

Internet Appendix to Measuring Agency Costs over the Business Cycle

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This internet appendix contains supplemental material for the paper “Measuring agency costs over the business cycle.” The order of the sections corresponds to the order of appearance in the main body of the paper. All variables are defined in the paper, and parameters correspond to the ones presented in Table I of the paper.

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1. The value functions after investment

The valuation of corporate debt. The value of corporate debt after investment in regime i , \hat{d}_i , corresponds to the present value of the expected payoffs to debt holders until default and in default, i.e.,

$$\hat{d}_i(X) = \mathbb{E}^{\mathbb{Q}} \left[\int_t^{\hat{D}} e^{-r_{I_u}^n(u-t)} c_n du + \alpha_{I_{\hat{D}}} y_{I_{\hat{D}}} X_{\hat{D}} | X_t = X \right], \quad (1)$$

in which \hat{D} is the firm's default time, defined as

$$\hat{D} = \inf \left\{ u \geq 0 : X_u \leq \hat{D}_i, I_u = i \right\}, \quad (2)$$

and $I_{\hat{D}}$ is the realized regime at the time of default. The associated system of ordinary differential equations (ODEs) reads:

$$\text{For } 0 \leq X \leq \hat{D}_B : \quad \begin{cases} \hat{d}_B(X) &= \alpha_B (1 - \tau) y_B X \\ \hat{d}_R(X) &= \alpha_R (1 - \tau) y_R X. \end{cases} \quad (3)$$

For $\hat{D}_B < X \leq \hat{D}_R$:

$$\begin{cases} r_B^n \hat{d}_B(X) &= c_n + \tilde{\mu}_B X \hat{d}'_B(X) + \frac{1}{2} \tilde{\sigma}_B^2 X^2 \hat{d}''_B(X) + \tilde{\lambda}_B \left(\alpha_R (1 - \tau) y_R X - \hat{d}_B(X) \right) \\ \hat{d}_R(X) &= \alpha_R (1 - \tau) y_R X. \end{cases} \quad (4)$$

For $X > \hat{D}_R$:

$$\begin{cases} r_B^n \hat{d}_B(X) &= c_n + \tilde{\mu}_B X \hat{d}'_B(X) + \frac{1}{2} \tilde{\sigma}_B^2 X^2 \hat{d}''_B(X) + \tilde{\lambda}_B \left(\hat{d}_R(X) - \hat{d}_B(X) \right) \\ r_R^n \hat{d}_R(X) &= c_n + \tilde{\mu}_R X \hat{d}'_R(X) + \frac{1}{2} \tilde{\sigma}_R^2 X^2 \hat{d}''_R(X) + \tilde{\lambda}_R \left(\hat{d}_B(X) - \hat{d}_R(X) \right). \end{cases} \quad (5)$$

This system of ODEs reflects the following intuitions. As long as the firm is solvent, the claim to debt requires an instantaneous return equal to the risk-free rate r_i^n . The realized rate of return is composed of the coupon payment and the expected change in the value of debt. The latter can be computed by an application of Ito's lemma with regime switches. At default, the value of debt is given by the value of the assets in place less default costs.

This type of ODEs is standard in regime-switching contingent claim models, see, e.g., Hackbarth, Miao, and Morellec (2006).

The boundary conditions are given by

$$\lim_{X \rightarrow \infty} \hat{d}_i(X) = \frac{c_n}{r_i^p}, \quad i = B, R, \quad (6)$$

$$\lim_{X \searrow \hat{D}_R} \hat{d}_B(X) = \lim_{X \nearrow \hat{D}_R} \hat{d}_B(X), \quad \lim_{X \searrow \hat{D}_R} \hat{d}'_B(X) = \lim_{X \nearrow \hat{D}_R} \hat{d}'_B(X), \quad (7)$$

$$\hat{d}_B(\hat{D}_B) = \alpha_B(1 - \tau)y_B D_B, \quad \hat{d}_R(\hat{D}_R) = \alpha_R(1 - \tau)y_R D_R. \quad (8)$$

