profits from private benefits, and an increase in the owned equity value. The plain curve in Graph 1 is steep for null tax rates. Positive tax rates will yield lower debt values (because of the tax subsidy), so shareholders can afford higher debt leverage. Globally, the controller's optimal debt curves have similar but smoother downward shapes when

introducing the tax rate. The former sees her optimal leverage decrease when she is awarded private benefits. It is a consequence of the disciplinary role of debt: avoiding risky leverage is important to protect the source of wealth. Bankruptcy risk will threaten the specific private benefits appropriated by the controlling shareholder.

INSERT GRAPH 1

We now consider the optimal debt setting for outside shareholders. Their contract loci are displayed as dashed lines (curve AX). The outside shareholders will “pay” the private benefits to incentivize the controller. They lose a share γ of equity. Outside shareholders need a further increase in leverage to pull value back from creditors. The more incentivization they choose to abandon, the more repatriation of the creditors’ holdup and the more debt they seek. Numerical simulations show that the contract loci for outside shareholders are increasing with γ . In Graph 1, the controller is the first to be exposed to the disciplinary effect of leverage. The divergence in goals appears as the gap between the optimal contract curves of the controller (curve AB) and the outside shareholders (curve AX) widens with increasing value drift.

3.4. Bargaining and admissible solutions: An illustration

The setting of an incentive contract with private benefits is first illustrated in Graph 1.¹³ The origin of the y-axis starts with an initial debt of 3% (i.e., a coupon flow of 0.03 scaled by a total asset value of 1). The initial total wealth of shareholders is 0.527 (with a total asset

¹³ Numerical simulations in this section start with an initial debt with a coupon flow of 0.03 scaled by an asset value of 1.

- The risk-free rate is 5%, as in Leland (2007) and He (2011). DeMarzo and Fishman (2007) use a risk-free rate of 10%, Leland (1998) uses 6%, Morellec et al. (2012) 4.21%, and Goldstein et al. (2001) use 4.5%.
- It results in an initial risk-free debt value of 0.6.
- The parameter σ is set to 0.32. Morellec et al. (2012) use a σ value of 0.2886, while Goldstein et al. (2001) use 0.25.
- The liquidation costs percentage is set to 0.30. Morellec et al. (2012) refer to 0.4852, Branch (2002) takes a parameter value of 0.44, Davydenko et al. (2012) take a value of 0.216, He (2011) takes 0.25, Goldstein et al. (2001) take 0.05, and Leland (1998) takes 0.25.
- The asset drift is set to 0% in Dangl and Zechner (2016), 1% in He (2011) and 0.67% in Morellec et al. (2018).
- We use a parameter $\delta=2\%$ and a null tax rate. In their simulations Goldstein et al. (2001), Morellec et al. (2012) and Leland (2007) take 0.35, and Leland (1998) uses 0.25.

value scaled to 1). The wealth is equally split between outside shareholders and the controller, as their respective share of equity is 50%. Both know that the potential for value creation exists and that it may be captured only if the controller is incentivized with some private benefits. At point A, controller and outside shareholders increase their respective wealth only by leveraging and implementing a pure transfer of value from the creditors without any prior creditors' holdup. The gain resulting from moving to A is a common hypothetical situation where a releveraging decision is made without any creation of additional value; no incentivization and no effort are implemented. At point A, the optimal increase in debt results in a total coupon of 6.7%, and the equity global value becomes 0.563. The mechanical transfer of value from debtholders to shareholders is +0.036 (i.e., 3.6% of the asset value before incentivization, which is set to 1). The optimal increase in leverage corresponds to a coupon flow that more than doubled. When the controlling share is 50%, the gain is halved between the two categories of shareholders (+0.018 and +0.018).

The process of negotiation is initiated by the controller who seeks to set a contract of control yielding some private benefits ($\gamma > 0$) and triggering value creation. Outside shareholders are in a position to refuse contracts detrimental to their wealth. Point A is not acceptable from the controller's viewpoint, as the profit is not a feasible equilibrium. At that point, she will receive no private benefits, and the firm creates no additional value. As it is common knowledge that the potential to create value exists, she will improve her wealth by being rewarded and by developing an effort. The controller maximizing her wealth will consider her optimal contract at loci AB and is expected to go toward B alongside her optimal curve choice. The region above curve AB defines an effort zone where the gain in value is lower than her optimal first-order condition. A choice of private benefits defined by point B, i.e., $\gamma = 5.2\%$, will give the controller an additional creation of value of +0.253, which is above the pure gain from a simple releveraging decision at point A (+0.018). This point B is a maximum incentivizing award because any increase in private benefit above $\gamma_{max} = 5.2\%$ will not result in any additional debt issue. This is the controller's first-best solution. Point B defines a vertical line BX once the private appropriation rate is fixed at γ_{max} . A bargaining process can develop on the line BX. Point B is important, as it defines a region for possible bargain solutions.

However, point B is not a first-best solution for the outside shareholders, as it stands very far away from their optimal curve of contract (see Graph 1, dotted line). They will gain

only +0.156 compared to their initial wealth situation before any decision. The outside shareholders will propose a 5.2% incentive plan only if the debt leverage moves up toward their optimal 0.088 coupon flow (Point X in Graph 1). If the leverage moves up to the optimal situation for outside shareholders, the respective gain will be +0.228 for the controller and +0.198 for the outside shareholders. Outside shareholders ask for more leverage to balance the cost of the incentivization plan *and* to repatriate the creditors' holdup. In this situation, the debt level strongly departs from the controller's optimal locus C^{*C} . Any incentivization γ , i.e., any creation of value will widen the conflict between the controlling and outside shareholders. The gap between the two curves widens with γ .

A bargaining process starting from B upward and from X downward will be initiated, as BX contracts are second-best admissible solutions for both parties. A feasible solution will be for the controlling and outside shareholders to accept standing on the global shareholders' contact curve C^{*O+C} at point Z (see Equation 12b). This defines a possible incentivization scheme identifying a bargain solution among the group of shareholders. Point Z on the curve will correspond to a 0.065 optimal coupon debt, as calculated from the global shareholder's point of view. The global profit for both categories is +0.436 at point Z (versus +0.409 at point B and +0.426 at point X). The profit is lower for the outside shareholders, departing from their optimal locus C^{*O} . However, combined with an incentivization of 5.2%, they are left with a net profit of +0.192 compared to their initial wealth situation without any agreement. The controller who accepts raising the debt leverage up to a 0.065 coupon flow will gain +0.244. Both will gain more than if they were to pursue pure predatory releveraging without any effort, as defined by point A. Point Z is a feasible and dominant second-best solution, defining an incentivization scheme and controlling the creditors' holdup phenomenon. The incentivization/releveraging contract defined by Z yields a total gain for all shareholders, which gives enough room to find a profit-sharing agreement with the outside shareholders. Profit sharing is based on the existence of an incentive contract that creates additional value for creditors *and* initiates a repatriation mechanism necessary to pull the value back to shareholders. In our analysis, this mechanism is releveraging. More precisely, pegged to the incentivization contract, shareholders' wealth is positively linked to the issuance of new debt that allows funding a transfer back to shareholders as an exceptional dividend.

