

# Strategic Ownership Structure and the Cost of Debt

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We theoretically and empirically address the endogeneity of corporate ownership structure and the cost of debt, with a novel emphasis on the role of control concentration in post-default firm restructuring. Control concentration raises agency costs of debt, and dominant shareholders trade off private benefits of control against higher borrowing costs in choosing their ownership stakes. Based on our theoretical predictions, and using an international sample of syndicated loans and unique dynamic ownership structure data, we present new evidence on the firm- and macro-level determinants of corporate control concentration and the cost of debt. (*JEL* G21, G32)

It is a stylized fact that corporate ownership is concentrated (Holderness 2009). Moreover, in much of the world, dominant shareholders, whose control (or voting) ownership exceeds significantly their cash-flow stakes, typically control public companies.<sup>1</sup> The determinants and consequences of such ownership structures have received extensive attention. In particular, La Porta, Lopez-de-Silanes, and Shleifer (1999) and La Porta et al. (1998) argue that variations in control concentration across countries are driven by their differences in the quality of legal protection of minority shareholders. The literature also highlights the consequences of dominant shareholder agency risk for minority shareholders through the nefarious impact of control

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We thank two anonymous referees and Paolo Fulghieri (the Editor) for very helpful comments. We also thank participants in seminars at various universities, the Financial Intermediation Research Society (FIRS) Meeting (Prague, 2009), the European Finance Association (EFA) Meeting (Bergen, 2009), and Franklin Allen, Sudheer Chava, Mark Flannery, Stuart Greenbaum (FIRS discussant), Kose John, Karl Lins, John McConnell, David Smith (EFA discussant), Anjan Thakor, Stuart Turnbull, Arthur Warga, and Andrew Winton for useful comments or discussions on the issues addressed in this article. Send correspondence to: Praveen Kumar, C.T. Bauer College of Business, University of Houston, 334 Melcher Hall, Houston, TX 77204-6021; telephone: (713) 743-4770. E-mail: pkumar@uh.edu.

<sup>1</sup> In a striking illustration of the deviation of control from cash-flow rights, Claessens, Djankov, and Lang (2000) found that more than two-thirds of listed East Asian companies are controlled by a single shareholder. Dominant shareholders use a variety of channels to create a deviation between control and cash-flow rights, including multiple classes of shares (La Porta, Lopez-de-Silanes, and Shleifer 1999; Doidge 2004), voting pyramids (Bebchuk, Kraakman, and Triantis 2000), and cross-holdings across firms (Claessens, Djankov, and Lang 2000; Faccio and Lang 2002).

concentration on corporate equity values (Claessens et al. 2002; La Porta et al. 2002; Lins 2003).<sup>2</sup>

But there is a significant cross-sectional and intertemporal variation in control concentration at the level of the firm *within* countries (or legal traditions), which is not really surprising because ownership structure is itself endogenous (Demsetz 1983; Demsetz and Villalonga 2001; Kumar and Ramchand 2008). This not only raises the challenge of explaining differing ownership structures within a legal framework but also poses an endogeneity issue for the observed relationship between control concentration and the costs of external financing: If firms with higher control concentration suffer greater agency costs, then dominant shareholders must trade off higher external financing costs with private benefits of control; ownership structures and external financing costs should therefore be jointly determined in equilibrium. However, this endogeneity remains an open issue in the literature.

In this article, we address theoretically and empirically the endogeneity of corporate control concentration and the cost of debt. In contrast to the effects of control concentration on equity valuation, the relationship between ownership structure and the agency cost of debt has received relatively little attention even though debt is a major source of external capital for firms and bank loans are typically the principal form of external financing for firms in many economies (see Figure 1).<sup>3</sup> In particular, there is considerable evidence that tunneling by dominant shareholders can hurt creditors (Johnson et al. 2000; Gilson 2006; Jiang, Lee, and Yue 2010), and firm characteristics that influence strategic decisions regarding default and debt renegotiations significantly affect credit spreads (Davydenko and Strebulaev 2007). However, there is sparse available analysis of the agency costs of debt from the impact of control concentration on tunneling and debt renegotiations.

We derive refutable predictions from a model of incomplete debt contracting with a public firm controlled by a dominant shareholder.<sup>4</sup> The firm's true cash flows are observable only to insiders, and the dominant shareholder can tunnel by incurring indirect equity and direct personal costs.<sup>5</sup> Financial contracting

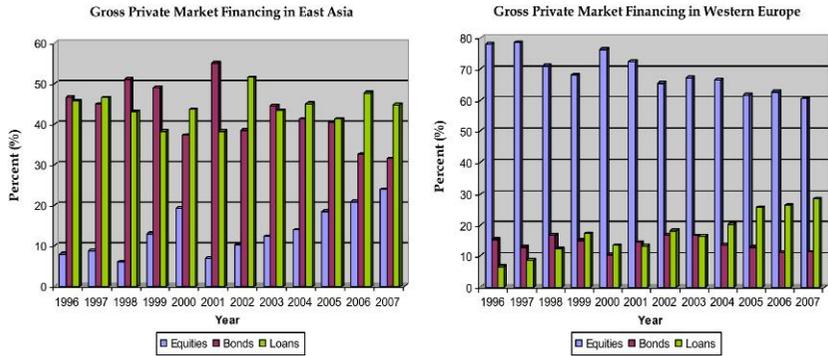
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<sup>2</sup> Large shareholders have an incentive to improve firm performance by monitoring deviant management (Shleifer and Vishny 1986). However, Stulz (1988) and McConnell and Servaes (1990), among others, argue that these owners tend to reduce firm value through extraction of private benefits once ownership concentration exceeds some threshold.

<sup>3</sup> For example, industrial firms borrowed \$13.2 trillion between 1993 and 2003 using syndicated loans arranged by commercial banks, while the public issuance of debt and equity during this time period was \$12.5 trillion (Drucker and Puri 2006). Recent data from the International Monetary Fund also indicate that bank loans are the most important source of external capital for firms in the other parts of Asia, Africa, Latin America, and Eastern Europe (IMF Statistics 2007).

<sup>4</sup> Hart (2001) and Roberts and Sufi (2009) provide excellent surveys of the literature on security design and renegotiation with incomplete contracts.

<sup>5</sup> Tunneling comes in several forms, such as asset sales or transfers at nonmarket prices, contracts that are advantageous to the controlling shareholder, loan guarantees, expropriation of corporate opportunities, intercorporate loans, and so on (Johnson et al. 2000; Jiang, Lee, and Yue 2010). However, tunneling in public firms imposes direct costs to controlling shareholders (Shleifer and Wolfenzon 2002).



**Figure 1**  
**Distribution of financing sources in East Asian and Western European countries**

This figure illustrates the gross private market financing in East Asia (left panel) and Western Europe (right panel) expressed as a percentage of equity financing (blue), bond financing (red), and bank loan financing (green). Data sources: IMF, *Global Financial Stability Report* (various issues), *World Federation of Exchanges* (annual reports), and *Bank of International Settlements' Quarterly Review: International Banking and Financial Market Developments by sector and country of issuer* (electronic annual data)

and payouts occur on the basis of the firm's reported (and verifiable) earnings that differ from actual cash flows because of tunneling. In case of a default—that is, when earnings are less than the stipulated debt payments—lenders have the option either to liquidate the firm's assets or to restructure the control and cash-flow rights by negotiating with the equity holders (Gilson 1990; Baird and Rasmussen 2006).

We focus on two major channels for the ownership structure to influence creditor payoff risk. *Ceteris paribus*, increasing the dominant shareholder's control concentration or lowering its cash-flow stakes raises the risk of *strategic default* (Hart and Moore 1994, 1998; Bolton and Scharfstein 1996) by reducing the costs of tunneling.<sup>6</sup> But we also argue that raising the dominant shareholder's control stakes will influence the post-default restructuring against the interests of the creditors. To see the point, consider the case where the creditors are concentrated—for example, a syndicate of banks—and the equity owners are dispersed. In this case, the lenders will have an advantage during the restructuring negotiations because it will be difficult for the equity owners to coordinate active and timely opposition (and responses) to creditors' plans.<sup>7</sup> In contrast, a dominant shareholder with a supermajority of control ownership can avoid the coordination problem, actively contest lenders' plans,

<sup>6</sup> This literature distinguishes between *liquidity default* (where the firm's cash flows cannot cover the promised debt payments) and *strategic default*, which occurs because of tunneling by insiders.

<sup>7</sup> This is a version of the more general argument made in the literature that dispersed claimants—whether equity owners or creditors—will be at a disadvantage in distressed renegotiations. For example, Gertner and Scharfstein (1991) and Bris and Welch (2005) argue that creditor dispersion facilitates bondholder expropriation (during debt renegotiations). Note that this is quite different from situations where coordination failures can aid dispersed claimants (e.g., Grossman and Hart 1980).

and extract *for itself*—but not necessarily for the minority shareholders—some of the surplus from the creditors. Thus, dominant shareholder control concentration will be negatively related to creditors' expected payoffs from post-default restructuring.

We present a model parameterization where raising the dominant shareholder's ratio of control-to-cash-flow ownership (the "ownership structure ratio") increases the unconditional probability of default *and* lowers the creditors' payoffs conditional on a default. The equilibrium cost of debt is therefore positively related to the ownership structure ratio, which is chosen optimally *ex ante* by the dominant shareholder, taking into account the effects of control concentration on the agency costs of debt. In general, the endogenous ownership structure ratio (or control concentration) is positively (negatively) associated with factors that weaken (strengthen) the agency costs of debt from dominant shareholder moral hazard. This analysis clarifies the mechanism through which firm- and macro-level factors—such as the firm's economic prospects and quality of corporate governance and the strength of investor rights in the country—influence the ownership structure and the cost of debt, and it also generates some novel predictions.

For example, we find not only that more economically productive firms have higher expected cash flows *ceteris paribus*, but also that they suffer lower agency costs of tunneling compared with less productive firms. Hence, the effects of raising control concentration on the cost of debt are weaker for more productive firms, and consequently, their dominant shareholders optimally choose greater control concentration, other things held fixed. And using this reasoning, we derive predictions on the influence of other firm- and macro-level factors on the ownership structure and its effects on the agency costs of debt. Some of these predictions can be surprising. For instance, while the quality of the firm's corporate governance is negatively related to credit spreads, it has an ambiguous effect on the dominant shareholder's ownership choice: There is a direct *cost effect* of stronger corporate governance that, by raising tunneling costs, lowers the incentives to accumulate control rights, but there is also an opposing *governance effect* because the agency costs of control concentration are lower for better-governed firms *ceteris paribus*.

We empirically test the predictions of the theoretical framework on an international sample of syndicated bank loans and a unique hand-collected data set from company reports that tracks the *dynamics* of control and cash-flow ownership rights of borrowing firms, which often change significantly during our sample period. Our ownership structure data are of special interest because, unlike earlier studies, we treat ownership structure as time-varying and we also obtain information on the direct and indirect ownership of sample firms by *unlisted* companies. To facilitate comparisons with the studies that relate ownership structure to the cost of equity, we choose our sample countries to match those considered by Claessens *et al.* (2002) and Faccio and Lang (2002). Our sample includes 3,605 loan tranches (or facilities) in twenty-two

major European and East Asian countries during 1996–2007. Our empirical results are robust to employing different instruments for the strength of investor rights and using the information contained in the higher-order moments of the empirical distributions in generalized method of moments (GMM) estimation.

Our empirical results support the theoretical predictions. Raising the ownership structure ratio increases the originating loan spreads (or price) in a statistically and economically significant fashion: Other things held fixed, increasing this ratio by 1% raises the loan price by about 10% (or twelve basis points in our sample). There is also evidence of nonlinearity in the effects of control concentration on the agency costs of debt because firms in the top quintile of the ownership structure ratios pay a higher loan price than the other firms. And increasing the cash-flow ownership of the dominant shareholder by 1% lowers the loan price by about 4%. Moreover, the agency costs of debt from control concentration are positively (negatively) related to factors that amplify (weaken) dominant shareholder moral hazard; thus, the effects of control concentration on loan spreads are stronger for family-owned firms; weaker for firms with multiple blockholders; and stronger in countries with weak disclosure requirements (La Porta, Lopez-de-Silanes, and Shleifer 2006) and more earnings management (Leuz, Nanda, and Wysocki 2003).

We also present new evidence regarding the determinants of the ownership structure ratio—that is, the ratio of the dominant shareholder’s control and cash-flow rights, which are positively related to the borrowers’ market-to-book ratio (the proxy for the borrower’s productivity), tangible asset-intensity (i.e., lower cost of debt *ceteris paribus*), and the level of stock and bond market development (the proxies for the strength of minority shareholder and creditor rights). Moreover, consistent with the theoretical predictions, the ownership structure ratio is ambiguously related to the firm-level governance characteristics—such as family ownership, multiple blockholders, and more stringent financial statement standards.