Condition (6) requires that the value of debt converges to the risk-free value calculated using the perpetual risk-free rate in each regime. The remaining boundary conditions are the continuity and smoothness conditions (7) as well as the value-matching conditions (8). The functional form of the solution is

$$\hat{d}_i(X) = \begin{cases} \alpha_i(1 - \tau)Xy_i & X \leq \hat{D}_i & i = B, R \\ \hat{C}_1 X^{\beta_1^B} + \hat{C}_2 X^{\beta_2^B} + \hat{C}_3 X + \hat{C}_4 & \hat{D}_B < X \leq \hat{D}_R, & i = B \\ \hat{A}_{i1} X^{\gamma_1} + \hat{A}_{i2} X^{\gamma_2} + \hat{A}_{i6} & X > \hat{D}_R, & i = B, R, \end{cases} \quad (9)$$

in which $\hat{A}_{B1}, \hat{A}_{B2}, \hat{A}_{R1}, \hat{A}_{R2}, \hat{A}_{B6}, \hat{A}_{R6}, \hat{C}_1, \hat{C}_2, \hat{C}_3, \hat{C}_4, \gamma_1, \gamma_2, \beta_1^B$, and β_2^B are real-valued parameters to be determined.

Solving the system of ODEs (3)-(5) subject to its boundary conditions (6)-(8), I find that

$$\hat{C}_3 = \frac{\tilde{\lambda}_B \alpha_R (1 - \tau) y_R}{r_B^n + \tilde{\lambda}_B - \tilde{\mu}_B}, \quad \hat{C}_4 = \frac{c_n}{r_B^n + \tilde{\lambda}_B}, \quad \hat{A}_{i6} = \frac{c_n}{r_i^p}. \quad (10)$$

Next, \hat{A}_{Bk} is a multiple of \hat{A}_{Rk} , $k = 1, 2$, with the factor $l_k := \frac{1}{\tilde{\lambda}_B} (r_B^n + \tilde{\lambda}_B - \tilde{\mu}_B \gamma_k - \frac{1}{2} \tilde{\sigma}_B^2 \gamma_k (\gamma_k - 1))$, i.e., $\hat{A}_{Rk} = l_k \hat{A}_{Bk}$, and γ_1 and γ_2 are the negative roots of the quartic equation¹

$$\left(\tilde{\mu}_R \gamma + \frac{1}{2} \tilde{\sigma}_R^2 \gamma (\gamma - 1) - \tilde{\lambda}_R - r_R^n \right) \left(\tilde{\mu}_B \gamma + \frac{1}{2} \tilde{\sigma}_B^2 \gamma (\gamma - 1) - \tilde{\lambda}_B - r_B^n \right) = \tilde{\lambda}_R \tilde{\lambda}_B. \quad (11)$$

¹According to arguments of Guo (2001), this quartic equation always has four distinct real roots, two of them negative, and two of them positive.

The reason for taking the negative roots is the no-bubbles condition for debt stated in Eq. (20). Finally,

$$\beta_{1,2}^B = \frac{1}{2} - \frac{\tilde{\mu}_B}{\tilde{\sigma}_B^2} \pm \sqrt{\left(\frac{1}{2} - \frac{\tilde{\mu}_B}{\tilde{\sigma}_B^2}\right)^2 + \frac{2(r_B^n + \tilde{\lambda}_B)}{\tilde{\sigma}_B^2}}. \quad (12)$$