The rationale of the negotiation process and its feasibility is shown through the shared trade-off rationale between private appropriation by the controller and the debt increase. The condition for convergence is that the participation conditions are met for both the controlling and outside shareholders. The incentive condition for the controller is to improve her wealth by more than the no-effort profit +0.018. Outside shareholders are dependent on the controller's will to develop effort. However, their agreement is conditioned by a positive increase in wealth. The coupon flow range between 0.03 and 0.09 defines a set of feasible agreements for the given value of γ^*_{max} . The limiting values for the bargaining process (here for a γ value fixed at 5.2%) are set by points X and B. Segment BX shows multiple acceptable solutions for sharing value creation.

In this bargaining process, the controlling shareholder balances more private benefits appropriation and additional releveraging, which may hurt her wealth by increasing the disciplinary effect of debt, i.e., bankruptcy risk. There is no simple trade-off for outside shareholders who may improve their wealth both by using more debt and/or through more private benefits. More private benefits have a complex double effect for outside shareholders: a negative effect with more appropriation by the controller and a positive effect with more incentivization, which leads to additional value creation.

3.5. Market value of debt after incentivization and releveraging

The situation of existing debtholders depends on the market value of D_1 after the implementation of the control contract. We represent in Graph 2a (respectively 2b) the market value of D_1 and D_2 as a function of γ if the controlling shareholder's (respectively outside shareholders') optimal releveraging is implemented.

INSERT GRAPH 2a and GRAPH2b

The initial debt market value curves D_1 (plain line in Graphs 2a and 2b) are increasing for both parties, which means that both are exposed to a creditors' holdup. However, the market value of D_2 is decreasing with γ if $C = C^{*c}$ (Graph 2a) since the optimal releveraging for the controlling shareholder is a decreasing function of the incentivization level. Note that existing shareholders of the firm could also become creditors by buying a part of the new

debt.¹⁴ As long as the controlling shareholders' stake α remains constant (which we assume in our model), this will not affect the releveraging decision since this additional debt is issued at market value (the proceeds from issuance are D_2 and fuel the wealth function of the shareholders). At the same time, the market value of the initial debt D_1 is strongly increasing, which means that initial creditors are clear winners. First, higher incentivization results in more value creation and more creditors' holdup. Second, the lower releveraging decided by the controller implies less limitation of this creditors' holdup. Obviously, outside shareholders would suffer from this combination of high creditors' holdup and high private benefits, and feasible contracts will be discussed in the next section.

In contrast, D_2 increases with γ if $C = C^{*o}$ (Graph 2b) since outside shareholders want more releveraging when incentivization is higher. The optimal value D_1 remains a positive function of γ . Despite the large releveraging, initial creditors are still capturing value. Since no shareholder will ask for more releveraging than C^{*c} , this means that the releveraging decision only reduces the creditors' holdup, and the net effect of incentivization and releveraging is positive for initial creditors.

4. The design of a control contract between the controller and outside shareholders

4.1. The design of negotiation

Private benefits γ and releveraging C are jointly set in a bargaining process between the controlling shareholder and outside shareholders. If the negotiation fails, the value-creating project will not be implemented, and no releveraging occurs. In other words, the participation condition (PC) for outside shareholders is such that the wealth they obtain from negotiation is higher than their wealth if the project is dropped, as denoted by \bar{W}_O :

$$W_o(\gamma, C) \geq \bar{W}_O \quad (\text{PC})$$

$$\text{where } \bar{W}_O = W_o(\gamma = 0, C = C_0)$$

In Graph 3, this level of wealth for outside shareholders is obtained at point O.

We assume that the controlling shareholder has an outside option if the negotiation fails. She will not implement the project, but her situation is different from that of the outside shareholders. With this outside option, she may obtain a higher level of wealth than the status

¹⁴ We thank an anonymous referee for this suggestion.

quo level represented by point O. On the left axis of Graph 3 (corresponding to $\gamma = 0$), the highest wealth for the controlling shareholder is obtained at point A, representing the optimal releveraging when private benefits are null. This point A is the target wealth that satisfies the first-order condition on debt with $\bar{W}_c = \alpha \bar{W}_{O+C}(\gamma = 0, C = C^*)$ and C^* defined by Equation (12).¹⁵ With this outside option, the controlling shareholder will never accept a contract that gives her a lower level of wealth. This is an incentive constraint for the controller since she will not implement the project for a lower level of wealth:

$$W_c \geq \bar{W}_c \quad (\text{IC})$$

$$\text{where } \bar{W}_c = W_c(\gamma = 0, C = C^*)$$

4.2. Existence of acceptable incentivization/releveraging contracts

We have shown above that the process of negotiation will converge to a set of multiple second-best solutions BX defining an incentivization/releveraging contract between shareholders. This process is not proof, as it is developed sequentially, starting from a value γ_{max} stated by the controller. Of course, this latter variable is itself part of the negotiation, and the two variables γ and C are jointly set.

We define the incentive condition and the participation condition as the minimum wealth value equal to the no-effort situation for the controller (IC) and to the minimum wealth limit equal to the initial no-leverage wealth for the outside shareholders (PC).

The first-order optimal solutions for the controller are defined by the derivative of their wealth with regard to C for given values of the incentive γ (see curve AB in Graph 3). This characterizes a set of wealth values after incentivization and private benefits, $W_c^*(C^*, \gamma)$. The highest wealth is obtained when the appropriation rate γ is the maximum affordable by the minor shareholders (Point B in Graph 3). However, nothing guarantees that these solutions, given increasing γ , will yield wealth above the controller's share of w_{O+C}^* at point A with $\gamma=0$. This will leave the incentive condition unsatisfied, as the controller will exert an effort only if her resulting wealth is above her wealth in a no-effort situation.

¹⁵ Any point of the y-axis for which $C^* \geq C \geq C_0$ could be defined as an alternate target. Choices above C^* (i.e., target A) are not solutions, as the wealth decreases above C^* . At the lower end, at the origin O, there is no increase in debt.

We define the first-order approximation of the increase in wealth in curve AB compared to the initial wealth in point A (see Annex 3, Equation A16) as follows:

$$\Delta = w_C^*(C_C^*, \gamma) - w_{C+O}^*(C_{C+O}^*, 0) = \alpha \frac{dw_C}{dC} (C_C^* - C_{C+O}^*) + \gamma E(C_C^*) \quad (15)$$

As $C_C^* < C_{C+O}^*$, the derivative $\frac{dw_C}{dC}$ is positive. The increase in wealth combines a negative and a positive term in the RHS. For high values of α and small γ , Δ can be negative. This means that the first-order solutions of curve AB will not all respect the incentive constraint. At some point, with higher values of γ , Δ becomes positive, and the contracts defined by the curves are admissible for the controller. We call γ_{min} the minimum value of γ satisfying the controller's incentivization constraint (IC). Depending on the values of the parameters, we generally have $\gamma_{min} = 0$. This will be shown in the numerical simulations. The admissible first-order condition contracts for the controller are AB. If γ_{min} exists and is positive, we have no admissible contract area.