To our knowledge, this is the first article to analyze both theoretically and empirically the joint determination of corporate ownership structure and the cost of debt when control concentration raises creditor risk by facilitating tunneling by dominant shareholders and empowering them to influence post-default debt restructuring. Our empirical results, guided by our theoretical analysis, indicate the significant influence of equity ownership structure and other firm- and country-level characteristics that affect dominant shareholder moral hazard on credit spreads; they also present new evidence on the determinants of control concentration. Our analysis therefore has implications for a variety of literatures.

We highlight tunneling and manipulation of debt restructuring by large shareholders as important sources of corporate credit risk. And, while the literature on incomplete financial contracts typically examines debt renegotiations between creditors and managers or creditors and dispersed shareholders, we present control concentration and the conflict of interests between dominant

and minority shareholders as important factors in distressed negotiations. In particular, we find that the dominant shareholder's optimal bargaining strategy attempts to "pay off" creditors by diluting the claims of minority shareholders.

Our results also complement and significantly extend recent empirical work on the effects of firm- and macro-level characteristics on the cost of debt, such as the strength of creditor rights (Qian and Strahan 2007; Bae and Goyal 2009) and managerial characteristics relating to strategic actions in distressed renegotiations (Davydenko and Strebulaev 2007). However, we present new evidence regarding the effects of firm- and country-level characteristics not only on credit spread *levels* but also on their moderating (or amplifying) influence on control concentration as a credit risk factor. Finally, the empirical effects of market-to-book, default risk, stock market development, and creditor rights on the concentration of control rights (relative to cash-flow rights) have not been hitherto highlighted in the literature.<sup>8</sup>

In the remainder of the article, Section 1 describes the model, and Section 2 analyzes the equilibrium cost of debt and ownership structure. Sections 3, 4, and 5 describe the data, the empirical test design, and the results, respectively. Section 6 provides a summary and concludes.

## 1. The Model

Our model examines the endogenous determination of ownership structure and the cost of debt when control concentration affects both the agency risk of tunneling and the relative bargaining power between the dominant shareholder and creditors during debt renegotiations. But our objective is also to derive expeditiously joint restrictions on the effects of firm- and country-specific factors on ownership structure and the cost of debt that we can empirically test on a sample of international loans. For parsimony, therefore, we do not model many aspects of financial contracting with agency conflicts that have been highlighted elsewhere.

In particular, we fix investment and, therefore, the size of equity capital and loans. Hence, we consider neither credit rationing as a screening device for lenders (Stiglitz and Weiss 1981) nor the effects of debt renegotiation on investment policy (Nini et al. 2009). We also do not endogenize nonpricing characteristics of loan contracts, such as loan maturity (Leland and Toft 1996), restrictive covenants (Chava, Kumar, and Warga 2010), and the number of creditors (Bolton and Scharfstein 1996). However, we argue below that these assumptions are unlikely to affect qualitatively the main refutable predictions

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<sup>8</sup> Demsetz (1983) argues for the endogeneity of equity (or cash-flow) ownership concentration in terms of firm size, the net benefits of monitoring management, and regulation; Demsetz and Lehn (1985) find empirical support for these factors, using profit variability as a proxy for agency costs. Bebchuk (1999) argues that control concentration will be positively related to private benefits from control. Kumar and Ramchand (2008) theoretically and empirically examine the post-listing evolution of control concentration in foreign firms that cross-list on U.S. stock exchanges and do international acquisitions. However, these studies do not consider the interaction between corporate control concentration and the cost of debt.

from the model. Moreover, we check the robustness of our empirical tests with respect to the nonpricing loan characteristics.

### 1.1 Investment, financing, and profits

We consider a publicly owned and unlevered firm whose only investment opportunity is a project that requires a fixed level of investment that we normalize to 1. However, the available funding from the equity owners is only  $H < 1$ . Hence, to undertake the project, the firm requires the debt financing of  $B = 1 - H$ . For simplicity, all decision makers are risk neutral. A riskless asset is available that pays a gross per-period return of  $R_f > 1$ .

The model has three dates:  $t = 1, 2, 3$ . At  $t = 1$ , the firm attempts to obtain debt financing from a competitive lending sector. The project lasts two periods and generates uncertain (operational) cash flows  $\Pi_t = \theta R_t$ ,  $t = 2, 3$ . Here,  $\theta \in [\theta_\ell, \theta_h]$  is a parameter that captures the quality of the firm's investment opportunities and is commonly observable at  $t = 1$ , while  $R_t$  are i.i.d. nonnegative random variables with a density function  $f(R)$  and expected value  $\mathbb{E}[R] \equiv \bar{R} > R_f$ . Project assets depreciate over time: Their net value is  $X_2 < B$  at  $t = 2$ , and they are worthless by the end of  $t = 3$ , when the firm is liquidated.

### 1.2 Control and ownership structure

The firm is controlled by a dominant shareholder ( $S$ ) who initially owns the proportions  $\lambda_0$  and  $v_0$  of the (outstanding) voting and cash-flow rights, respectively, with  $\lambda_0 \gg v_0$ . The initial ownership structure ratio (OSR) is therefore  $\kappa_0 \equiv \lambda_0/v_0$ . At  $t = 1$ , and *prior to* approaching the lenders,  $S$  can alter its ownership proportions to  $(\lambda_1, v_1)$ , resulting in the new OSR  $\kappa_1 \equiv \lambda_1/v_1$ .<sup>9</sup> However, in diluting minority shareholder ownership,  $S$  is restrained by laws that protect the rights of minority shareholders (apart from the adverse impact of the reorganization on the firm's equity valuation). We model the legal constraints through a cost function  $M(\Delta_\lambda, \Delta_v)$ , which applies to  $S$  if it increases its control and cash-flow rights by  $\Delta_\lambda$  and  $\Delta_v$ , respectively.

The project returns ( $\Pi_t$ ) are observed only by insiders, and  $S$  (effectively the "insider") can tunnel an amount  $0 \leq W_t \leq \Pi_t$ . And, consistent with the theoretical and empirical literature on private benefits of control (Grossman and Hart 1988; Harris and Raviv 1988; Jiang, Lee, and Yue 2010), we model the personal tunneling costs through the function  $C(\lambda, W, \Pi)$ , which is increasing in  $W$  but is decreasing in  $\lambda$  and  $\Pi$ .<sup>10</sup>

<sup>9</sup> The ownership structure can be altered in many ways, including the issuance of equity with specific voting and cash-flow rights, private sales of voting stocks, divestment from other companies that have ownership in the firm, and the reclassification of the voting rights of different share classes (Stulz 1988).

<sup>10</sup> There is also evidence that greater control concentration by dominant shareholders lowers the costs of manipulating governance mechanisms. While Claessens et al. (2002) and Lemmon and Lins (2003) provide indirect evidence through the response of market prices to control concentration, Jiang, Lee, and Yue (2010)

### 1.3 Debt contracts and renegotiation

We adopt the following “rules of the game” with respect to the debt contracting. At  $t = 1$ , the firm attempts to borrow  $B$  from a representative lender  $L$  in return for a sequence of promised debt payments  $D_t$ ,  $t = 2, 3$ . (The actual debt payments will be denoted by  $P_t$ ,  $t = 2, 3$ .) At the beginning of  $t = 2$  and 3,  $S$  privately observes  $\Pi_t$  and chooses the tunneling amount  $W_t$ . The firm then reports the earnings  $Y_t = \Pi_t - W_t$ , and debt payments are contractible on these reported earnings. If  $Y_t \geq D_t$ , then there is no default and the net earnings  $Y_t - D_t$  are paid out as dividends to the shareholders.<sup>11</sup> If there is a default, that is,  $Y_t < D_t$ , then  $L$  has the control and cash-flow rights. At the liquidation stage ( $t = 3$ ), there is clearly no role for renegotiation, and  $L$  receives  $P_3 = Y_3$ . But at  $t = 2$ ,  $L$  has the option of either reorganizing the ownership structure through negotiations with  $S$  or liquidating the firm. We represent the firm’s reorganization by  $\delta_2 = (G(Y_3), \lambda_2, v_2)$ , where  $G(Y_3)$  is the lender’s (possibly nonlinear) sharing rule from the (future) earnings  $Y_3$ , and  $\lambda_2$  and  $v_2$  are the new control and earnings shares of  $S$ , respectively.<sup>12</sup>

Our assumption that the main players in the debt renegotiation are (effectively) the controlling shareholder and the creditors is consistent with the large literature (some of which is cited in the Introduction) that documents that controlling shareholders effectively drive the major corporate decisions and are often represented (directly or indirectly) on the management roster. Furthermore, we model the argument that the dominant shareholder’s control concentration will enhance its ability to negotiate effectively with the lender (to influence the outcome toward its own interests) by building on a commonly used approach in the bargaining literature (Hart and Moore 1988, 1998). We assume that with probability  $q(\kappa_1)$ ,  $S$  makes a take-it-or-leave-it offer to  $L$ , while  $L$  makes an offer with the remaining probability, where  $q(\kappa_1)$  is an increasing and concave function with the range  $[q_\ell, q_h] \subseteq [0, 1]$ . Note that, unlike the literature, here the relative bargaining power of the negotiating players is determined *endogenously* through the choice of control concentration *ex ante* by  $S$ . Finally, if the renegotiation offer is rejected by the other party, then the firm is liquidated, and  $L$  receives  $P_2 = Y_2 + X_2$ .

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provide direct evidence. Complementary evidence is provided by the analysis of control premiums (Zingales 1994; Dyck and Zingales 2004).

- <sup>11</sup> This assumption is natural for  $t = 3$ , when the firm is liquidated. But even at  $t = 2$ , this assumption is substantively without loss of generality for the no-default states in our model. Note that *following* the initiation of the project, shareholders face the same alternative investment opportunity as the firm—namely, the riskless asset. Furthermore, earnings are public information and cannot be tunneled. Hence, there is no strategic incentive for  $S$  to retain the earnings in the no-default states at  $t = 2$ .
- <sup>12</sup> This formulation is consistent with post-default restructuring negotiations between borrowers and creditors (Baird and Rasmussen 2006). We will assume implicitly that the dilution of the controlling stakes of  $S$  during the reorganization does not displace him or her completely from the control of the firm. This is consistent with empirical studies (Gilson 1990; Nini, Smith, and Sufi, *forthcoming*), indicating an increased role for creditors in firm governance but typically not the complete ouster of erstwhile insiders. Finally, we assume that the party ( $L$  or  $S$ ) proposing any dilution of minority shareholder rights incurs the costs  $M(\Delta_\lambda, \Delta_v)$ .

## 2. Equilibrium

We will characterize the perfect Bayesian equilibrium of the model set up above. To sharpen the refutable predictions from the model, we parameterize the tunneling cost function using a quadratic specification, which can be viewed as a second-order approximation for a general cost function specification (Lau 1974):

$$C(\lambda, W, \Pi) = -\lambda W + \frac{\phi W^2}{2\Pi}. \tag{1}$$

Here,  $\phi$  is a “strength of corporate governance” parameter. Thus, the marginal tunneling costs, that is,  $(-\lambda + \phi \frac{W}{\Pi})$ , are decreasing in the dominant shareholder’s control stakes ( $\lambda$ ) but increasing in the proportion of the cash flows tunneled ( $W/\Pi$ ). We will consider the more economically interesting case where the direct costs of tunneling  $\phi$  are not too low and complete expropriation of cash flows is suboptimal.

To facilitate intuition on the effects of ownership structure on the payoff risk to  $L$ , we examine the *unconstrained* optimal tunneling policy—that is, the maximal amount  $S$  will optimally tunnel away for a given  $(\Pi, D)$  without considerations of avoiding default. This policy maximizes the tunneled amount net of the direct and indirect equity costs

$$\max_{0 \leq W \leq \Pi} [W - C(\lambda, W, \Pi) + v \max(\Pi - W - D, 0)]. \tag{2}$$

Given the quadratic tunneling costs (1), the solution to (2) is piecewise linear in earnings  $\Pi$ . Let  $A^\ell(\kappa, v) \equiv (\frac{v}{\phi})(\frac{1-v}{v} + \kappa)$  and  $A^h(\kappa, v) \equiv A^\ell(\kappa, v) + \frac{v}{\phi}$ . The unconstrained optimal tunneling is

$$\bar{W}(\Pi, D; \kappa, v) = \begin{cases} A^\ell(\kappa, v)\Pi & \text{if } \Pi(1 - A^\ell(\kappa, v)) \geq D \\ A^h(\kappa, v)\Pi & \text{if } \Pi(1 - A^\ell(\kappa, v)) < D \end{cases}. \tag{3}$$

Consistent with intuition, a greater proportion of cash flows is tunneled with higher leverage (relative to the cash flows).<sup>13</sup> But for each  $(\Pi, D)$ , the optimal tunneling is increasing in the OSR ( $\kappa$ ) and decreasing in the cash-flow stakes of  $S$  ( $v$ ). Now, at the liquidation stage,  $S$  will clearly use the unconstrained optimal tunneling policy. Therefore,

**Proposition 1.** The equilibrium expected payoffs to the lender at liquidation are negatively related to the ownership structure ratio ( $\kappa_2$ ), but they are positively related to the dominant shareholder’s cash-flow stakes ( $v_2$ ).