The remaining unknown parameters \hat{A}_{B1} , \hat{A}_{B2} , \hat{C}_1 , and \hat{C}_2 solve

$$\begin{bmatrix} \hat{A}_{B1} & \hat{A}_{B2} & \hat{C}_1 & \hat{C}_2 \end{bmatrix}^T = \hat{M}^{-1} \hat{b}, \quad (13)$$

in which

$$\hat{M} := \begin{bmatrix} \hat{D}_R^{\gamma_1} & \hat{D}_R^{\gamma_2} & -\hat{D}_R^{\beta_1^B} & -\hat{D}_R^{\beta_2^B} \\ \gamma_1 \hat{D}_R^{\gamma_1} & \gamma_2 \hat{D}_R^{\gamma_2} & -\beta_1^B \hat{D}_R^{\beta_1^B} & -\beta_2^B \hat{D}_R^{\beta_2^B} \\ 0 & 0 & \hat{D}_B^{\beta_1^B} & \hat{D}_B^{\beta_2^B} \\ l_1 \hat{D}_R^{\gamma_1} & l_2 \hat{D}_R^{\gamma_2} & 0 & 0 \end{bmatrix}, \quad (14)$$

$$\hat{b} := \begin{bmatrix} \hat{C}_3 \hat{D}_R + \hat{C}_4 - \hat{A}_{B6} \\ \hat{C}_3 \hat{D}_R \\ \alpha_B (1 - \tau) \hat{D}_{ByB} - \hat{C}_3 \hat{D}_B - \hat{C}_4 \\ \alpha_R (1 - \tau) \hat{D}_{RyR} - \hat{A}_{R6} \end{bmatrix}. \quad (15)$$

The valuation of a claim to the firm's net income. Next, I derive the Hamilton-Jacobi-Bellman equation for a claim to the firm's net income, $\hat{n}_i(X)$. Once the value of a claim to the firm's net income is known, the value of equity and the manager's claim to cash flows follow immediately.

The value of the firm's net income after investment in regime i , \hat{n}_i , corresponds to the present value of the expected after-tax gross cash flows less the coupon until default, i.e.,

$$\hat{n}_i(X) = \mathbb{E}^{\mathbb{Q}} \left[\int_t^{\hat{D}} e^{-r_u^n (u-t)} (1 - \tau) (X_u - c_n) du \mid X_t = X \right], \quad (16)$$

in which \hat{D} is the time of the firm's default defined in Eq. (2). Using a no-arbitrage argument and applying Ito's lemma, the system of ODEs satisfied by the value of a claim to the firm's net income is as follows:

For $0 \leq X \leq \hat{D}_B$:

$$\begin{cases} \hat{n}_B(X) = 0 \\ \hat{n}_R(X) = 0. \end{cases} \quad (17)$$

For $\hat{D}_B < X \leq \hat{D}_R$:

$$\begin{cases} r_B^n \hat{n}_B(X) = (1 - \tau)(X - c_n) + \tilde{\mu}_B X \hat{n}'_B(X) + \frac{1}{2} \tilde{\sigma}_B^2 X^2 \hat{n}''_B(X) - \tilde{\lambda}_B \hat{n}_B(X) \\ \hat{n}_R(X) = 0. \end{cases} \quad (18)$$

For $X > \hat{D}_R$:

$$\begin{cases} r_B^n \hat{n}_B(X) = (1 - \tau)(X - c_n) + \tilde{\mu}_B X \hat{n}'_B(X) + \frac{1}{2} \tilde{\sigma}_B^2 X^2 \hat{n}''_B(X) \\ \quad + \tilde{\lambda}_B (\hat{n}_R(X) - \hat{n}_B(X)) \\ r_R^n \hat{n}_R(X) = (1 - \tau)(X - c_n) + \tilde{\mu}_R X \hat{n}'_R(X) + \frac{1}{2} \tilde{\sigma}_R^2 X^2 \hat{n}''_R(X) \\ \quad + \tilde{\lambda}_R (\hat{n}_B(X) - \hat{n}_R(X)) \end{cases} \quad (19)$$