In the general case, the two participation conditions define two iso-wealth curves that are upward sloping. The curve AM' (resp. OO') is the locus of contracts, yielding a minimum \bar{W}_C (\bar{W}_O) wealth to the controller (outside shareholders). We show that the derivative $dC/d\gamma$ of the controller's iso-wealth curve AM' is positive and converges toward zero when γ is above γ_{max} .¹⁶ The value γ_{max} is the maximum incentivization percentage admissible by the outside shareholders.¹⁷

$$\left. \frac{dC}{d\gamma} \right|_{\bar{W}_C} > 0 \text{ for } \gamma_{min} < \gamma < \gamma_{max} \text{ and } \left. \frac{dC}{d\gamma} \right|_{\bar{W}_C} \rightarrow 0 \text{ for } \gamma = \gamma_{max} \quad (16)$$

The minimum appropriation rate γ shapes a truncated AM' curve in the area of possible contracts. This gives a bounding curve MM' with a horizontal asymptotic maximum debt. The rationale is similar for the participation condition OO', which is increasing and converges to a vertical asymptote. This comes from the partial derivative of the outside shareholders' iso-wealth curve, which is positive and converges toward infinity.

$$\left. \frac{dC}{d\gamma} \right|_{\bar{W}_O} > 0 \text{ for } \gamma < \gamma_{max} \text{ and } \left. \frac{dC}{d\gamma} \right|_{\bar{W}_O} \rightarrow +\infty \text{ for } \gamma = \gamma_{max} \quad (17)$$

¹⁶ The proofs of Equations (16) and (17) are available in a separate note. They are based on the implicit function theorem at the respective points \bar{W}_C and \bar{W}_O .

¹⁷ The outside shareholders will negotiate for a releveraging. They will not accept giving a γ value above the value yielding the maximum first-best admissible solution for the controller. This γ_{max} corresponds to point B in Graph 3 and is binding.

The two participation conditions AM' and OO' cross at some unique point Y in the contract space (γ, C) and define a conic region of admissible bargain solutions. In Graph 3, the region for admissible agreements is AZY. As Y is unique due to the divergence in the slopes of OO' and AM', there exists an area of admissible incentivization/releveraging contracts between the two categories of shareholders.

INSERT GRAPH 3

The controlling shareholder is also bounded at the bottom by her optimal first-order local solution contracts AB for different given values of γ .¹⁸ Under this curve, contracts are not acceptable to her because better solutions exist on the curve. AB strictly decreases with γ , and the PC curve of outside shareholders increases from O.¹⁹ As a result, the controller cannot reach her first-best dominant solution B. The “better” second-best contract that is acceptable to the controller is defined at point Z as the highest contract from the controller admissible by the other shareholders. This means that the negotiation process is mandatory in setting the contract of control within the shareholders, as the first-best optimal solution is not feasible. Even if the controller has strong bargaining power, she will sit on the A'Z curve and choose Z, but she cannot go below Z, as the outside shareholders will refuse to lose money. They are better off staying in the prior situation with no incentives and no releveraging. The space of admissible contracts is not empty, as the (IC) and (PC) constraints define a conic area. The first-best rationale pegged to the dominant bargaining power of the controller will define a bottom-line AZ, and the feasible contract set is AZY. This area stands over the first-best locus of contract from the viewpoint of the whole shareholder set. The incentive/releverage contract is defined by the setting of an admissible combination of the two key variables: private benefits award γ and the releveraging decision C .

Proposition 3. The participation constraint of outside shareholders and the incentive constraint of the controller define a nonempty space of feasible contracts of control defined

¹⁸ Let us recall that B is the wealth maximizing contract for the controller.

¹⁹ Annex 2 shows that the global shareholders' optimal debt curve decreases with z (Equation A8). Knowing that the controller's first-order optimal debt curve AB is below AW_{O+C} (see Annex 3, Equation A16) and that z is a positive function of γ , we have AB decreasing with γ .

by an incentive rate γ and a releveraging choice C . Equilibrium contracts exist and will be designed following a second-best rationale.

Moreover, we note that the AZY area of acceptable contracts of control is above the horizontal axis and that its bottom point Z involves at least a minimum jump in leverage. If the conditions are met, a negotiation process develops to determine the parameters and to share the extra profit resulting from incentivization. If not, no effort is implemented. For outside shareholders, allowing private benefits is not only an incentive tool but also a way to repatriate value capture by the creditors' holdup. Moreover, a minimum level of private benefits is necessary to obtain value creation. As a counterpart, the controller will concede to outside shareholders a minimum jump in releveraging, although she knows that a higher debt level will expose her equity wealth and private benefits to higher bankruptcy risk. Incentivization and releveraging are joint decisions, the former results in the latter because of the creditors' holdup.

Proposition 4. The admissible contracts of control involve a minimum jump in leverage.

Proposition 4 implies that the trade-off between incentivization and releveraging will involve a sensible and observable releveraging when setting the control contract. External analysts can identify this releveraging and infer private benefit awards.²⁰

4.3. An alternative bankruptcy rule: liquidity default

The bankruptcy rule that we use in the main part of the paper (and in the following numerical simulations) is an optimal default rule, in the spirit of Leland (1994). A key characteristic of this default rule is that the bankruptcy threshold A_b is an increasing function of the additional drift η through the parameter z . Alternatively, a liquidity default rule could be applied²¹. In this case, bankruptcy is no longer endogenously triggered by the impossibility of issuing equity to finance interest payments, and the default rule is no longer optimal. With a liquidity

²⁰ To check the robustness of our model, we have also considered another private appropriation scheme. We have assumed that private benefits are levied by the controlling shareholder before displaying the firm's cash flow and that private benefits rank first before the debtholder and outside shareholders' payments. In this alternate framework, the analysis of private benefits, the transfer of value through debt overhang, and the setting of an incentivization contract between the outside and controlling shareholders, remain unchanged. The optimal releveraging choices are slightly different in magnitude, and still open the way to second-best trade-off situations to offset the creditors' holdup. (See Proposition 5 in the Internet appendix.)