<sup>13</sup> Note that  $A^h(\kappa, v) < 1$  if  $\phi > 2$  since we can rewrite  $A^h(\kappa, v) = \frac{1+\lambda}{\phi}$ , which is clearly less than 1 if  $\phi > 2$  (since both  $\lambda$  and  $v$  are between 0 and 1).

Next, at  $t = 2$ , the optimal tunneling policy will depend on the equilibrium outcome following a default, which we now analyze. For tractability, we parameterize the costs for increasing the dominant shareholder's stakes as

$$M(\Delta_\lambda, \Delta_v) = 0.5 \left[ \beta_\lambda (\Delta_\lambda)^2 \mathcal{I}_\lambda + \beta_v (\Delta_v)^2 \mathcal{I}_v \right], \tag{4}$$

where  $\mathcal{I}_\lambda$  and  $\mathcal{I}_v$  are indicator variables that take a value of 1 if  $\Delta_\lambda$  or  $\Delta_v$  are positive, and 0 otherwise.

Following a default at  $t = 2$ , it is optimal for  $L$  to take any reported earnings  $Y_2$  because there is no investment financing needed by the firm. Moreover, in the renegotiation equilibrium, each player's offer will drive the opposing player to its threat point, which is the value of assets ( $X_2$ ) for  $L$  and zero for  $S$ . Thus,  $L$  will choose  $\delta_2^{L*} = (G^{L*}(Y_3), \lambda_2^{L*}, v_2^{L*})$  to maximize its expected payoffs, taking as given the optimal tunneling policy of  $S$  at  $t = 3$  and the dilution costs  $M$ . This policy extracts the reported earnings of the firm—that is,  $G^{L*}(Y_3) = Y_3$  because the marginal net benefits of leaving residual cash flows for shareholders are negative for  $L$ . Moreover, from  $L$ 's perspective the optimal control stakes for  $S$  are  $\lambda_2^{L*} = 0$ . And, while *in general* the lender may want to raise the dominant shareholder's cash-flow share ( $v_2$ ) to increase the indirect equity costs of tunneling at  $t = 3$ , the choice of  $v_2$  is irrelevant if  $G^{L*}(Y_3) = Y_3$ . Therefore, without loss of generality,  $v_2^{L*} = v_1$ . Finally,  $L$ 's expected payoffs from  $\delta_2^{L*}$  at  $t = 3$  are  $[\theta \bar{R}(\phi - 1)]/\phi$ ; therefore,  $L$  will reorganize only if the firm's productivity is sufficiently high—that is,  $\theta \geq [\phi X_2 R_f / \bar{R}(\phi - 1)]$ .

**Proposition 2.** For  $\theta$  sufficiently high, the lender's optimal offer, which is accepted by the dominant shareholder, extracts the entire reported earnings at  $t = 3$  (i.e.,  $G^{L*}(Y_3) = Y_3$ ), and modifies the ownership structure so that  $\lambda_2^{L*} = 0$ ,  $v_2^{L*} = v_1$ .

Meanwhile,  $S$  will choose  $\delta_2^{S*} = (G^{S*}(Y_3), \lambda_2^{S*}, v_2^{S*})$  to maximize its expected net payoffs subject to the constraint that  $L$  be indifferent between continuation and liquidation. It turns out that  $G^{S*}(Y_3)$  is linear (i.e.,  $G^{S*}(Y_3) = \alpha^S Y_3$ ) because both  $S$  and  $L$  are risk neutral and there are no monitoring transaction costs. Furthermore,  $S$  increases its control and cash-flow stakes to the detriment of minority shareholder interests.

**Proposition 3.** For  $\theta$  sufficiently high, the dominant shareholder offers an earnings share  $0 < \alpha^S \leq 1$  to the lender to keep it indifferent between continuing and liquidating the firm, and raises the ownership stakes to  $\lambda_2^{S*} = \min(\lambda_1 + \frac{\alpha^S \theta \bar{R} - X_2 R_f}{\alpha^S \beta_\lambda}, 1)$  and  $v_2^{S*} = \min(v_1 + \frac{(1 - \alpha^S) X_2 R_f}{\alpha^S \beta_v}, 1)$ .

The optimal  $\alpha^S$  is increasing in the lender's threat point  $X_2$  but is decreasing with the expected cash flows  $\theta \bar{R}$ . (Indeed, successful renegotiation is possible

only if  $\theta$  is sufficiently high.) And  $\lambda_2^{S^*} > \lambda_1$  because  $\alpha^{S^*}\theta\bar{R} > X_2R_f$  (since  $\alpha^{S^*}Y_3 = X_2R_f$ ) and  $v_2^{S^*} > v_1$  (unless  $\alpha^{S^*} = 1$ ). Not surprisingly, the increase in the dominant shareholder's ownership during the renegotiation is moderated by the costs of diluting minority shareholder ownership.

Building on Propositions 2 and 3, we can characterize the dominant shareholder's optimal tunneling policy at  $t = 2$ . There exist  $D_2 \leq \Pi'_2(\theta) < \Pi''_2$  such that the firm defaults at  $t = 2$  whenever  $\Pi_2 < \Pi'_2(\theta)$ , and  $S$  tunnels away its unconstrained optimal amount. But there is no default whenever  $\Pi_2 \geq \Pi'_2(\theta)$ . If  $\Pi_2 \leq \Pi'_2 < \Pi''_2$ , then  $S$  tunnels an amount that just avoids default. But if  $\Pi_2 \geq \Pi''_2$ , then  $S$  again tunnels the unconstrained optimal amount. Thus, for an intermediate range of cash flows,  $S$  voluntarily restricts tunneling to avoid default.

**Proposition 4.** The equilibrium default probability at  $t = 2$  is positively related to the ownership structure ratio  $\kappa_1$  but is negatively related to the dominant shareholder's cash-flow stakes  $v_1$ . And, conditional on a default, the lender's expected payoffs from renegotiation are negatively related to the ownership structure ratio.

We can now relate the equilibrium cost of debt to the parameters of the model.

### 2.1 Cost of debt

The lender's equilibrium present value of expected payoffs when the productivity is  $\theta$  and promised payments are  $D_t, t = 2, 3$ , is  $V_1^L(D_2, D_3; \theta) = \sum_{t=2}^3 \mathbb{E}[P_t^* | \theta] / R_f^{t-1}$ . The existence of a competitive and risk-neutral lending sector implies that the equilibrium condition for the debt payments is  $V_1^L(D_2, D_2; \theta) = B$ . We will measure the equilibrium cost of debt by the implied return over the risk-free rate—namely,  $\gamma^* \equiv (D_2R_f + D_3) / (BR_f^2)$ . The equilibrium cost of debt  $\gamma^*$  is positively related to  $\kappa_1$  because raising the OSR lowers expected payoffs in two ways: The default probability increases in both periods, and the payoffs *conditional* on a default are also lower. Conversely, raising the cash-flow stakes of  $S$  (i.e.,  $v_1$ ) increases the implicit costs of tunneling and hence the expected payoffs.

**Theorem 1.** The equilibrium cost of debt  $\gamma^*$  is positively related to the ownership structure ratio  $\kappa_1$  and negatively related to the dominant shareholder's cash-flow stakes  $v_1$ .

In addition, raising productivity  $\theta$  lowers the cost of debt  $\gamma^*$  *ceteris paribus* because, first, higher productivity improves the probability distribution of cash flows in the sense of first-order stochastic dominance, and second, the dominant shareholder's incentives for tunneling are negatively related to  $\theta$ .

The effects of raising the expected returns  $\bar{R}$  are similar, while the negative relationship between  $\gamma$  and the value of the recoverable assets ( $X_2$ ) follows straightforwardly.

Turning to the corporate governance and investors' rights-related parameters, raising the marginal tunneling costs  $\phi$  in (1) lowers optimal tunneling by  $S$  and thus reduces  $\gamma^*$  unambiguously. And, conditional on  $(\kappa_1, v_1)$ , the costs of minority shareholder dilution ( $\beta_v, \beta_\lambda$ ) are potentially relevant to the lender's payoffs only if there is renegotiation. But Proposition 2 indicates that  $L$ 's optimal equity ownership structure does not involve  $(\beta_v, \beta_\lambda)$ , while Proposition 3 shows that if  $S$  makes the offer, then the present value of expected payoffs for  $L$  is just  $X_2$ .<sup>14</sup> Thus, in our model, because the ownership structure  $(\kappa_1, v_1)$  is known at the time of the debt contract,  $\gamma^*$  is *unaffected* by the costs of diluting minority shareholder interests during debt renegotiations.

**Theorem 2.** The equilibrium cost of debt  $\gamma^*$  is negatively related to the capital productivity ( $\theta$ ); the expected investment return ( $\bar{R}$ ); the value of recoverable assets ( $X_2$ ); and the marginal tunneling costs ( $\phi$ ).

### 2.2 Equilibrium ownership structure

At  $t = 1$ , if  $S$  raises the OSR  $\kappa_1$  to reduce the tunneling costs and increase its bargaining power in renegotiations with creditors, then it also suffers higher agency costs of debt. Hence,  $\theta$  will be positively related to the optimal ownership structure  $\kappa_1^*$  because (i) raising  $\kappa_1$  has a smaller upward effect on the equilibrium cost of debt for more productive firms, (ii) more productive firms can "tolerate" a higher cost of debt if one keeps fixed the expected payoffs to  $S$ , and (iii) the marginal benefits (for  $S$ ) of higher control stakes on the expected tunneled amount are increasing with  $\theta$ . A similar reasoning applies to the influence of  $\bar{R}$  and  $X_2$  on  $\kappa_1^*$ . Next, raising the costs of minority shareholder dilution ( $\beta_v, \beta_\lambda$ ) makes upward adjustments of the initial ownership structure more costly for  $S$ . However, the effects of varying  $\phi$ , the marginal costs of tunneling, on  $\kappa_1^*$  are ambiguous for reasons mentioned in the Introduction.

**Theorem 3.** The equilibrium ownership structure ratio  $\kappa_1^*$  is positively related to productivity  $\theta$ ; the expected return  $\bar{R}$ ; and the value of recoverable assets  $X_2$ . However, it is non-positively related to the costs of minority shareholder dilution ( $\beta_v, \beta_\lambda$ ).

### 2.3 Robustness of predictions

The laws governing the renegotiation process vary across countries with differing allocations of bargaining power between creditors and equity holders.

<sup>14</sup> In other words, while raising the costs of diluting minority shareholder stakes may constrain  $S$  from raising its voting ownership (and lowering the tunneling costs), the lender does not benefit from the reduced moral hazard, because  $S$  extracts the surplus when it makes the offer.

Therefore, we check the predictions of the model with respect to the Nash (1950) bargaining solution in the debt renegotiation process. In Appendix B, we indicate that the comparative statics results of Theorems 1–3 are robust to this alternative bargaining equilibrium. Moreover, while we have assumed that investment is fixed, the predicted effects of ownership structure on the cost of debt and the other comparative statics will hold as long as investment efficiency is not positively related to the deviation of control from cash-flow ownership of the dominant shareholder, which is consistent with the arguments in the literature (Stulz 1988; McConnell and Servaes 1990; Claessens et al. 2002). Finally, allowing creditors to manage payout risk through modifications of loan size, maturity, or attached covenants will affect the magnitude but not the sign of the comparative statics.

In summary, Theorems 1–3 provide refutable predictions with respect to the OSR and the cost of debt that can be taken to the data. We do so in the remainder of the article. In the next section, we describe our data and the sample selection and the empirical measures. In the following section, we discuss the empirical framework and identification, and in the succeeding section we report the empirical results.

### 3. Data and Empirical Proxies

#### 3.1 Sample construction

Claessens et al. (2002) examine the effects of dominant shareholders on the cost of equity for a sample of East Asian countries, while Faccio and Lang (2002) do so for a sample of Western European countries. To facilitate comparisons with this literature, we choose our sample countries to match those considered by Claessens et al. (2002) and Faccio and Lang (2002).

We construct our data using several sources. We obtain loan data from the Loan Pricing Corporation's (LPC) Dealscan database for January 1996 through December 2007. We begin our sample in 1996 because the loan data prior to this date are very sparse for deals originating outside the United States. However, the non-U.S. coverage has grown steadily during the past decade.<sup>15</sup> All our sample loans are floating-rate instruments. As is usual in the literature, we exclude firms in the financial (SIC 6) and the public sectors (SIC 9). After merging the databases, there are 3,605 loan facilities for our sample countries from 1996 through 2007.