The boundary conditions are

$$\lim_{X \rightarrow \infty} \frac{\hat{n}_i(X)}{X} < \infty, \quad i = B, R, \quad (20)$$

$$\lim_{X \searrow \hat{D}_R} \hat{n}_B(X) = \lim_{X \nearrow \hat{D}_R} \hat{n}_B(X), \quad \lim_{X \searrow \hat{D}_R} \hat{n}'_B(X) = \lim_{X \nearrow \hat{D}_R} \hat{n}'_B(X), \quad (21)$$

$$\hat{n}_B(\hat{D}_B) = 0, \quad \hat{n}_R(\hat{D}_R) = 0. \quad (22)$$

Condition (20) is the no-bubbles condition. The remaining boundary conditions are the continuity and smoothing conditions (21), and the value-matching conditions (22). The functional form of the solution to the system of ODEs (17)–(19) subject to the boundary conditions (20)–(22) is

$$\hat{n}_i(X) = \begin{cases} 0 & X \leq \hat{D}_i & i = B, R \\ \hat{C}_1 X^{\beta_1^B} + \hat{C}_2 X^{\beta_2^B} + \hat{C}_3 X + \hat{C}_4 & \hat{D}_B < X \leq \hat{D}_R, & i = B \\ \hat{A}_{i1} X^{\gamma_1} + \hat{A}_{i2} X^{\gamma_2} + \hat{A}_{i5} X + \hat{A}_{i6} & X > \hat{D}_R, & i = B, R, \end{cases} \quad (23)$$

in which $\hat{A}_{B1}, \hat{A}_{B2}, \hat{A}_{R1}, \hat{A}_{R2}, \hat{A}_{B5}, \hat{A}_{R5}, \hat{C}_1, \hat{C}_2, \hat{C}_3, \hat{C}_4, \gamma_1, \gamma_2, \beta_1^B$, and β_2^B are real-valued parameters to be determined.

Using standard techniques, I find that

$$\hat{C}_3 = \frac{(1-\tau)}{r_B^n + \tilde{\lambda}_B - \tilde{\mu}_B}, \quad \hat{C}_4 = -\frac{(1-\tau)c_n}{r_B^n + \tilde{\lambda}_B}, \quad \hat{A}_{i5} = (1-\tau)y_i, \quad \hat{A}_{i6} = -\frac{(1-\tau)c_n}{r_i^p}. \quad (24)$$

As before, \hat{A}_{Bk} is a multiple of \hat{A}_{Rk} , $k = 1, 2$, with the factor $l_k := \frac{1}{\tilde{\lambda}_B}(r_B^n + \tilde{\lambda}_B - \tilde{\mu}_B\gamma_k - \frac{1}{2}\tilde{\sigma}_B^2\gamma_k(\gamma_k - 1))$, i.e., $\hat{A}_{Rk} = l_k\hat{A}_{Bk}$. $\gamma_{1,2}$ and $\beta_{1,2}^B$ are given in Eqs. (11) and (12), respectively.

The remaining unknown parameters $\hat{A}_{B1}, \hat{A}_{B2}, \hat{C}_1$, and \hat{C}_2 solve

$$\begin{bmatrix} \hat{A}_{B1} & \hat{A}_{B2} & \hat{C}_1 & \hat{C}_2 \end{bmatrix}^T = \hat{M}^{-1}\hat{b}, \quad (25)$$

in which

$$\hat{M} := \begin{bmatrix} \hat{D}_R^{\gamma_1} & \hat{D}_R^{\gamma_2} & -\hat{D}_R^{\beta_1^B} & -\hat{D}_R^{\beta_2^B} \\ \gamma_1\hat{D}_R^{\gamma_1} & \gamma_2\hat{D}_R^{\gamma_2} & -\beta_1^B\hat{D}_R^{\beta_1^B} & -\beta_2^B\hat{D}_R^{\beta_2^B} \\ 0 & 0 & \hat{D}_B^{\beta_1^B} & \hat{D}_B^{\beta_2^B} \\ l_1\hat{D}_R^{\gamma_1} & l_2\hat{D}_R^{\gamma_2} & 0 & 0 \end{bmatrix}, \quad (26)$$