²¹ We thank an anonymous referee for suggesting this discussion.

default rule, bankruptcy is triggered by creditors. It happens when the asset value is too low relative to the debt value, so that the creditors are better off with bankruptcy despite its cost l . The threshold A_b is now defined as a fixed portion b of the nominal debt value, and equation (9) of the model is replaced by

$$A_b = b \frac{(1-\tau)C}{r} \quad (9')$$

With this setup, for a given level of total debt, the probability of default decreases more with drift because the threshold is no longer a growing function of the drift. However, creditors obtain less value upon default. The net effect remains positive, and we still demonstrate a (slightly reduced) creditors' holdup. The releveraging decision now depends on the b parameter. For a given drift η (defining the parameter z), the optimal releveraging for each category of shareholders will be higher than that with optimal default when $b > \frac{z}{1+z}$ and lower otherwise. In our numerical simulations, we obtain very similar results to those with optimal default, with slightly less releveraging when γ increases.

4.4. Numerical simulations

The productivity of the controller's incentivization is controlled by the parameter μ .²² In our simulation, we considered values ranging between 0.1 and 0.5, meaning that an incentive stake of 10% of the equity will result in an increase in the value creation drift between 0.8% and 4.0%. The controlling shareholders' optimal debt curve AB in Graph 2 decreases with the private benefits award. Point A is given for any value of the μ parameter, as it corresponds to $\gamma=0\%$, i.e., a pure jump in leverage. We consider different initial coupon debt values C_0 between 0.02 and 0.05.²³ The value of γ_{max} corresponding to point B is important, as it delimits the conic region of feasible agreements. The negative steepness of the AB curve depends on the productivity of the controller's best efforts. It increases with the latter. It also depends on the initial level of indebtedness, with higher initial debt giving a more negative slope.

μ	$C_0=0.02$	$C_0=0.03$	$C_0=0.04$	$C_0=0.05$
0.1	7.80%	6.50%	5.25%	3.75%
0.2	6.25%	5.25%	4.50%	3.25%

²² The additional drift in the creation of value is set as follows: $\eta = \mu \cdot \gamma \cdot (1-\gamma)$.

²³ Using a risk-free rate of 5%, this gives a risk-free value of debt ranging between 0.4 and 1.0. Scaled by total assets of 1, this results in debt-to-total-assets ratios that are characterized moderately by heavily indebted firms.

0.3	5.25%	4.50%	3.75%	2.75%
0.4	4.50%	3.75%	3.25%	2.50%
0.5	4.25%	3.50%	3.00%	2.25%

Table 1 Maximum incentive stake of equity awarded to the controlling shareholder (maximum incentive stake is γ_{max} corresponding to the point B location on the x-axis in Graph 2; maximum wealth for different initial coupon flow C_0 varying from 0.02 to 0.05; initial asset drift 2%; additional drift is positive in the appropriation rate $\eta = \mu \cdot \gamma \cdot (1 - 2\gamma)$, with effort productivity μ varying from 0.1 to 0.5; firm's assets $A=1$; risk-free rate $r=5\%$; volatility of the firm's assets $\sigma=32\%$; corporate tax rate $\tau=0\%$; bankruptcy cost $l=32\%$; ownership $\alpha=50\%$).

Table 1 shows numerical simulations for the values of the maximum incentivizing award γ_{max} . They are calculated for different levels of initial debt C_0 and for different values of the productivity of the incentivization, μ . Globally, the maximum appropriations rates are far below a 10% equity stake. The value of γ_{max} decreases with the productivity of the effort developed by the controller. Interestingly, γ_{max} also decreases at the initial debt level. A highly indebted firm will not implement a very high incentivization scheme ($\gamma=3.75\%$ for $C_0=0.05$, compared to $\gamma=7.80\%$ for $C_0=0.02$) because in this case, the controlling shareholder will prefer not to increase leverage because of an existing debt overhang. The incentivization stakes resulting from the parameters are relatively limited. The awarding of stakes of capital between 3 and 6% does not imply a massive dilution of the outside shareholders.

Looking at the outside investors, their optimal curve AY is upward oriented, and its steepness increases with the effort's productivity. This means that the region between the two curves AB and AY of Graph 2 defines the disagreement between the two parties about the optimal debt level that is negotiated. A productive incentivization will result in a larger disagreement (i.e., a wider bargaining space) and thus make the negotiation process more necessary. Conversely, nonproductive efforts (i.e., $\mu=0$) will lead to a pure transfer of value from creditors (no value creation and no private benefits).

The definition of admissible first-best contracts for the controller relies on the incentive constraint that she will develop effort to create value instead of pure releveraging. She needs to obtain increased wealth compared to her wealth in a situation of no private benefits, i.e., $\gamma=0$.

We have shown that this condition defines a minimum award of private benefits above which the incentive constraint is met (AA' curve in Graph 2). This minimum threshold depends on the value of the parameters. Numerical simulations identify the minimum

ownership threshold for triggering incentivization and creating minimum value increases in the controller's wealth. We generally obtain situations where the condition is met as soon as γ becomes positive, meaning that γ_{min} is null. This happens as soon as the effort becomes moderately productive (i.e., $\mu > 0.05$). When the effort function is poorly productive ($\mu = 0.05$ resulting in an additional drift of only 0.40% for $\gamma = 10\%$), we evidence γ_{min} values of 1.6%-1.8% of the equity stake to be given to the controller. When the effort function is poorly productive, there is a minimum stake of equity capital to abandon and to trigger incentivization and then to initiate a value-creating bargaining process without releveraging.

4.5. Practical and empirical implications

Our propositions are testable; mainly propositions 3 and 5. They identify a link between leverage jumps and the setting of incentivization through private benefits. However, private benefits are implicit contracts and are not observable. If successful, they will result in higher drifts in value creation flowing into the firm, at least for the part captured by the firm. We may also expect an increase in asset substitution (proposition 1). The previous results have been drawn with no reference to the equity stake held by the controller. We assume only that a major shareholder has control. Changes in the debt level without a change in ownership are potential signals of private benefits appropriation (or modification) for investors. A jump in debt and the agreement of an incentive contract will demonstrate a reaction to the holdup problem. This is a consequence of propositions 3 and 4. The basic empirical implication of the above model is to identify a jump in a firm's debt leverage after a change in the incentive compensation scheme. This will occur in the situation of a controlled firm.

The identification of incentive contracts is difficult. Those contracts could reasonably be proxied in the following ways:

- Recapitalizations (associated with releveraging), as identified by Shivdasani and Zak (2007).
- Jumps in leverage resulting from share buyback programs. If these offers are contemporaneous with new incentivization schemes, we can hypothesize a causal relationship. The aim of limiting the transfer of value to creditors and repatriating value to shareholders may explain share repurchases (Jun et al. 2009). The

development of share repurchases is also identified after an acquisition (Jandik and Lallemand 2017).