We use Worldscope and ORBIS (provided by Bureau Van Dijk) for firm-specific characteristics. We hand match the borrowers in LPC to Worldscope and ORBIS. (We convert all financial values to nominal U.S. dollars.) We collect information on multiple classes of voting rights and the ownership structure of companies from several sources: ORBIS for information on the

<sup>15</sup> The number of loan contracts covered for our sample countries increased from 144 in 1990 to 7,090 in 2007, with the value of syndicated loans increasing from \$74 billion to over \$5.8 trillion.

ownership structure of both private and public companies as well as their financials; LEXIS/NEXIS (the major companies' database); Mergent/Moody's International Manual; Thompson Financial's Extel Cards; and Worldscope and Datastream International. The ownership identification process is complicated when registered shareholders are nominee/custodian companies and hold shares on behalf of other entities—including financial institutions—but are not themselves beneficial owners of the shares. This occurs for a large number of firms in our sample. Our data sources allow us to directly access the annual company reports, through which we identify the ultimate owner of the nominee accounts for a large number of firms; this type of information is usually not available in the handbooks used in earlier ownership studies. The result is an ownership structure data set that, uniquely in the literature, tracks the evolution of the ownership rights dynamically. We find a significant evolution in the ownership structure of sample firms, abetted by the merger and acquisition waves that have swept over world markets in the past decade.<sup>16</sup>

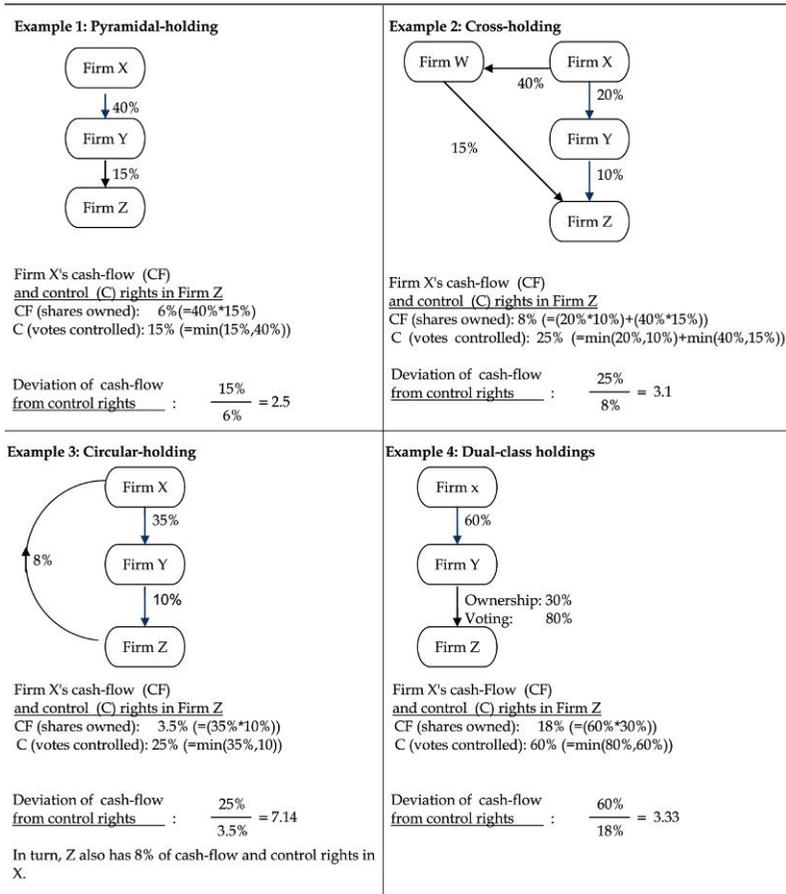
We obtain macro data on financial market development, such as bond market capitalization, from the Bank of International Settlements' Quarterly Review and the World Development Indicators (published by the World Bank). Finally, the data on minority shareholder and creditor rights and other country-level variables related to dominant shareholder monitoring are taken from a variety of sources that we identify below.

## 3.2 Empirical measures

**3.2.1 The cost of debt.** Our data are in the form of loan facilities  $i = 1, 2, \dots, n$ , with their originating dates  $t = 1, 2, \dots, T$ . We measure the cost of debt in terms of the loan spread (in basis points) at the time of origination, which is calculated against the benchmark rate that is specified in the loan agreement.<sup>17</sup> The cost of debt ( $\gamma_{it}$ ) is the (logarithm of the) “drawn all-in-spread” above the benchmark ( $AISD$ ) at the time of loan origination; this is the standard loan pricing variable used in the bank financing literature (see Guner 2006). Because corporate bank loans are almost invariably floating-rate instruments, this spread represents the markup over the benchmark rate (typically LIBOR) and is paid by the borrower on all drawn lines of credit. Our test design controls for the differences in the benchmark rates.

<sup>16</sup> For instance, the Belgian Frère Group is dominated by the Frère-Bourgeois company, which is privately held and controlled (with 100% ownership) by Albert Frère and his family. We traced twenty-one companies under the ultimate control of this family in 1996, twenty-eight companies in 1999, and twenty-three companies in 2005. Overall, the OSR decreased from 15.4 in 1996 to 7.8 in 1999 and to 6.1 in 2005—that is, there was an approximately 40% decline in the OSR from 1996 to 2005. There are many other such examples in our sample.

<sup>17</sup> There are a variety of benchmark rates used in our sample. While the London Interbank Offered Rate (LIBOR) and the Euro Interbank Offered Rate (EURIBOR) are the benchmark rates for over 80% of the sample loans, the other benchmark rates are the money market rate and the Hong Kong, Singapore, and Tokyo Interbank Offered Rates (HIBOR, SIBOR, and TIBOR, respectively).



**Figure 2**  
**Calculating control and cash-flow rights**

This figure illustrates our basic methodology of calculating the control and cash-flow rights through various examples that depict common ownership patterns in our data.

**3.2.2 Ownership and control characteristics.** We follow the literature (see Claessens, Djankov, and Lang 2000) in the calculation of control and cash-flow ownership rights. We illustrate the basic methodology through examples in Figure 2. For each sample firm-year, we search for the largest single owner of voting rights. If this shareholder owns at least 10% of the firm's voting rights, we identify it as the dominant shareholder (for that firm-year). We consider a firm to be widely held (in a given year) if it does not have any shareholder with control rights at or above this threshold level.<sup>18</sup> We measure

<sup>18</sup> The 10% share-ownership threshold is commonly used in this literature (e.g., Claessens et al. 2002; Doidge et al. 2009). However, our results are robust to alternative thresholds; for example, we used a 20% share-ownership threshold with similar results.

the OSR  $\kappa_{it}$  directly by the control-to-cash ownership ratio of the dominant shareholder (*ControlCashRatio*) of the firm with loan  $i$  originating at  $t$ . For analytic tractability, we have used a quadratic tunneling cost function that yields an optimal tunneling policy that is linear in  $\kappa$ . But our empirical test design will be flexible to allow for nonlinear effects of control concentration. We therefore create a dummy variable (*ControlCashH*) that is triggered if the OSR is in the top quintile. Similarly, we measure  $v_{it}$  directly by the cash-flow stakes of the dominant shareholder (*CashFlowRights*).

**3.2.3 Independent factors.** Following the corporate finance and asset pricing literatures, we use the ratio of the firm's market-to-book equity (*Market-to-book*) as a proxy for the quality of the investment opportunity set ( $\theta$ ). Because the expected investment returns are forward-looking, we use the firm's stock market returns (*MktRet*) as a proxy for  $\bar{R}$ . And we use the firm's ratio of tangible-to-total assets (*Tangibles*) as a proxy for the recoverable assets ( $X$ ). Next, we empirically proxy the project return distribution function (related to the liquidity default risk) by Altman's Z-score (Altman 1968, 2000), which is negatively associated with default risk and is frequently used in the literature.<sup>19</sup> We also use an indicator for investment-grade credit rating of the borrower (with S&P rating of BBB– and higher) (*Ratings*).

To relate the corporate governance and investor rights parameters of the model to the data, we use a variety of measures that are motivated by the literatures on corporate governance and law and finance. The country-level variables are:

*Legal Origin:* The legal origin of countries is a major determinant of the legal protection of minority shareholder and creditor rights and is correlated with control concentration and ownership structure at the firm level (La Porta et al. 1998; La Porta, Lopez-de-Silanes, and Shleifer 1999). La Porta et al. (1998) find that countries with the common-law origin have better investor protection and more developed economies than countries with civil-law origin. We use a dummy variable that equals 1 if the legal origin is common law, and 0 otherwise.

*Creditor Rights:* The literature employs an index of creditor rights (La Porta et al. 1998; Qian and Strahan 2007; Bae and Goyal 2009); this index is recorded on a scale from zero to four, with a higher score indicating better protection of creditors.

*Financial Market Development:* The literature argues that the strength of investor rights is positively associated with the level of financial market development (La Porta et al. 1998). We use the level of stock and bond market

<sup>19</sup> Recent studies that use the Altman Z-score as a measure of default risk include Bharath, Acharya, and Srinivasan (2007), Santos and Winton (2008), and Chava, Livdan, and Purnanandam (2009). We use the specification in the Altman (1968) model but also check the extension to emerging markets (Altman 2000) for robustness. Since the Z-score uses profitability and earnings information in its computation, we also run our tests excluding those variables from regression specifications. Our results are robust.

development in the country; the former is measured by the ratio of the market capitalization of public firms to the GDP (*StockMktDev*), while the latter is the ratio of the public and private bond capitalization to the GDP (*BondMktDev*).

*Disclosure Index:* The strength of investor rights should presumably be positively related to that of the disclosure requirements. We measure the strength of a country's disclosure regulations using the disclosure index from a new securities law database compiled by La Porta, Lopez-de-Silanes, and Shleifer (2006), with a higher value indicating more stringent disclosure requirements.<sup>20</sup>

*Ownership Threshold:* In most countries there is a threshold level of equity ownership beyond which a blockholder must reveal its identity. For example, the threshold is 2% for Portugal and Italy; 3% for Ireland and the United Kingdom; and 5% for South Korea, Thailand, Hong Kong, Denmark, and France. Presumably the strength of minority shareholder rights will be negatively correlated with this threshold. We hand collect the threshold data from several sources.<sup>21</sup>

*Efficiency of Debt Enforcement:* We use the "time to payment" measure constructed by Djankov et al. (2008) to proxy for the efficiency of debt enforcement. This is the estimated duration, in years, from the moment of a firm's default to the time when the creditor gets paid in each country.

*Earnings Management (EM) Measure:* Leuz, Nanda, and Wysocki (2003) document a link between insiders' incentives to consume private control benefits and financial reporting practices. They examine earnings management practices in thirty-one countries and show that firms in countries with poor investor protection are associated with more earnings management (i.e., less informative financial statements). We employ a composite measure of earnings management by combining four measures: the extent of income smoothing, the magnitude of total accruals, correlation between changes in accruals and cash flows, and small loss avoidance.

*Information Sharing:* We also flag the presence of information sharing bureaus (either a public registry or a private bureau) in the country by a dummy variable.

For the firm-level governance or agency-related variables, we use:

*Family Ownership:* There are conflicting views on the effects of family ownership on controlling shareholder moral hazard. While La Porta, Lopez-de-Silanes, and Shleifer (1999), Claessens, Djankov, and Lang (2000), and Fan and Wong (2002) suggest that family ownership weakens governance, Anderson, Mansi, and Reeb (2003) suggest that family ownership lowers the

<sup>20</sup> This database is based on a survey of securities law attorneys from forty-nine countries, and La Porta, Lopez-de-Silanes, and Shleifer (2006) gauge the strength of disclosure requirements in six areas: (i) prospectus delivery, (ii) insiders' compensation, (iii) ownership structure, (iv) insider ownership, (v) irregular contracts, and (vi) transactions with related parties such as the issuer, its directors, and large shareholders.

<sup>21</sup> These include the corporate governance code of individual countries, Schouten and Siems (2010), and working documents from the Commission for European Communities (2008).

agency cost of debt. We identify family firms in our sample whenever a family founder is still involved with the control of the firm.

*Second Blockholder:* The literature also presents conflicting views on the effects of second blockholders on agency costs. Faccio, Lang, and Young (2001) argue that the presence of a second blockholder can aggravate agency risk, while Edmans and Manso (2010) suggest that multiple blockholders can alleviate this agency problem because of better monitoring of the dominant shareholder. We identify the presence of a *second* blockholder with at least 10% of voting rights. (If there are more than two blockholders with greater than 10% voting ownership, we take the one with the second highest controlling stakes.)