$$\hat{b} := \begin{bmatrix} \hat{C}_3\hat{D}_R + \hat{C}_4 - \hat{A}_{B5}\hat{D}_R - \hat{A}_{B6} \\ \hat{C}_3\hat{D}_R - \hat{A}_{B5}\hat{D}_R \\ -\hat{C}_3\hat{D}_B - \hat{C}_4 \\ -\hat{A}_{R5}\hat{D}_R - \hat{A}_{R6} \end{bmatrix}. \quad (27)$$

The valuation of equity. The manager captures a fraction ϕ of net income as private benefits. Therefore, the value of equity after investment corresponds to a fraction $(1-\phi)$ of net income \hat{n}_i after investment, i.e.,

$$\hat{e}_i(X) = (1-\phi)\hat{n}_i(X). \quad (28)$$

The solution of $\hat{n}_i(X)$ is given in Eq. (23).

The manager's claim to cash flows. The manager owns a fraction ψ of equity and captures a fraction ϕ of net income as private benefits. Therefore, the value of the manager's

total claim to cash flow after investment, \hat{m}_i , can be written as the sum of the value of his equity share and the value of the captured cash flows, i.e.,

$$\hat{m}_i(X) = \psi \hat{e}(X) + \phi \hat{n}_i(X) = (\psi + \phi - \phi\psi) \hat{n}(X), \quad (29)$$

in which I used Eq. (28). The solution of $\hat{n}_i(X)$ is given in Eq. (23).

Default and financial policy. Once debt has been issued, equityholders select the default policy that maximizes the value of equity ex-post. Value matching requires that the value of equity at the time of default be zero:

$$\begin{cases} \hat{e}_B(\hat{D}_B) = 0 \\ \hat{e}_R(\hat{D}_R) = 0. \end{cases} \quad (30)$$

Hence, shareholders' optimal default policy $\{\hat{D}_B^*, \hat{D}_R^*\}$ is determined by the smooth-pasting conditions:

$$\begin{cases} \hat{e}'_B(\hat{D}_B^*) = 0 \\ \hat{e}'_R(\hat{D}_R^*) = 0. \end{cases} \quad (31)$$

After investment and given a capital structure, equityholders and the manager agree on the default policy. Hence, an alternative assumption of the manager selecting the default policy as in Lambrecht and Myers (2008) leads to identical policies and value functions after investment.

The firm value after investment, \hat{v}_i , is calculated as the sum of equity and debt value, i.e.,

$$\hat{v}_i(X) = \hat{e}_i(X) + \hat{d}_i(X). \quad (32)$$

The manager selects the coupon level c_n^* that maximizes the ex ante value of his claim:

$$c_n^* := \arg \max_{c_n} (\psi \hat{v}_i(X; c_n) + \phi \hat{n}_i(X; c_n)). \quad (33)$$

The first term represents the manager's equity share, whereas the second term is due to private benefits.

2. Comparative statics on agency costs

To provide an intuition of the range of agency costs generated by the model, Figure 1 plots total agency costs for a wide range of managerial ownership (10% to 1%, on the x-axis) and private benefits (0% to 1%, on the y-axis). The left panel corresponds to issuance in a boom, whereas the right panel assumes issuance in a recession. Figure 1 shows that total agency costs can vary between 0% and 20% [27%] in booms [recessions]. The plots confirm that agency costs are increasing in private benefits and decreasing in managerial ownership. For a fixed value of ownership ψ , total agency costs are strongly increasing in private benefits ϕ up to a certain point and then less so. The change in the slope represents the cutoff value of private benefits for which the manager decides for an unlevered capital structure. Below this cutoff value, agency costs are more strongly increasing in private benefits due to augmenting underleverage; however, once the cutoff value is reached, leverage cannot be further reduced, resulting in agency costs increasing less steeply. For example, given a managerial ownership of 1%, the manager chooses the unlevered capital structure if private benefits are greater or equal than 0.6%, which corresponds to the kink in the upper far right corner of both graphs. Comparison of the two graphs reveals that the magnitude of total agency costs in booms and recessions is similar for small to moderate values of private benefits and moderate to large values of managerial ownership. However, for small values of ownership and large values of private benefits (in the back of the graphs), agency costs are larger in recessions than in booms. The main reason is that the unlevered capital structure corresponds to stronger underleverage in recessions because the optimal leverage is countercyclical for firms with valuable investment opportunities.