Debt changes level off as bankruptcy threatens. Controllers and minor investors are then exposed to the same event of default. In a situation of high financial distress risk, debt has no specific role in the setting of the private benefits scheme. Stock option-like compensation schemes are internal rules between shareholders. They will not directly modify the bankruptcy risk level (however, they will affect it indirectly through incentivization). Other compensation schemes with priority rules, such as private benefits expropriation before cash-flow payment to creditors, will directly affect the financial distress risk. We should expect that stock option-like compensation contracts will be more frequent for highly levered firms. Highly indebted and controlled firms should show a higher probability of setting up SO incentive contracts to appropriate an additional portion of the benefits. Conversely, controlling shareholders will use private expropriation schemes in less indebted firms. The latter will, as a consequence, show lower public profitability after private appropriation.

A new control situation is an event that will introduce a break. A transfer of control resulting from an acquisition may call into question the current incentive scheme of the manager or the new controlling shareholder and open new possibilities for value creation. As such, we expect the transfer of control to trigger a debt leverage jump. If the controller is able to initiate a positive drift in value creation, she will try to avoid a transfer of value to the creditors, as documented in Jandik and Lallemand (2017) within and after the acquisition process. The target firm's leverage ratio increases by 5.5% after completion compared with the figure before completion. Interestingly, the abnormal returns for buyers of targets who raise their debt leverage during the acquisition are shown to be higher than those of other acquired targets. This is in line with creditors' holdup mitigation and value repatriation mechanisms. Another expected consequence can be asset substitution toward more risk (Bigus 2002; Garvey and Mawani 2005; Tarentino 2013). An increase in the economic risk of the firm after an M&A transaction without an increase in debt conditions and without an increase in investors' profitability suggests appropriation by a controlling shareholder.

5. Conclusion

This paper addresses the question of the relationship between private benefits and the choice of a debt structure with senior standard debt and equity, as the latter belongs to the controlling shareholder and to outside investors simultaneously. Each of these two questions corresponds to an agency conflict that is addressed in the literature. Establishing a link between the two issues is not common. The relation becomes more complex with three parties. We show that the two issues are linked in a financial governance framework. We can no longer separate the issues when a holdup problem is identified and when a controlling shareholder is incentivized through private benefits. Incentivization will not profit outside investors, as creditors are the first to be enriched by safer claims. Debt is a disciplinary tool for shareholders, but to avoid a creditors' holdup, we also need to discipline the disciplinary tool.

Creditors' holdup risk upon the arrival of the controlling shareholder allows for a further dimension in the contract design. It triggers a releveraging jump without making creditors worse off. This further dimension includes a wealth transfer from creditors to shareholders through the issuance of new debt.

As a consequence, we predict a jump in leverage to protect outside shareholders. Our paper derives some testable implications and proposes an empirical test. The traditional disciplinary role of debt is analyzed as a limitation on the free cash flow of the firm. Indebtedness limits the discretionary misuse of resources. A slightly more sophisticated view is that debt increases the probability of bankruptcy and, as such, limits the time scope of entrenchment behavior and cash flow appropriation or diversion. We show that debt is also *per se* an appropriation device for creditors. This will trigger a set of reactions, as shareholders will try to limit the transfer of value to creditors. Several possibilities are explored, among which a nonintuitive solution is demonstrated: shareholders will increase debt leverage to increase the risk of default and to lower the debt value. The controlling shareholder may also target higher equity ownership or a lower appropriation rate. She can also maximize the value creation drift, which is beneficial (a) to the controller herself and (b) to the creditors. The shareholders are the losers in the holdup area. However, we show that with regard to the creditors' holdup problem, the two categories of shareholders may bargain on an incentive contract, designing private benefits and resulting in releveraging. Debt is an appropriation device for creditors in the context of value creation. The disciplinary tool is no longer disciplinary, and creditors also need to be disciplined.

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Appendix

Annex 1. Derivative $\frac{dD}{dz}$

We first recall the sign of the partial derivatives of $z = z(\eta, \sigma^2)$: $\frac{dz}{d\eta} > 0$.

The derivative $\frac{dA_b}{dz} = sgn \frac{1}{(1+z)^2} > 0$. Starting from Equations (4) and (9) in the text, respectively setting $D(z)$ and A_b :

$$\frac{dD(z)}{dz} = sgn \frac{d\left[-\frac{C}{r}f(z)\right]}{dz} \text{ with } f(z) = \left[\frac{1+z(\tau+l(1-\tau))}{1+z}\right] \left(\frac{A_b}{A}\right)^z \quad (A1)$$

We consider $h'(z)$ the log-derivative of:

$$h(z) = \log(f(z)) = \log\left(1 + z(\tau + l(1 - \tau))\right) - \log(1 + z) + z \log\left(\frac{A_b}{A}\right)$$

The derivative $h'(z)$ has the sign of:

$$h'(z) = \frac{(\tau + l(1 - \tau)) - 1}{(1 + z(\tau + l(1 - \tau)))(1 + z)} + \log\left(\frac{A_b}{A}\right)$$

Recalling the negative sign of $\left(-\frac{C}{r}\right)$ in Equation (A1), the derivative of debt versus z is negative if

$$A_b \exp\left(\frac{(\tau+l(1-\tau))-1}{(1+z(\tau+l(1-\tau)))(1+z)}\right) \geq A \quad (A2)$$

This is never verified because l and τ are between 0 and 1 and $(\tau + l(1 - \tau))$ is lower than 1, what turns the term in the exponential function negative and gives the exponential a value below 1. As the value A_b is a binding limit to A , the condition (A2) is never satisfied and the derivative of debt value with regard to z and to value creation η is always positive. As a consequence of the positive sign of (A1), the risk neutral probability of default $\left(\frac{A_b}{A}\right)^z$ decreases with z .

Annex 2. Global shareholders' point of view

The value of total debt is related to the perpetual coupon flow C by Equations (4b) and (9) in the text.

$$\begin{aligned} D(C) &= \frac{C}{r} \left(1 - \left(\frac{A}{A_b}\right)^{-z}\right) + [(1-l)A_b] \left(\frac{A}{A_b}\right)^{-z} \\ &= \frac{C}{r} \left(1 - \left(\frac{A}{A_b}\right)^{-z}\right) + \left[(1-l) \frac{z}{1+z} \frac{(1-\tau)C}{r}\right] \left(\frac{A}{A_b}\right)^{-z} \end{aligned}$$

$$= \frac{c}{r} \left\{ \left(1 - \left(\frac{A}{A_b}\right)^{-z}\right) + \left[(1-l) \frac{z}{1+z} (1-\tau)\right] \left(\frac{A}{A_b}\right)^{-z} \right\} = \frac{c}{r} \{ \dots \}$$

The above equation shows that the total debt value is strictly proportional to the coupon flow C . We recall that the expression $\left(\frac{A}{A_b}\right)^{-z}$ is homogenous to a probability of bankruptcy.