*Affiliation with Lenders:* The net benefits of tunneling (for the dominant shareholder) will arguably be lower for firms that are *affiliated* with (some of) the lending institutions in the syndicate. We identify borrowers as *Affiliated* if they belong to a business group that also controls one or more banks in the loan syndicate.

*Domestic Lenders:* Lead banks that are in the same country as the borrower may have informational and knowledge-based advantages (relative to foreign lead banks). We identify those loans where one of the lead banks is from the same country as the borrower (*Domestic*).

**3.2.4 Other control variables.** For tractability, in our model we ignore existing leverage (other than the loan at hand) and the presence of internal financing sources. These characteristics obviously influence loan prices. Our empirical tests (on the determinants of loan prices) therefore control for these variables. For leverage, we use the firm's debt-to-assets ratio (*Leverage*). For internal financing sources, we use earnings normalized by the total assets—that is, the ratio of the EBITDA-to-total assets (*Earnings*)—but our results are robust to alternative liquidity measures. For nonpricing loan characteristics, we normalize loan (or deal) size with the firm's leverage (*LoanSize*); use the natural logarithm of the maturity (*Log(Maturity)*); use other control variables to address the heterogeneity of loan-types in the data, including whether loans are secured (*Secured*); and control for syndicate size (*SyndicateSize*) to allow for risk-pooling effects on loan price. Finally, we include the Fama and French (1997) industry dummies and currency (domestic or foreign) choice of the loan contract (*Currency*).<sup>22</sup>

<sup>22</sup> Previous studies, such as Angbazo, Mei, and Saunders (1998), find that loan prices vary with the purpose of the loan. We classify the primary purpose of loans into four groups: debt repayment, general corporate purposes, financing acquisitions, and commercial paper backup. Moreover, we identify loans used to finance long-term investments (term loans). We control for stated loan purpose and term loans in all our regressions. And, consistent with the literature, we control for the log of the gross domestic product of the borrower's country. Finally, we control for the benchmark rate (LIBOR, EURIBOR, etc.) used in a loan agreement. However, to save space, we do not tabulate these results (and those for the industry dummies).

### 3.3 Sample characteristics

In Table 1, Panel A reports salient loan and borrower characteristics, while Panel B reports ownership characteristics of the borrowers. The average loan size in the European countries is substantially higher than that in the Asian countries. The variations in loan sizes do not appear related to the level of economic development or whether the country has a market-based (e.g., the United Kingdom) versus bank-based (e.g., Japan) economy. Loan syndicates in European countries also tend to have a higher number of participants than those in Asian countries. There is a wide variation in the average loan spreads and maturities across countries, but there appears to be no systematic trend in terms of geographic dispersion or the level of development; similar comments apply to the average leverage and returns-to-assets of the borrowing firms. However, the average market capitalization of the European firms is significantly higher than that of the Asian firms (except Japan).

Examining Panel B, we find that the average control-rights ownership (among all the shareholders) is significant for all the sample countries—ranging from 9% in Japan to 58% in France. Moreover, the control stakes exceed the cash-flow stakes for a significant fraction of companies in a majority of the sample countries. We note that the OSR exceeds 1 for at least 10% of the sample companies in sixteen (out of twenty-two) countries in the sample; this fraction reaches over 80% for countries as varied as Belgium and Indonesia. Thus, our sample reinforces earlier studies in highlighting the extent of the controlling shareholder agency risk globally. But there is significant cash-flow ownership by insiders and institutional owners as well, with European firms exhibiting appreciably higher institutional ownership than Asian firms. Finally, there is wide variation regarding the presence of a second blockholder.

## 4. Empirical Framework and Identification

Our empirical test design is guided by the theoretical framework of Section 3, in particular the predictions of Theorems 1–3. But, to account for factors not considered explicitly in our model, our empirical tests will allow for the presence of latent factors in the determination of ownership structure and the cost of debt. Our basic empirical specification for the joint determination of the cost of debt and the ownership structure is

$$\gamma_{it} = \kappa_{it}A + z_{it}^{\gamma}B + \Phi_{it} + \varepsilon_{it} \quad (5)$$

$$\kappa_{it} = z_{it}^{\kappa}C + \Phi_{it} + \nu_{it}. \quad (6)$$

Here,  $z_i^{\gamma}$  and  $z_i^{\kappa}$  are the vectors of observable exogenous variables (with the first entry of 1) that are the covariates in the regression equations for  $\gamma_i$  and  $\kappa_i$ , respectively;  $\Phi_i$  is the vector of unobservable common factors that influences both  $\gamma_i$  and  $\kappa_i$ ;  $A$ ,  $B$ , and  $C$  are vectors of unknown parameters; and  $(\varepsilon_i, \nu_i)$  are unobservable firm-specific error terms. Specifically,  $z_{it}^{\gamma}$  includes the

**Table 1**  
**Descriptive statistics**

**Panel A: Loan and Firm Characteristics**

Country	Number of loans	Number of lenders	Loan Maturity (months)	Loan Spread (bps)	Loan Facility (\$millions)	Market Cap. (\$millions)	Debt/Assets	ROA (%)
Austria	6	11.33	71.8	23.75	683.45	3037.4	0.19	0.07
Belgium	24	10.04	45.7	39.33	952.65	2592.5	0.26	0.09
Finland	53	10.28	64.4	36.12	868.06	2359.8	0.34	0.10
France	446	13.28	61.8	115.53	1,466.04	2602.7	0.31	0.08
Germany	306	15.14	61.2	131.46	3,633.59	3876.2	0.23	0.09
Hong Kong	665	3.97	52.3	59.85	82.94	2092.7	0.29	0.02
Indonesia	33	10.01	54.9	206.25	493.02	568.8	0.68	0.05
Ireland	60	7.79	63.2	220.56	2,018.12	3013.0	0.43	0.02
Italy	93	14.61	47.1	85.59	5,473.40	3673.9	0.39	0.07
Japan	1838	6.19	40.2	38.99	269.12	2763.0	0.34	0.09
South Korea	591	5.36	60.2	70.76	257.92	491.0	0.42	0.08
Malaysia	201	4.06	67.3	78.94	102.29	273.4	0.36	0.03
Norway	136	6.76	64.9	112.99	407.85	1244.8	0.41	0.01
Philippines	190	5.69	67.7	185.21	318.83	420.2	0.43	0.02
Portugal	9	14.40	28.8	43.50	644.72	2474.6	0.42	0.01
Singapore	183	3.96	49.1	77.33	160.46	953.8	0.37	0.03
Spain	127	14.31	63.7	104.40	2,085.73	1145.4	0.25	0.07
Sweden	133	9.65	63.9	113.08	509.40	1646.9	0.30	0.11
Switzerland	57	11.92	48.3	91.88	1,106.92	4157.8	0.36	0.10
Taiwan	346	7.69	61.3	93.50	11.18	1374.2	0.37	0.09
Thailand	243	6.05	72.3	24.66	173.91	331.7	0.53	0.04
United Kingdom	1474	8.75	58.5	138.70	1,773.94	4414.4	0.20	0.13

**Panel B: Ownership Characteristics**

Country	Control Rights	CashFlow Rights	Control > CashFlow	Second Blockholder	% Holdings by Insiders	% Holdings by Institutions
Austria	0.43	0.43	0.00	0.67	14.64	18.25
Belgium	0.40	0.28	0.83	0.13	15.86	14.88
Finland	0.44	0.38	0.51	0.35	18.11	22.63
France	0.58	0.57	0.08	0.05	20.40	15.28
Germany	0.47	0.42	0.33	0.17	26.31	16.02
Hong Kong	0.25	0.24	0.11	0.84	28.19	13.41
Indonesia	0.26	0.14	0.81	0.79	8.179	15.22
Ireland	0.41	0.40	0.01	0.00	10.92	31.82
Italy	0.52	0.32	0.74	0.08	17.24	14.97
Japan	0.09	0.06	0.61	0.35	9.830	17.23
South Korea	0.23	0.19	0.26	0.44	28.79	10.55
Malaysia	0.38	0.33	0.23	0.96	30.88	14.58
Norway	0.46	0.36	0.42	0.20	7.662	26.03
Philippines	0.28	0.22	0.47	0.89	12.82	11.91
Portugal	0.35	0.35	0.00	0.22	8.289	18.34
Singapore	0.28	0.19	0.71	0.86	27.46	17.00
Spain	0.42	0.41	0.06	0.06	33.39	25.28
Sweden	0.24	0.17	0.38	0.02	17.26	28.38
Switzerland	0.31	0.27	0.24	0.25	16.86	20.15
Taiwan	0.22	0.19	0.35	0.68	11.11	6.729
Thailand	0.45	0.45	0.03	0.79	25.93	10.77
United Kingdom	0.24	0.21	0.22	0.01	15.69	39.31

This table provides averages of some salient loan and ownership characteristics for our sample consisting of nonfinancial and non-public-sector corporations from thirteen European and nine East Asian countries during 1996–2007. Panel A reports the loan and borrower characteristics, while Panel B reports the ownership characteristics of the borrowers. *Maturity* is the average loan term (in months); *Loan Spread* is the average spread above the benchmark rate; *Facility* is the loan amount; *CashFlow Rights* and *Control Rights* are the equity ownership and the voting rights held by the dominant blockholder, respectively; and *Second Blockholder* is a dummy that equals 1 if there is another blockholder with at least 10% of voting rights.

independent factors in Theorems 1 and 2, along with the firm- and loan-specific control variables (cf. Section 3.2.4); and  $z_{it}^K$  includes the factors in Theorem 3.

For the identification of the relationship between the OSR  $\kappa$  and the cost of debt  $\gamma$ , we employ two estimation methodologies. We use the information contained in the higher-order moments (of the joint distribution of the observed regression variables) to estimate the system (5)–(6) with the GMM, and we use instrumental variables (IV) related to the ownership structure and investor rights.

#### 4.1 Estimation using higher-order moments

Following Lewbel (1997), Dagenais and Dagenais (1997), and Erickson and Whited (2000, 2002), we use the information contained in the third- and higher-order moments of the joint distribution of the observed regression variables. This approach (which we call EW-GMM) controls for the presence of common latent determinants of the cost of debt and the OSR, and it is robust to nonsymmetric distributions. We summarize the approach here but provide details in Appendix C.

Returning to (5)–(6), we let  $z_i = (z_i^\gamma, z_i^K)$ . Then, under the assumptions that (i) the random errors  $\varepsilon_i$  and  $v_i$  have mean zero and variances  $\sigma_\varepsilon^2$  and  $\sigma_v^2$ , respectively, (ii)  $\varepsilon_i$  and the elements of  $z_i$ ,  $\Phi_i$ ,  $v_i$  have finite moments of every order, (iii)  $(z_i, \Phi_i, \varepsilon_i, v_i)$  are i.i.d. for every  $i$ , and (iv)  $\mathbb{E}[(z_i, \Phi_i)'(z_i, \Phi_i)]$  is positive definite, we obtain GMM estimates for each year and combine them using the MDE (minimum distance error) method (cf. Erickson and Whited, 2000, 2012).<sup>23</sup> Following usual practice, we perform inference by calculating standard errors based on Hansen (1982) and through the GMM  $J$ -test of overidentifying restrictions.

#### 4.2 Estimation using instrumental variables

The effect of ownership structure (in particular, the ratio of the control-to-cash-flow stakes of the dominant shareholder) on the firm's cost of debt is of central interest to our study. We therefore supplement the EW-GMM estimation by using IVs related to the ownership structure and investor rights; these tests provide additional evidence on the statistical and economic significance of the effects of ownership structure on the cost of debt. We employ four country-level instruments that are exogenous and have been shown in the literature to be correlated with minority shareholder and creditor rights. These instruments (which have been described above) are legal origin; ownership threshold; disclosure index; and the efficiency of debt enforcement. Our tests of significance use the heteroscedasticity-consistent standard errors of White (1980).

<sup>23</sup> Using Monte Carlo simulations, Almeida, Campello, and Galvez (2010) argue that the EW-GMM estimator can sometimes underperform IV-based estimators in the presence of fixed effects and heteroscedasticity. Erickson and Whited (2012) present a response to Almeida, Campello, and Galvez (2010). However, to ensure reliable estimation and inference, we use both estimation methodologies.

In addition to these IVs, we also use the [Arellano and Bond \(1991\)](#) approach for IV variables estimation using GMM (the AB-GMM estimator). Because the AB-GMM is a panel estimator, we use the lagged values of the dominant shareholder's control-to-cash ratio as an IV for the first-differenced version of the model (5)–(6). This procedure helps eliminate the persistent components of the latent or unobservable variables and the error terms (see, e.g., [Gavazza 2011](#)).

## 5. Results

For ease of exposition, and to highlight the interaction between the ownership structure and the cost of debt, we first estimate (5)–(6) with a base specification that excludes certain agency-related variables (such as presence of multiple blockholders, family ownership, etc.). We examine the effects of these variables separately to better relate them to the literature.