Table I provides comparative statics with respect to firm-specific parameters. The magnitude of agency costs appears stable. For example, increasing idiosyncratic cash flow volatility from 16.8% to 21.8% leaves agency costs unchanged (rounded to two decimals). The reason is that the change in volatility has comparable quantitative effects on the firm with and without private benefits, respectively.

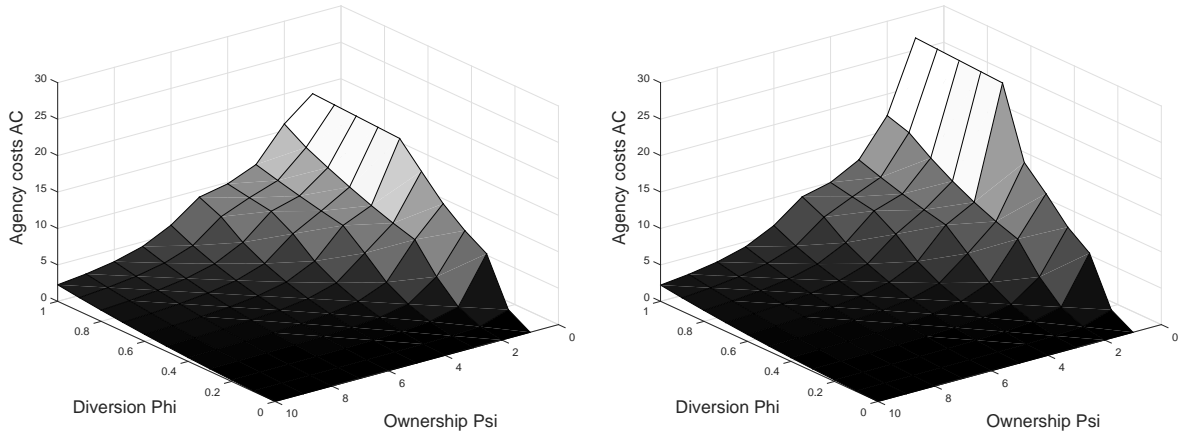


Figure 1. Total agency costs at issuance in a boom (left Panel) and a recession (right Panel). The graph shows total agency costs for a firm initiated in a boom (left panel) and a recession (right panel) depending on managerial ownership ϕ and private benefits ψ . Managerial ownership ψ is inversely displayed on the x-axis, ranging from 10% to 1%. Private benefits vary from 0% to 1% of net income (y-axis). Total agency costs (z-axis) are reported as a percentage of firm value loss relative to the corresponding firm without private benefits. The remaining parameters are as in Table I in the paper.

Table I
Comparative statics.

This table presents the impact of parameter variation on agency costs at issuance in a boom (first column) and in a recession (second column). Panel A shows the results with parameters as in Table I in the paper. The nominal cash flow growth rates are 0.0782 in booms and -0.401 in recessions, the idiosyncratic volatility is 0.168, the tax rate is 0.15, and the recovery rate is 0.7 in booms and 0.5 in recessions. Panel B displays comparative statics.