Using the definition from the text, we have:

$$k = \frac{D_2}{D} = \frac{(C-C_0) \frac{1}{r} \{ \dots \}}{C \frac{1}{r} \{ \dots \}} = 1 - \frac{C_0}{C} \quad (\text{A3})$$

From Equation (11c) in the text we set the total shareholders' wealth w_{O+C} replacing E and D by respectively Equations (8) and (4) by their equations.

$$\begin{aligned} w_{O+C} &= E(C) + kD(C) \\ &= A - \frac{(1-\tau)C}{r} + \left[\frac{(1-\tau)C}{r} - A_b \right] \left(\frac{A}{A_b}\right)^{-z} \\ &\quad + k \left[\frac{C}{r} + \left[(1-l)A_b - \frac{C}{r} \right] \left(\frac{A}{A_b}\right)^{-z} \right] \end{aligned}$$

We replace k by (A3) and use the variable $AA = \left(\frac{(1-\tau)z}{r} \frac{1}{1+z} A\right)^z$:

$$\left(\frac{A}{A_b}\right)^{-z} = AA \cdot C^z \quad (\text{A4})$$

$$\begin{aligned} w_{O+C} &= A + \frac{(C\tau)}{r} - \frac{C_1}{r} + AA \cdot C^z \cdot \frac{(1-\tau)C}{r} - AA \cdot C^z \cdot \frac{z}{1+z} \frac{(1-\tau)C}{r} \\ &\quad + AA \cdot C^z \left[(1-l) \frac{z}{1+z} \frac{(1-\tau)C}{r} - \frac{C}{r} \right] \\ &\quad - \frac{C_1}{C} AA \cdot C^z \left[(1-l) \frac{z}{1+z} \frac{(1-\tau)C}{r} - \frac{C}{r} \right] \end{aligned}$$

We now derive this expression with respect to C and express it as a function of C and the tax-rate τ :

$$g(C, \tau) = \frac{1}{r} \left\{ \begin{array}{l} \tau - AA(\tau) \cdot C^z \cdot [lz + \tau(1+z(1-l))] \\ + AA(\tau) \cdot C^{z-1} \cdot C_0 \cdot \frac{z}{1+z} \cdot [1 + lz + \tau z(1-l)] \end{array} \right\} \quad (\text{A5})$$

The first-order condition sets the optimal amount of debt for a given value of γ . This maximum C^* is obtained by solving the equation:

$$g(C^*, \tau) = 0 \quad (\text{A6})$$

$g(C, \tau)$ is a regular continuously derivable function. There exists an implicit function $C^* = f(\tau)$ solving (A5). We cannot find a closed-form solution for this function. However, stating that the tax rate τ is null allows us to cancel out the term proportional to C and to obtain a

closed-form solution. We have: $g(C, 0) = \frac{1}{r} \left[-AA(0) \cdot C^z \cdot lz + AA(0) \cdot C^{z-1} \cdot C_0 \cdot (1 + lz) \cdot \frac{z}{1+z} \right]$. Solving $g(C, 0) = 0$ for $\tau = 0$ and $C > 0$ gives the unique solution:

$$C_{\tau=0}^* = \frac{C_0 \cdot [1+lz]}{(1+z)l} \quad (\text{A7})$$

Since $l < 1$, C^*/C_0 is larger than one which means that there will be a positive debt issuance. We compute the derivative of C^*/C_0 with regard to z :

$$\frac{d\left(\frac{C_{\tau=0}^*}{C_0}\right)}{dz} = l(1+z)l - (1+lz)l = l^2 - l = (l-1)l < 0 \quad (\text{A8})$$

The derivative is negative as l is below one. The variable $C_{\tau=0}^*/C_0$ decreases with z (but always remains higher than one).

We now turn to the second order condition in the general case where $\tau \geq 0$. We verify that:

$$\frac{dg}{dc}(f(\tau), \tau) < 0$$

From (A4) we find:

$$\begin{aligned} \frac{dg}{dc}(C, \tau) &= \frac{1}{r} \left\{ z \cdot AA(\tau) \cdot C^{z-1} \cdot [lz + \tau[1 + z(1-l)]] \right. \\ &\quad \left. + (z-1)AA(\tau) \cdot C^{z-2} \cdot C_0 \cdot \frac{z}{1+z} \cdot [1 + lz + \tau z(1-l)] \right\} \\ \frac{dg}{dc}(C, \tau) &= \frac{1}{c} \left\{ z \cdot g(C, \tau) - \frac{1}{r} [AA(\tau) \cdot C^{z-1} \cdot C_0 \cdot \frac{z}{1+z} \cdot [1 + lz + \tau z(1-l)] + \tau z] \right\} \end{aligned}$$

With (A5) we obtain the second-order condition (all the remaining terms are negative):

$$\frac{dg}{dc}(f(\tau), \tau) < 0 \quad (\text{A9})$$

The regular form of g also allows us to study the derivative of the implicit function $f(\tau)$:

$$f'(\tau) = \frac{d(C^*)}{d\tau} = -\frac{\frac{dg}{d\tau}(C^*, \tau)}{\frac{dg}{dc}(C^*, \tau)}$$

Using (A9) this means that the sign of $f'(\tau)$ is the same as the sign of $\frac{dg}{d\tau}(C^*, \tau)$. Rearranging (A5):

$$g(C, \tau) \cdot r = \tau + AA(\tau) \cdot C^{z-1} \left\{ \begin{array}{l} \tau \cdot [-C \cdot [1 + z(1-l)] + C_1 \cdot \frac{z^2}{1+z} (1-l)] \\ -C \cdot lz + C_0 \cdot \frac{z}{1+z} \cdot (1+lz) \end{array} \right\} \quad (\text{A10})$$

Calling $h(C, \tau)$ the second term in the right-hand side of this equation:

$$h(C, \tau) = \tau \cdot [-C \cdot [1 + z(1-l)] + C_0 \cdot \frac{z^2}{1+z} (1-l)] - C \cdot lz + C_0 \cdot \frac{z}{1+z} \cdot (1+lz)$$

or

$$h(C, \tau) = -C\{\tau \cdot [1 + z(1 - l)] - lz\} + C_0 \cdot \left\{ \tau \cdot \frac{z^2}{1+z} (1 - l) + \frac{z}{1+z} \cdot (1 + lz) \right\} \quad (\text{A11})$$

$$\frac{dh}{d\tau}(C, \tau) = -C \cdot [1 + z(1 - l)] + C_0 \cdot \frac{z^2}{1+z} (1 - l)$$

or

$$\frac{dh}{d\tau}(C, \tau) = \frac{1}{\tau} (h(C, \tau) + C \cdot lz) - C_0 \left(\frac{z}{1+z} \cdot \frac{1+lz}{\tau} \right) \quad (\text{A12})$$

$$\text{With } AA(\tau) = \left(\frac{(1-\tau) \cdot z}{r \cdot (1+zA)} \right)^z, \text{ we get: } AA'(\tau) = -\frac{z}{(1-\tau)} AA \quad (\text{A13})$$