### 5.1 Determinants of the cost of debt

**5.1.1 EW-GMM estimation.** Table 2 presents the results of the EW-GMM estimation for base specification for the cost of debt (Panel B). We use three specifications. Model 1 excludes as control variables important nonpricing loan characteristics—namely, loan size, maturity, and syndicate size—that are not derived in our model and that are clearly different from other control variables (in their influence on loan prices). In Model 2, we include these variables, and a comparison between these two model estimations helps illustrate the impact of the endogenous variables emphasized in our model on the key relationship between control concentration and the cost of debt. Finally, Model 3 also tests for nonlinear effects of control concentration by including *ControlCashH* (the indicator for the top quintile of ownership structure ratios).

The estimate of Model 1 indicates that the OSR ( $\kappa$ ) has a positive effect on the loan price that is highly statistically significant and economically substantial: Increasing the OSR by 1% raises the loan price by over 10% (or over twelve basis points [bps], based on the sample median spread of 123 bps). We also find that the dominant shareholder's cash-flow ownership ( $v$ ) is significantly and negatively related to the cost of debt (holding fixed the control-to-cash ownership ratio). These results are consistent with the predictions of Theorem 1.<sup>24</sup> Further, comparing these results with Model 2, we find that controlling for the nonprice loan characteristics reduces only marginally the strong positive influence of control concentration on loan prices; the effect is still significant at 1% levels, and the economic significance is essentially the same. The results in Model 3 indicate that the effects of control concentration

<sup>24</sup> Of course, these results only imply that the predictions of our model are not refuted and do not suggest that alternative mechanisms leading to the same result are not plausible. In particular, as pointed out by a referee, high cash-flow stakes of controlling shareholders may indicate reduced portfolio diversification and hence the choice of less risky projects that are rewarded by lower loan prices.

**Table 2**  
**GMM estimates of the determinants of ownership structure and loan pricing**

	Model 1		Model 2		Model 3	
	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat
<b>Panel A: Ownership Structure</b>						
Market-to-book	0.018**	(3.55)	0.006***	(3.18)	0.010***	(3.68)
Tangibles	0.435**	(2.18)	0.216**	(2.33)	0.307**	(2.06)
AltmanZ	0.062***	(2.97)	0.052***	(2.59)	0.044***	(2.81)
Ratings	-0.003*	(-1.73)	-0.001*	(-1.74)	-0.001*	(-1.82)
StockMktDev	-0.007**	(-2.08)			-0.004**	(-2.01)
BondMktDev	-0.002	(-1.36)			-0.005	(-1.27)
Legal Origin	-0.018**	(-2.09)			-0.011**	(-2.06)
Sharing	-0.001	(-1.49)			-0.001	(-1.48)
CreditorRights	-0.018**	(-2.14)			-0.012**	(-2.10)
CashFlowRights	-4.117***	(-3.59)	-4.013**	(-2.02)	-3.032**	(-2.08)
<b>Panel B: Loan Pricing</b>						
	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat
ControlCashRatio	10.10***	(5.65)	9.107***	(4.02)	9.003***	(3.22)
ControlCashRatioH					11.96**	(2.17)
LoanSize			4.029***	(2.67)	4.113**	(2.02)
Log (Maturity)			1.115**	(2.01)	0.972*	(1.74)
SyndicateSize			-1.279*	(-1.83)	-1.015*	(-1.68)
Currency	-0.019*	(-1.76)	-0.016*	(-1.73)	-0.010	(-1.54)
Leverage	10.23***	(5.69)	10.01***	(4.76)	9.169***	(4.76)
Market-to-book	-1.102***	(-2.88)	-1.005**	(-2.29)	-1.334*	(-1.72)
Earnings	-9.276***	(-3.39)	9.010***	(-3.13)	-9.879***	(-2.83)
Tangibles	-5.883***	(-2.87)	-4.615**	(-2.15)	-5.019**	(-2.16)
AltmanZ	10.02***	(-4.55)	-9.223***	(-4.19)	-9.102***	(-3.80)
Type	0.497	(1.56)	0.576	(1.38)	0.321	(1.03)
Secured	-0.076*	(-1.67)	-0.047*	(-1.65)	-0.076	(-1.42)
Ratings	5.627***	(4.32)	5.012***	(4.77)	4.097***	(4.53)
Log (GDP)	-0.066*	(-1.85)	-0.069	(-1.50)	-0.048	(-1.58)
Legal Origin	-0.099***	(-2.54)	-0.083**	(-2.13)	-0.077**	(-2.02)
MktRet	-0.096*	(-1.89)	-0.131*	(-1.78)	-0.091*	(-1.76)
StockMktDev	-0.086	(-1.57)	-0.069*	(-1.66)	-0.058	(-1.33)
BondMktDev	-0.543**	(-2.15)	-0.425**	(-2.22)	-0.413*	(-1.84)
CreditorRights	-0.994***	(-2.56)	-0.765**	(-2.18)	-0.669**	(-2.35)
Sharing	-0.067*	(-1.77)	-0.062*	(-1.70)	-0.038	(-1.47)
<i>J</i> -test ( <i>p</i> -value)	0.402		0.519		0.472	
Wald test ( <i>p</i> -value)	<0.001		<0.001		<0.001	

This table reports the GMM estimates of the joint determination of ownership structure and loan pricing (using a model with latent common factors) from a sample of over 3,600 syndicated bank loans from thirteen European and nine East Asian countries during 1996–2007. In Panel A, the dependent variable is the control-cash ratio, and in Panel B it is the logarithm of all-in-drawn spread (*AISD*) above benchmark. *CashFlow* is the cash-flow ownership stake of the largest blockholder; *ControlCashRatio* is the ratio of control rights to cash-flow rights of this blockholder; *ControlCashH* is a dummy variable that equals 1 when the *ControlCashRatio* for a given firm-year is in the top quintile; *LoanSize* is the ratio of deal amount to total debt; *SyndicateSize* is the number of lenders in the syndicate; *Currency* is a dummy that is 1 for domestic currency; *Leverage* is the total debt (long-term plus short-term) divided by the total assets of the firm; *Market-to-book* is defined as the market value of assets divided by the book value of assets; *Earnings* is the ratio of EBITDA to the total assets; *Tangibles* is the ratio of net property, plant, and equipment to the total assets; *Type* is a dummy variable that equals 1 for term loans; *AltmanZ* is constructed according to Altman (1968); *Secured* is a dummy variable that equals 1 for loans secured (collateralized), and 0 otherwise; *Ratings* is the investment-grade dummy for the borrower (with S&P rating of BBB– and higher); *GDP* is the gross domestic product; *MktRet* is the market return in the current year; *StockMktDev* is the stock market capitalization as a proportion of the GDP. *BondMktDev* is the value of private and public domestic debt securities issued by financial institutions and corporations as a proportion of the GDP. *Legal origin* is a dummy equal to 1 if the country's legal origin is common law (La Porta, Lopez-de-Silanes, Shleifer, and Vishny 2008); *CreditorRights* is an index aggregating different creditor rights that ranges from 0 (weak creditor rights) to 4 (strong creditor rights); *Sharing* is a dummy variable that equals 1 if either a public registry or a private bureau operates in the country and is 0 otherwise. Regressions also include (Fama–French) industry dummies, year and country dummies, and loan purpose indicators. Standard errors are computed by the delta method. (\*), (\*\*), and (\*\*\*) indicate significance at the 10%, 5%, and 1% levels, respectively. *p*-values of *J*-tests of the over-identifying restrictions and Wald test statistics for the joint significance of the coefficients are also provided.

on debt costs are nonlinear: The coefficient for *ControlCashH* is highly significant and implies that firms with OSR in the top quintile pay about a 3% higher loan price (on average) than firms in lower OSR quintiles do.

We also find that the effect of the market-to-book ratio (the proxy for  $\theta$ ) on the loan price is negative and highly significant, while the effect of the default risk (as measured by a low Altman Z-score and low credit ratings) is positive and also highly significant. In addition, the effects of stock returns and the tangible-to-total assets ratio on the loan price are negative and significant at conventional levels. These results are consistent with the predictions of Theorem 2. Turning to the role of country-level creditor and investor rights, in Model 2 we find that loan prices are significantly negatively related to the strength of minority shareholder and creditor rights—as measured by the legal origin, the creditor rights index, and the level of development of the equity and debt markets—and the presence of information-sharing institutions. While the analysis of the role of creditor rights complements Qian and Strahan (2007) and Bae and Goyal (2009), who use measures of private credit, the role of the level of bond market development (broadly defined) and information sharing is novel to our analysis. However, we notice that in Model 3 the estimates for financial market development variables lose some statistical significance, suggesting that its role is particularly important in dealing with the agency risk posed for creditors by borrowers with extraordinarily high control concentration. Overall, these results are also consistent with Theorem 2.<sup>25</sup>

**5.1.2 Estimation with instruments.** In Tables 3 and 4, we report the determinants of the cost of debt when we use different instruments (described above) for the dominant shareholder's control-to-cash ownership ratio (or the OSR). (For reliable inference, we use only one instrument in a regression; hence, we exclude the indicator variable for high control concentration.) Here again, we compare the regressions with and without the nonprice loan characteristics. The significance and pattern of the effects of ownership structure on loan costs are similar to those observed with the EW-GMM estimation. The OSR ( $\kappa$ ) has a statistically and economically significant positive effect on the loan prices for all four IVs: In each case, increasing the OSR by 1% raises the loan price by at least 6.7% and up to 8.7%. Furthermore, the dominant shareholder's cash-flow ownership ( $v$ ) has a significantly negative effect on the loan price in all four regressions. And, even when we control for the nonprice loan characteristics, the positive effects of control concentration on

<sup>25</sup> The effects of leverage and earnings are highly significant and consistent with expectations. Secured loans pay a significantly higher loan price, which is consistent with the theoretical prediction that banks will demand higher collateral from relatively high-risk borrowers (Aghion and Bolton 1992; Rajan and Winton 1995) and complements other empirical studies (Berger and Udell 1990; John, Lynch, and Puri 2003; Chava, Livdan, and Purnanandam 2009). Loan prices are significantly and positively associated with loan maturity, which is consistent with Merton (1974). Finally, we find that larger loan syndicates tend to charge lower loan prices ceteris paribus, which could be indicative of risk pooling.

**Table 3**  
**Instrumental variable estimates I : Effects of ownership structure on loan pricing**

	IV: Legal Origin		IV: Legal Origin		IV: Ownership Threshold		IV: Ownership Threshold	
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
CashFlowRights	-2.311**	(-2.39)	-2.016*	(-1.82)	-3.105***	(-2.56)	-2.010*	(-1.82)
ControlCashRatio	6.727***	(2.87)	5.825**	(2.14)	7.117***	(3.79)	6.512**	(2.10)
Loansize			3.112**	(2.04)			2.824**	(2.07)
Log(Maturity)			2.002***	(2.50)			1.815***	(2.56)
SyndicateSize			-0.673**	(-2.02)			-1.006***	(-2.53)
Currency	-0.087***	(-2.05)	-0.015*	(-1.98)	-0.063**	(-2.19)	-0.012*	(-1.79)
Leverage	9.213***	(6.20)	8.165***	(4.89)	10.89***	(6.13)	8.613***	(4.16)
Market-to-book	-1.012**	(-2.49)	-0.927**	(-2.38)	-1.217***	(-3.79)	-0.917***	(-2.95)
Earnings	-6.768***	(-3.76)	-6.114***	(-2.62)	-11.89***	(-2.92)	-10.01***	(-2.86)
Tangibles	-5.020**	(-2.46)	-5.106**	(-2.18)	-2.925***	(-3.66)	-2.315**	(-2.29)
AltmanZ	-11.81***	(-3.91)	-10.05***	(-2.79)	-10.66***	(-3.80)	-8.723***	(-2.88)
Type	0.795	(1.48)	0.683	(0.97)	0.916	(1.49)	0.615	(1.10)
Ratings	-0.044*	(-1.69)	-0.050	(-1.47)	-0.125*	(-1.97)	-0.054*	(-1.81)
Secured	2.667***	(5.83)	2.015***	(4.52)	5.119***	(5.75)	3.618***	(4.27)
Log (GDP)	-0.038*	(-1.67)	-0.024	(-1.38)	-0.019*	(-1.68)	-0.012	(-1.58)
MktRet	-0.006*	(-1.78)	-0.004*	(-1.70)	-0.010*	(-1.97)	-0.004*	(-1.72)
StockMktDev					-0.082*	(-1.82)	-0.067*	(-1.65)
BondMktDev					-0.119***	(-2.55)	-0.072**	(-2.04)
CreditorRights					-0.784**	(-2.39)	-0.524**	(-2.03)
Sharing					-0.082**	(-1.80)	-0.067*	(-1.65)
First-stage F-stat (Prob > F)	0.019		<0.001		0.008		<0.001	
Partial R-square	0.069		0.088		0.077		0.098	

This table presents the second-stage estimation results for the effects of ownership structure on loan prices from a sample of over 3,600 syndicated bank loans from thirteen European and nine East Asian countries during 1996–2007. The dependent variable is the all-in-drawn spread (AIDS) above benchmark. We use two instruments for *ControlCashRatio* during the first-stage regressions (not reported): (i) a dummy equal to 1 if the country's legal origin is common law (La Porta et al. 1998), and (ii) ownership disclosure threshold. Regressions also include (Fama–French) industry dummies, year and country dummies, and loan purpose indicators. The other controls are defined in Table 2. The bottom panel of the table reports the test statistics for the relevance of our instruments. Tests of significance use the heteroscedasticity-consistent standard errors of White (1980). (\*), (\*\*), and (\*\*\*) indicate significance at the 10%, 5%, and 1% levels, respectively.