	AC_B	AC_R
Panel A: Baseline firm		
Baseline firm	1.67	1.64
Panel B: Comparative statics		
Higher nominal cash flow growth rate in booms ($\mu_B = 0.0882$)	1.62	1.60
Higher nominal cash flow growth rate in recessions ($\mu_R = -0.0301$)	1.59	1.57
Higher idiosyncratic cash flow volatility ($\sigma^{X,id} = 0.218$)	1.67	1.64
Higher tax rate ($\tau = 0.20$)	1.30	1.26
Higher recovery rate in booms ($\alpha_B = 0.8$)	1.67	1.64
Higher recovery rate in recessions ($\alpha_R = 0.6$)	1.67	1.63

3. The net benefit of debt

Empirically, Korteweg (2010) and van Binsbergen, Graham, and Yang (2010) estimate the net benefit of debt for a large cross-section of firms dependent on firm characteristics. Morellec, Nikolov, and Schürhoff (2012) complement the analysis by estimating the gross and net benefits of debt as perceived by managers. The authors show that their structural model explains the magnitude of the gross benefits of debt to shareholders; however, their structural model overestimates the mean empirical net benefit of debt to shareholders of about 3.5% to 4% (van Binsbergen, Graham, and Yang, 2010, Korteweg, 2010) with an estimated net benefit of debt of 9.6%. In the following, I explore how different levels of agency conflicts impact benefits of debt in my model. Panel A of Table II presents the net benefit of debt at initiation of a baseline firm in both a boom and a recession.

Analogous to the empirical measure of Korteweg (2010), I define the model-implied net benefit of debt to shareholders (NBDS) as the gain in firm value compared to a firm that is financed with equity only (“all-equity firm”) expressed as a percentage of the levered firm:

$$NBDS_i(X) = 100 \left(1 - \frac{v_i(X; 0, X_B^{*,ae}, X_R^{*,ae}, 0, 0)}{v_i(X; c_o^*, X_B^*, X_R^*, c_{n,B}^*, c_{n,R}^*)} \right),$$

in which $X_B^{*,ae}, X_R^{*,ae}$ correspond to the investment boundaries selected by the manager of an all-equity financed firm. Similarly, the net benefit of debt to the manager (NBDM) is defined as the increase in the ex-ante managerial objective function compared to an all-equity firm expressed as a percentage of the managerial objective function in the levered firm:

$$NBDM_i(X) = 100 \left(1 - \frac{m_i(X; 0, X_B^{*,ae}, X_R^{*,ae}, 0, 0)}{m_i(X; c_o^*, X_B^*, X_R^*, c_{n,B}^*, c_{n,R}^*) + \psi d_i(X; c_o^*, X_B^*, X_R^*)} \right).$$

Based on the model, the net benefit of debt to shareholders comprises the tax benefits and the disciplining effect of debt net of bankruptcy cost. The net benefit of debt to the manager is defined as the percentage increase in the manager’s ex-ante objective function compared to the identical firm but with all-equity financing. The net benefit of debt to the manager can be decomposed into the net benefit of debt to shareholders (due to the

manager's equity share) net of the disciplining effect of debt. The net benefit of debt to shareholders of the baseline firm corresponds to 6.02% in a boom and 5.96% in a recession. While the magnitude of the implied benefits of debt is lower than the 9.6% estimated by Morellec, Nikolov, and Schürhoff (2012), it is still larger than the empirical magnitude.

The comparative statics in Panel B indicate how the net benefits of debt vary with private benefits, managerial incentive alignment, q , and recovery rates. Net benefits of debt decrease with agency conflicts due to stronger underleverage and overinvestment. For instance, Panel B shows that without private benefits, the net benefit of debt in the baseline case amounts to 6.25% in a boom and 6.16% in a recession. Further, the model predicts a positive relation between q and benefits of debt. While this result is consistent with the marginal gross benefit of debt increasing in q (van Binsbergen, Graham, and Yang, 2010), it is not in line with the positive relation between q and net benefit of debt reported by Korteweg (2010). The author argues that this latter result is due to firms with low leverage ratios expected to lever up in the future, a feature, which my model does not capture. Finally, Panel B illustrates the sensitivity of the net benefits of debt to the recovery rate. Specifically, increasing the recovery rates of the base case in both booms and recessions by 0.1, i.e., to $\alpha_B = 0.8$ and $\alpha_R = 0.6$, yields a moderate increase in the net benefits of debt to 6.67% (6.60%) in a boom (recession).