Deriving (A10):

$$\frac{dg}{d\tau}(C, \tau) \cdot r = 1 + C^{z-1} \left(AA'(\tau) \cdot h(C, \tau) + AA(\tau) \cdot \frac{dh}{d\tau}(C, \tau) \right)$$

Using (A12) and (A13) gives:

$$\begin{aligned} \frac{dg}{d\tau}(C, \tau) \cdot r = 1 - \frac{z}{(1-\tau)} AA \cdot C^{z-1} \cdot h(C, \tau) + C^{z-1} \cdot AA \cdot \left[\frac{1}{\tau} (h(C, \tau) + C \cdot lz) - \right. \\ \left. C_0 \cdot \frac{z}{1+z} \cdot \frac{1+lz}{\tau} \right] \end{aligned}$$

We now use (A6) in order to study the sign of the derivative at C^* . Using (A6) and (A10):

$$AA \cdot f(\tau)^{z-1} \cdot h(f(\tau), \tau) = -\tau$$

$$\frac{dg}{d\tau}(f(\tau), \tau) \cdot r = \frac{z\tau}{(1-\tau)} + AA(\tau) \cdot f(\tau)^{z-1} \cdot \frac{1}{\tau} \left(f(\tau) \cdot lz - C_0 \cdot \frac{z}{1+z} \cdot (1 + lz) \right)$$

For any $f(\tau) \geq \frac{C_1 \cdot [1+lz]}{(1+z)l}$, which is true for $\tau = 0$, we obtain:

$$\frac{dg}{d\tau}(f(\tau), \tau) > 0$$

$$f'(\tau) > 0 \quad (\text{A14})$$

This proves that C^* is a growing function of the tax rate, and that there will always be a positive net issuance ($C^* > C_1$).

Annex 3. Situations of the outside and the controlling shareholders

Using the variable AA defined in Annex 2 we know that

$$E(C) = A - \frac{(1-\tau) \cdot C}{r} + AA \cdot C^{z+1} \cdot \frac{(1-\tau)}{r} \cdot \frac{1}{1+z}$$

$$E'(C) = \frac{(1-\tau)}{r} \cdot (AA \cdot C^z - 1)$$

We start from the outside shareholders' Equation (13a) in the text. The derivative of w_0 with regard to C is (with $g(\cdot)$ defined in Eq. A5):

$$w'_0 = (1 - \alpha) \cdot g(\cdot) - \gamma E' \quad (\text{A15})$$

At $C^* = f(\tau)$, we know that $g(C^*, \tau) = 0$. With (A4) we also have $AA.C^z < 1$ so that $E'(C) < 0$. It means that the derivative of the outside shareholders wealth around the (collective) optimal coupon C^* is positive:

$$w'_o(C^*) > 0$$

Outside shareholders want more debt that shareholders considered as a whole. This is not surprising since outside shareholders receive higher proportion of the debt issuance compared to their effective share of equity (net of private benefits).

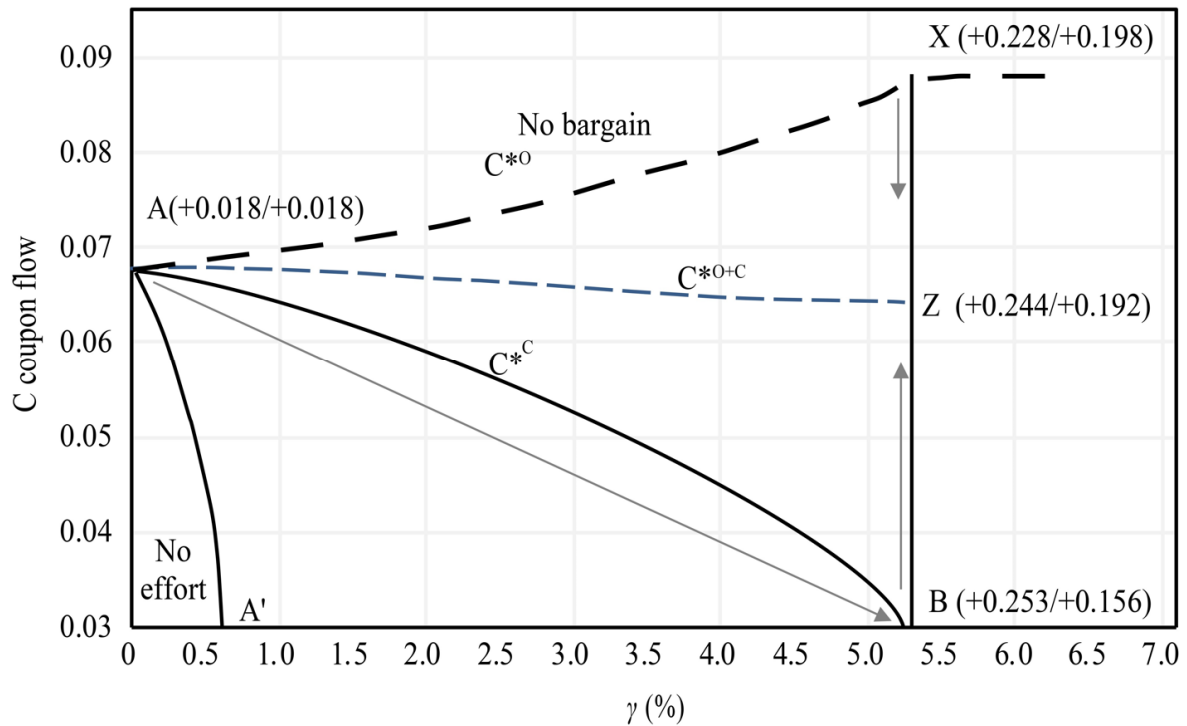
Symmetrically, considering the controlling shareholder and deriving (13b) we have:

$$w'_c = \alpha \cdot g(.) + \gamma E' \tag{A16}$$

$$w'_c(C^*) < 0$$

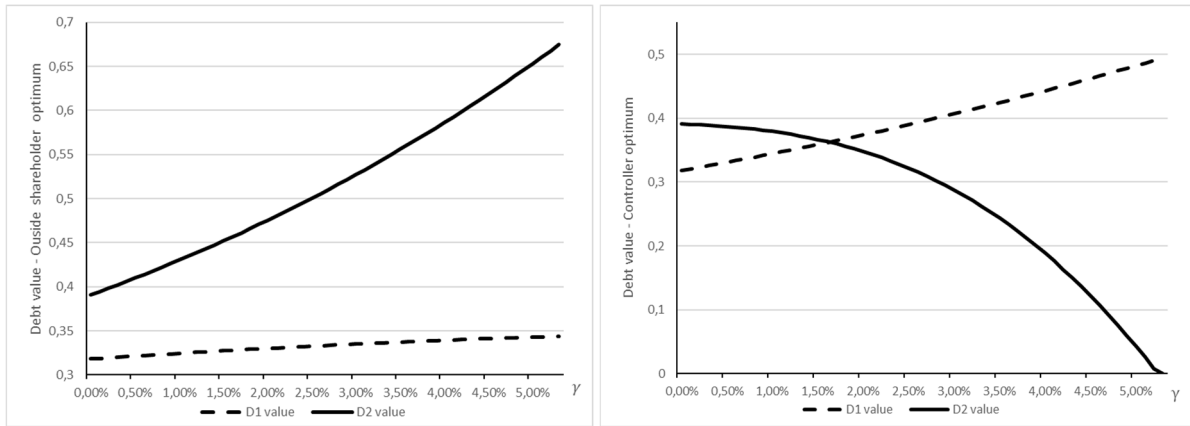
The controlling shareholder wants less debt that shareholders considered as a whole. The optimal coupon is higher for outside shareholders than for the controlling shareholder:

$$C^{*o} > C^{*c} \tag{A17}$$



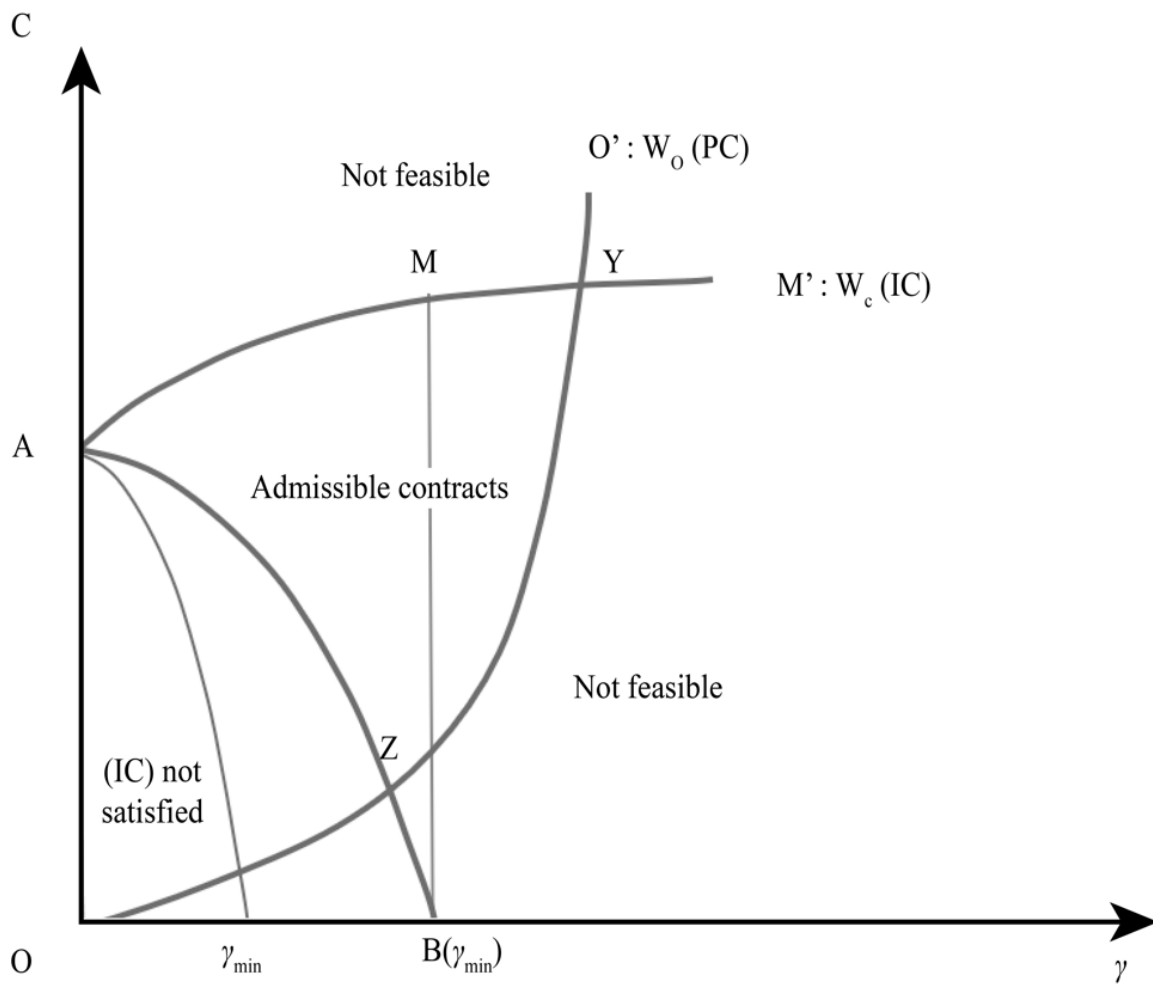
Graph 1 Optimal incentivization and re-leveraging settings

Outside shareholders' wealth: dashed line; controller' wealth: plain line; whole shareholders' wealth: dotted line; maximum wealth for different coupon flow varying from 0.03 to 0.085; initial coupon flow $C_1=0.03$; appropriation rate γ varying from 0% to 7%; initial asset drift $\delta=2\%$; additional drift is positive in appropriation rate: $\eta=\mu.\gamma *(1-2\gamma)$, with $\mu=0.2$; asset $A=1$; risk free rate $r =5\%$; volatility of the firm's assets $\sigma =32\%$; corporate tax rate τ equal to 0%; bankruptcy cost $l=32\%$; ownership $\alpha=50\%$; data between parentheses after the points A, B, X, and Z are the increases in wealth from the origin of the axes situation (i.e. coupon flow=0.03 and $\gamma=0\%$) for respectively the controlling and the outside shareholders. Curve AA' is the iso-wealth curve for the controlling shareholder yielding a wealth increase of 0.018.



Graph 2a and 2b – Debt value after releveraging for increasing γ

Graph 2a: market value of debt if $C = C^*c$; graph 2b: market value of debt if $C = C^*o$; market value of the initial debt (D_1): dashed line; market value of the debt issuance (D_2): plain line; appropriation rate γ varying from 0% to 5.2%; same parameters as Graph1.



Graph 3 - Definition of a feasible region of bargained solution

Horizontal axe: appropriation rate γ is the percentage of additional equity awarded to the controlling shareholder; vertical axe: C is the increase in debt coupon flow; point A is the maximum increase in wealth for both categories of shareholders for the value $\gamma=0\%$; point B is the maximum increase of wealth for the controlling shareholder for a no change in the debt coupon flow; curve AB is the optimum contract curve maximizing the controller's wealth; A'B is the fraction of the optimal controller's curve AB satisfying the incentive constraint; IP: Incentive constraint that the wealth of the controller is increased with a γ value above γ_{min} ; curve AM' is the iso-wealth curve satisfying the incentive condition (IC) of the controller; OO' is the minimum iso-curve of contract for minor shareholders corresponding to their participation constraint (PC).