**Table 4**  
**Instrumental variable estimates II : Effects of ownership structure on loan pricing**

	IV: Disclosure Index		IV: Disclosure Index		IV: Debt Enforcement		IV: Debt Enforcement	
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
<i>CashFlowRights</i>	-3.618**	(-2.19)	-2.013*	(-1.80)	-3.614***	(-3.77)	-2.639***	(-3.02)
<i>ControlCashRatio</i>	8.723***	(3.22)	7.218***	(2.62)	8.682***	(2.64)	6.972***	(2.50)
<i>LoanSize</i>			2.003***	(2.66)			3.007***	(2.38)
<i>Log (Maturity)</i>			2.519**	(2.39)			1.168**	(2.29)
<i>SyndicateSize</i>			-0.827**	(-2.02)			-1.022**	(-2.12)
<i>Currency</i>	-0.067**	(-2.00)	-0.032*	(-1.76)	-0.068**	(-2.06)	-0.053	(-1.87)
<i>Leverage</i>	8.219***	(5.89)	7.315***	(4.65)	8.760***	(3.39)	7.889***	(3.10)
<i>Market-to-book</i>	-0.889***	(-2.58)	-0.632**	(-2.39)	-0.913**	(-2.38)	-0.628**	(-2.05)
<i>Earnings</i>	-9.014***	(-3.77)	-7.838***	(-3.10)	-9.002***	(-4.26)	-8.623***	(-2.88)
<i>Tangibles</i>	-5.220**	(-2.49)	-4.002**	(-2.16)	-4.446***	(-3.35)	-3.012***	(-2.76)
<i>AltmanZ</i>	-10.87***	(-3.66)	-9.373***	(-3.10)	-10.58***	(-3.76)	-8.457***	(-3.05)
<i>Type</i>	0.076*	(1.78)	0.055	(1.48)	0.056	(1.62)	0.037	(1.48)
<i>Ratings</i>	-0.059***	(-2.59)	-0.042**	(-2.15)	-0.072*	(-2.18)	-0.040*	(-1.84)
<i>Secured</i>	5.112***	(4.65)	4.018***	(3.96)	3.992***	(4.34)	3.063***	(3.69)
<i>Log (GDP)</i>	-0.022*	(-1.72)	-0.010	(-1.52)	-0.018	(-1.57)	-0.009	(-1.42)
<i>MktRet</i>	-0.028**	(-2.39)	-0.015*	(-1.87)	-0.067*	(-1.93)	-0.030*	(-1.79)
<i>StockMktDev</i>					-0.055*	(-1.88)	-0.038	(-1.63)
<i>Sharing</i>					-0.020**	(-2.10)	-0.014*	(-1.85)
First-stage <i>F</i> -stat (Prob > <i>F</i> )	0.006		0.005		0.005		0.004	
Partial <i>R</i> -square	0.076		0.090		0.078		0.110	

This table presents the second-stage estimation results for the effects of ownership structure on loan prices from a sample of over 3,600 syndicated bank loans from thirteen European and nine East Asian countries during 1996-2007. The dependent variable is the all-in-drawn spread (*AISD*) above benchmark. We use two instruments for *ControlCashRatio* during the first-stage regressions (not reported): (i) disclosure index (La Porta, Lopez-de-Silanes, and Shleifer 2006), and (ii) efficiency of debt enforcement (Djankov et al. 2008). Regressions also include Fama-French industry dummies, year and country dummies, and loan purpose indicators. The other controls are defined in Table 2. The bottom panel of the table reports the test statistics for the relevance of our instruments. Tests of significance use the heteroscedasticity-consistent standard errors of White (1980). (\*), (\*\*), and (\*\*\*) indicate significance at the 10%, 5%, and 1% levels, respectively.

loan prices retain their economic and statistical significance. The effects of the other independent variables on the cost of debt in Tables 3 and 4 are also largely consistent with the results in Table 2.<sup>26</sup> In particular, and consistent with Theorem 2, the market-to-book ratio, stock returns, and the tangible-to-total assets ratio have a significantly negative effect on the loan price, while the default risk has a significantly positive effect.

Overall, both the EW-GMM and the IV estimation methodologies support the basic prediction that dominant shareholder moral hazard, as measured by this shareholder's control-to-cash-flow ownership ratio (and inversely related to its cash-flow stakes), has a significantly positive effect on the cost of debt.<sup>27</sup> We note that the effect of ownership structure on the cost of debt holds even when we control for (i) the factors typically used by the literature to explain loan price dispersion, and (ii) the endogeneity of the ownership structure.

## 5.2 Determinants of ownership structure

We return now to Panel A of Table 2, where we report the EW-GMM estimation of the ownership structure equation (cf. (5)). Results of Model 2, where we do not include the (country-level) variables related to the strength of minority shareholder and investor rights, indicate that the OSR ( $\kappa$ ) is positively and significantly related to the firm's market-to-book ratio and the tangibles-to-total-asset ratio, while it is significantly and negatively related to the default risk as measured by the Altman *Z-score* and the credit ratings. The results are robust to the inclusion of the variables related to minority shareholder and investor rights in Models 1 and 3. Thus, the empirical results are consistent with the predictions of Theorem 3. Moreover, Models 1 and 3 indicate that the OSR is significantly and negatively related to the strength of minority shareholder rights, as measured by the legal origin, the level of stock market development, and the strength of creditor rights. While our theoretical analysis is based on the costs of dilution of minority shareholder rights and ownership, the empirical measures—for example, the legal origin and the creditor rights index—are informative as to the strength of investor rights generally. It is nevertheless interesting that the level of stock market development plays a more significant role than bond market development; this is consistent with the model's perspective that costs of minority shareholder dilution will have a significant impact on the endogenous control concentration both directly and indirectly (by strengthening the positive association between the cost of debt and control concentration).

<sup>26</sup> We exclude the country-level proxies for minority and creditor rights used in Table 2 when these are known to be positively correlated with the instruments—for example, the known association between legal origin and creditor rights and financial market development. But when we are able to include these variables—for example, when we use the ownership threshold as an instrument—the results are consistent with Table 2.

<sup>27</sup> These results are consistent with Lin et al. (2011), who examine empirically the effects of excess control rights on borrowing costs but take the ownership structure to be exogenous.

We now examine in more detail the effects of certain attributes—at the level of the country, the borrowing firm, and the loan—that influence the dominant shareholders' agency costs with respect to debt.

### 5.3 Effects of selected agency-related variables

*Disclosure Requirements and Earnings Management:* Dominant shareholders in countries with stronger disclosure requirements (La Porta, Lopez-de-Silanes, and Shleifer 2006) and lower earnings management due to more stringent financial reporting practices (Leuz, Nanda, and Wysocki 2003) should face greater monitoring and difficulty in tunneling. Hence, Theorem 2 predicts that the loan spreads should be lower in such countries. However, the implications for ownership structure are ambiguous for the reasons discussed above. In Table 5, we present results of EW-GMM regressions where we use the disclosure index and the earnings management score (cf. Section 3.2.3) in the system of Equations (5)–(6). Results in Panel B of Table 5 indicate that loan prices are significantly lower in countries with stronger disclosure requirements but are significantly higher in countries with greater incidence of earnings management, *ceteris paribus*. These effects are also economically significant. For example, controlling for the other independent factors, firms in countries with stronger disclosure requirements pay over 2% less (in the originating loan spread over the benchmark) compared with countries with weaker disclosure requirements. These findings are consistent with the predictions of Theorem 2. Meanwhile, results in Panel A show that the OSR of controlling shareholders is significantly lower in countries with stronger disclosure requirements but higher in countries with greater incidence of earnings management (or weaker financial reporting practices)—that is, the effects of stronger financial monitoring at the firm level on the ownership structure are ambiguous.

*Multiple Blockholders:* In Panel A of Table 6, we analyze the effect of an additional blockholder (that owns more than 10% of the voting rights) on the cost of debt, using both the IV (with legal origin and the ownership threshold as instruments for the OSR) and the EW-GMM estimation methodologies. The GMM estimates indicate that the presence of a second blockholder is associated with lower loan prices in a statistically and economically significant fashion: Firms with a second blockholder pay about 3% lower loan prices compared with firms without such a blockholder. Moreover, the positive influence of the OSR on the cost of debt is diluted significantly when a second blockholder is present. The second blockholder also appears to have a complementary effect on the cash-flow ownership of the dominant shareholder (*v*). These results are supported by the IV estimation results.

As we noted above, the literature presents two conflicting hypotheses on the effects of multiple blockholders. However, we find that the presence of multiple blockholders unambiguously reduces loan costs *ceteris paribus*. Furthermore, untabulated results indicate that the second blockholder reduces the incentive

**Table 5**  
**GMM estimates of the effects of disclosure requirements**

Panel A: Ownership Structure	Model 1		Model 2	
	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat
Market-to-book	0.072	(2.28)	0.024**	(2.10)
Tangibles	0.215*	(2.08)	0.457*	(1.76)
AltmanZ	0.056	(2.16)	0.032***	(2.33)
Ratings	-0.001	(-1.33)	-0.000**	(-2.30)
Sharing			0.001*	(1.66)
CreditorRights			0.004	(1.02)
BondMktDev			-0.007*	(-1.87)
Disclosure	-0.005*	(-2.27)		
EM Score			0.004***	(2.60)
Panel B: Loan Pricing	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat
<i>CashFlowRights</i>	-1.052	(-1.42)	-1.370*	(-1.87)
<i>ControlCashRatio</i>	6.236**	(2.20)	7.446***	(2.84)
<i>Disclosure</i>	-2.018***	(-2.53)		
<i>EM Score</i>			3.121**	(2.10)
<i>LoanSize</i>	3.105*	(1.66)	3.613*	(1.88)
<i>Log (Maturity)</i>	3.682**	(2.17)	4.942**	(2.06)
<i>SyndicateSize</i>	-0.047*	(-1.83)	-0.084*	(-1.69)
<i>Currency</i>	-0.026*	(-1.92)	-0.020*	(-1.76)
<i>Leverage</i>	10.02***	(2.86)	8.076***	(2.62)
<i>Market-to-book</i>	-0.316**	(-2.14)	-0.129***	(-3.38)
<i>Earnings</i>	-4.970***	(-2.89)	-5.213**	(-2.26)
<i>Tangibles</i>	-3.165**	(-2.45)	-4.066**	(-2.04)
<i>AltmanZ</i>	-7.200***	(-3.36)	-6.886***	(-2.87)
<i>Type</i>	0.089	(1.30)	0.074	(1.29)
<i>Ratings</i>	-0.047**	(-2.06)	-0.010*	(-1.72)
<i>Secured</i>	2.005*	(1.79)	3.012**	(2.02)
<i>Log (GDP)</i>	-0.011*	(-1.75)	-0.008	(-1.10)
<i>Legal Origin</i>	-0.019*	(-1.94)	-0.016**	(-2.15)
<i>MktRet</i>	-0.080	(-1.52)	-0.066*	(-1.65)
<i>StockMktDev</i>	-0.045*	(-1.66)	-0.062*	(-1.72)
<i>BondMktDev</i>	-0.062**	(-2.07)	-0.104*	(-1.89)
<i>CreditorRights</i>	-0.683***	(-2.54)	-0.214**	(-2.20)
<i>Sharing</i>	-0.004	(-1.26)	-0.002*	(-1.87)
<i>J</i> -test ( <i>p</i> -value)	0.212		0.183	
Wald test ( <i>p</i> -value)	<0.001		<0.001	

This table reports the GMM estimates (using a model with latent common factors) of the joint impact of ownership structure, disclosure requirements, and earnings management on loan prices from a sample of over 3,600 syndicated bank loans from thirteen European and nine East Asian countries during 1996–2007. In Panel A, the dependent variable is the control-cash ratio, and in Panel B it is the logarithm of all-in-drawn spread (*AISD*) above benchmark. *Disclosure* is an index based on disclosure requirements in each country and taken from La Porta, Lopez-de-Silanes, and Shleifer (2006); *EM Score* is the aggregate earnings management score based on Leuz, Nanda, and Wysocki (2003). The other controls are defined in Table 2. Standard errors are computed by the delta method. (\*), (\*\*), and (\*\*\*) indicate significance at the 10%, 5%, and 1% levels, respectively. *p*-values of *J*-tests of the overidentifying restrictions and Wald test statistics for the joint significance of the coefficients are also provided.

of dominant shareholders to accumulate control rights. Thus, the presence of multiple blockholders appears to lower the agency costs of debt by reducing control concentration and the effects of this concentration on loan prices.