Panel C presents the implied net benefits of debt in the cross section, which are based on the calibration (Subsection 3.1 of the paper) and construction of the cross section (Subsection 3.2 of the paper). The net benefits of debt are calculated for each matched model-implied firm at the time of initiation. The approach is inspired by Morellec, Nikolov, and Schürhoff (2012), who consider net benefit of debt at refinancing points. I report characteristics of the cross section in Panel C, in which the numbers correspond to averages over simulations. The mean (median) net benefit of debt is 5.58% (4.74%) to shareholders and 3.67% (1.91%) to managers. This model-implied net benefit of debt is smaller than the estimate of Morellec, Nikolov, and Schürhoff (2012), but still somewhat larger than the empirical estimates of 3.5%–4.0%. Similarly, the net benefit of debt to the manager is lower than the estimate of Morellec, Nikolov, and Schürhoff (2012). Inspection of the quantiles suggest that the model-implied cross sectional variation is substantial, ranging from net benefits to debt of 3.28 (10% quantile) to 5.46% (90% quantile). The empirical estimates of van Binsbergen, Graham, and Yang (2010) amount to a variation between 0%–6.2%.

Table II
Net benefit of debt to shareholders (NBDS) and the manager (NBDM).

This table presents the net benefit of debt to shareholders (NBDS) and the manager (NBDM). Panel A shows the results for a baseline firm with parameters as in Table I in the main body of the paper. Panel B displays comparative statics, in which one parameter at a time is changed. Panels A and B report results for firms initiated in booms and recessions. In Panel C, the cross section of firms is considered. Specifically, for each model-implied firm in the matching procedure described in Appendix 3.2, I calculate the net benefits to debt at the time of (prior) initiation. The net benefit of debt to shareholders in regime i , $NBDS_i$, is defined as the increase in firm value compared to the corresponding all-equity firm expressed as a percentage of the levered firm value, and the net benefit of debt to the manager is given as the increase in the value of the manager's claim to cash flows relative to his claim in the corresponding all-equity firm expressed as a fraction of the value of his claim in the levered firm.

		<i>NBDS</i>	<i>NBDM</i>
<hr/> <hr/> Panel A: Baseline firm <hr/>			
Boom	Base case	6.02	2.28
Recession	Base case	5.96	2.25
<hr/> <hr/> Panel B: Comparative statics <hr/>			
	No private benefits ($\phi = 0.0\%$)	6.25	6.25
Boom	Lower managerial incentive alignment ($\psi = 5.0\%$)	4.47	0.70
	Lower scale parameter ($s = 1.7$)	5.16	2.00
	Higher recovery rates ($\alpha_B = 0.8, \alpha_R = 0.6$)	6.67	2.55
	No private benefits ($\phi = 0.0\%$)	6.16	6.16
Recession	Lower managerial incentive alignment ($\psi = 5.0\%$)	4.46	0.70
	Lower scale parameter ($s = 1.7$)	4.99	1.93
	Higher recovery rates ($\alpha_B = 0.8, \alpha_R = 0.6$)	6.60	2.52
<hr/> <hr/> Panel C: Cross section <hr/>			
	All firms	5.58	3.67
	10% Quantile	3.28	0.32
	25% Quantile	4.05	0.88
	50% Quantile	4.74	1.91
	75% Quantile	5.24	2.82
	90% Quantile	5.46	3.36

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