*Family Ownership:* In Panel B of Table 6, we analyze the effects of family ownership on the cost of debt. We find that family ownership magnifies the effects of dominant shareholder moral hazard on the cost of debt because

**Table 6**  
**Instrumental variable and GMM estimates of various agency-related variables**

	IV: Legal Origin		IV: Ownership Threshold		GMM	
	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat	Estimate	<i>t</i> -stat
<i>Panel A: Effect of a Second Blockholder</i>						
<i>CashFlowRights</i>	-2.878	(-1.33)	-2.715*	(-1.83)	-1.819*	(-1.86)
<i>ControlCashRatio</i>	6.419**	(2.17)	7.017**	(2.06)	8.223***	(2.55)
<i>SecondBlockholder</i>	-1.829**	(-2.02)	-1.933*	(-1.99)	-3.087***	(-2.40)
<i>CashFlow</i> * <i>SecondBlockholder</i>	-0.088*	(-1.71)	-0.092*	(-1.78)	-0.319	(-1.08)
<i>ControlCash</i> * <i>SecondBlockholder</i>	-1.616**	(-2.00)	-1.525**	(-2.02)	-0.920***	(-2.65)
<i>Panel B: Effect of a Family Ownership</i>						
<i>CashFlow</i>	-2.513**	(-2.25)	-2.176*	(-1.90)	-1.987*	(-1.86)
<i>ControlCash</i>	7.009***	(2.76)	7.213***	(2.67)	9.013***	(2.60)
<i>Family</i>	1.876**	(2.42)	1.667**	(2.36)	2.007**	(2.44)
<i>CashFlow</i> * <i>Family</i>	0.068*	(1.84)	0.059*	(1.86)	0.356	(1.13)
<i>ControlCash</i> * <i>Family</i>	1.145**	(2.39)	1.025**	(2.38)	1.002***	(2.68)
<i>Panel C: Effect of Borrower's Affiliation with a Financial Institution</i>						
<i>CashFlowRights</i>	-2.779**	(-2.02)	-2.003	(-1.25)	-1.892	(-1.51)
<i>ControlCashRatio</i>	7.220***	(2.65)	6.432***	(2.56)	8.055***	(2.76)
<i>Affiliated</i>	-1.015**	(-2.17)	-1.064**	(-2.17)	-2.879**	(-2.00)
<i>CashFlow</i> * <i>Affiliated</i>	-0.005	(-0.76)	-0.006	(-0.86)	-0.004	(-0.78)
<i>ControlCash</i> * <i>Affiliated</i>	-2.016**	(-2.39)	-2.012***	(-2.77)	-2.816**	(-2.30)
<i>Panel D: Effect of Lead Lender's Nationality</i>						
<i>CashFlowRights</i>	-1.979*	(-1.64)	-1.761	(-1.32)	-2.456	(-1.37)
<i>ControlCashRatio</i>	7.213***	(3.78)	6.009***	(3.23)	9.313***	(3.22)
<i>Domestic</i>	-2.055***	(-4.53)	-1.560***	(-4.05)	-2.987***	(-4.00)
<i>CashFlow</i> * <i>Domestic</i>	-0.049	(-0.66)	-0.055	(-0.67)	-0.056	(-0.63)
<i>ControlCash</i> * <i>Domestic</i>	-1.563**	(-1.74)	-1.539*	(-1.91)	-1.615*	(-1.80)

The first two columns of this table report the second-stage estimation results, and the last column reports the GMM estimates of the effects of ownership structure and various agency-related variables on loan prices from a sample of over 3,600 syndicated bank loans from thirteen European and nine East Asian countries during 1996–2007. The dependent variable is the all-in-drawn spread (*AISD*) above benchmark. We use two instruments for *ControlCashRatio* during the first-stage regressions (not reported): (i) a dummy equal to 1 if the country's legal origin is common law (La Porta et al. 1998), and (ii) ownership disclosure threshold. *SecondBlockholder* is a dummy variable that equals 1 if there is another blockholder with at least 10% of voting rights, and is equal to 0 otherwise; *Family* is a dummy variable that equals 1 if the founding family is involved and 0 otherwise. A corporation is defined as *Affiliated* if it belongs to a group that also controls a financial institution; *Domestic* is a dummy that equals 1 whether the syndicate includes any lead bank with nationality the same as the borrower. The other controls are defined in Table 2. Tests of significance use the heteroscedasticity-consistent standard errors of White (1980). (\*), (\*\*), and (\*\*\*) indicate significance at the 10%, 5%, and 1% levels, respectively.

such firms pay a significantly higher loan price *ceteris paribus*. The GMM estimations show that raising the OSR by 1% increases the loan price of family-owned firms by about 2% more than is the case for firms that are not family owned. The IV estimation results complement these results and show in addition that family ownership also dilutes (or reduces) the beneficial effects of dominant shareholder cash-flow ownership on the cost of debt. Thus, in contrast to Anderson, Mansi, and Reeb (2003), who examine large firms in the United States, in our international sample with a varied firm size distribution,

family ownership increases the agency costs of debt and amplifies the positive association between control concentration and the cost of debt.

Meanwhile, untabulated results show that the “cost of debt effect” of problematic governance associated with family ownership lowers the incentives of dominant shareholders of such firms to accumulate control stakes. In particular, we find that multiple blockholders and family ownership have similar effects on the OSR even though they have opposing implications for the monitoring of dominant shareholders; this supports the theoretical prediction that the strength of corporate governance has ambiguous effects on the incentives for control concentration.

*Affiliated Firms:* In Panel C of Table 6, we analyze the effects of borrowing firm affiliation with banks in the syndicate on the cost of debt. Using both types of estimation methodologies, we find that affiliated firms pay a significantly lower loan price compared with nonaffiliated firms. Furthermore, the positive effects of raising the OSR on the cost of debt are diluted for affiliated firms, and this effect is highly statistically significant. However, there is no significant difference between affiliated and nonaffiliated firms with respect to the effects of the dominant shareholder’s cash-flow stakes ( $v$ ) on the cost of debt. Our results here complement and extend the analysis of La Porta et al. (2003). Using data on Mexican firms, they find that related lending transactions take place on better terms than arm’s-length lending. Our sample extends to many countries in Europe and East Asia, and the analysis indicates that the cost of bank debt for firms not affiliated with the financial institutions is more subject to dominant shareholder moral hazard.

*Domestic Lead Banks:* Loan syndicates with one of the lead bankers from the same country as the borrower may have an informational advantage regarding the borrower’s agency risk. In Panel D of Table 6, we find that the cost of debt and the effect of OSR on loan prices are significantly lower for syndicates with domestic lead banks compared with those where all the lead banks are foreign. However, there is no significant difference between the said loan syndicate structures with respect to the effects of the dominant shareholder’s cash-flow stakes ( $v$ ) on the cost of debt.

#### 5.4 Robustness

Untabulated results indicate that the empirical analysis that we have reported above is robust along a variety of dimensions.

*Alternative Specifications:* Our main results are robust to different specifications in both the EW-GMM or the IV regressions. For example, adding other country-level indicators of the strength of investor rights in the ownership structure equation or in the loan price specifications with instruments does not materially change the results.

*Measurement Errors:* Our extensive data collection process regarding ownership structure highlights the complex web of ownership by dominant

shareholders. Thus, there is the possibility of measurement error in the control and cash-flow ownership of the dominant shareholders. To help address this issue, we pool the EW-GMM estimates using the grouping method of Fama and MacBeth (1973). We found quantitatively similar results to those reported in Table 2.

*AB-GMM Instrumental Variables Estimation:* We also used the instruments suggested by Arellano and Bond (1991), and the results were very similar to those in Table 2. For example, raising the OSR by 1% increases loan prices by about 7% (even when controlling for nonprice loan characteristics), and the effects of extreme control concentration and cash-flow ownership are also similar to those in Table 2. The effects of the market-to-book, tangible-to-total asset ratio, default risk, and market returns on the OSR are also similar to the reported results. And, following Arellano and Bond (1991), we also obtained the AB-GMM estimates using all the orthogonality conditions and with all available lags of  $\kappa$  as instrumental variables; the results were again similar.

## 6. Summary and Conclusions

Concentration of corporate control by dominant shareholders is ubiquitous globally and is a major agency risk for minority shareholders. However, the effects of tunneling and manipulation of distressed renegotiations by dominant shareholders on debt costs have received relatively little attention. And there has been sparse analysis of the endogeneity of control concentration and the external financing costs. We examine theoretically and empirically the endogenous determination of corporate control concentration and the cost of debt when dominant shareholders can tunnel and strategically influence post-default debt and ownership restructuring negotiations against the interests of creditors and minority shareholders. However, dominant shareholders choose their control and cash-flow stakes optimally, keeping in view the effects of ownership structure on the cost of debt.

Consistent with the predictions of the theoretical framework, our empirical tests on an international sample of syndicated loans and a unique dynamic ownership structure data set verify a significant positive impact of control concentration on loan prices and indicate that this effect is itself influenced by the strength of internal governance mechanisms and investor rights. Moreover, control concentration responds to factors that amplify or weaken its effects on the cost of debt, such as the quality of investment opportunities, tangible asset intensity, financial market development, and the strength of investor rights. However, the relationship between control concentration and stronger monitoring of the dominant shareholder is ambiguous. We thus present new evidence on the determinants of control concentration and the cost of debt and conclude that strategic actions by self-interested dominant shareholders are a major source of corporate credit risk.

### Appendix A: Proofs

**Proof of Proposition 1:** At  $t = 3$ , either there was no default at  $t = 2$  (labeled  $\sigma_2^D = 0$ ) or there was a successful renegotiation (i.e.,  $\sigma_2^D = 1$ ). If  $\sigma_2^D = 0$ , then  $(\kappa_2, v_2) = (\kappa_1, v_1)$  and the lender's sharing rule is  $G(Y_3) = \min(Y_3, D_3)$ . Here,  $S$  uses the tunneling policy (3). Using the density function for  $\tilde{f}(\Pi_3 | \theta) = (1/\theta)f(R/\theta)$  and letting  $Z(D_3, \kappa_1, v_1) \equiv D_3/(1 - A^\ell(\kappa_1, v_1))$ ,

$$\mathbb{E}[P_3 | \theta, \sigma_2^D = 0] = \left[ \int_0^{Z(D_3, \kappa_1, v_1)} \Pi_3(1 - A^h(\kappa_1, v_1)) + \int_{Z(D_3, \kappa_1, v_1)}^\infty \Pi_3(1 - A^\ell(\kappa_1, v_1)) \right] \tilde{f}(\Pi_3 | \theta) d\Pi_3. \quad (7)$$

Differentiating (7) with respect to  $\kappa_1$  yields

$$\frac{\partial \mathbb{E}[P_3 | \theta, \sigma_2^D = 0]}{\partial \kappa_1} = -\frac{v_1}{\phi} \left( \int_0^\infty \Pi_3 \tilde{f}(\Pi_3 | \theta) d\Pi_3 + \frac{D_3 \frac{v_1}{\phi}}{(1 - A^\ell(\kappa_1, v_1))^2} \right) < 0.$$

Similarly,  $\frac{\partial \mathbb{E}[P_3 | \theta, \sigma_2^D = 0]}{\partial v_1} > 0$ . But if  $\sigma_2^D = 1$ , then, as we show below,  $G(Y_3) = \alpha Y_3$ . Therefore,

$$W_3^*(\Pi_3; \kappa_2, v_2, \alpha) = \left( \frac{v_2}{\phi} \right) \left( \frac{(1 - v_2)(1 - \alpha)}{v_2} + \kappa_2 \right) \Pi_3 \equiv \bar{A}(\kappa_2, v_2, \alpha) \Pi_3. \quad (8)$$

Hence,  $E[P_3 | \theta, \sigma_2^D = 1] = E[\Pi_3] (1 - \bar{A}(\kappa_2, v_2, \alpha))$  and straightforward computations using (8) show that  $E[P_3 | \theta, \sigma_2^D = 1]$  is decreasing in  $\kappa_2$  but increasing in  $v_2$ . ■

**Proof of Proposition 2:** The optimization problem is to choose  $\delta_2^L = (G^L(\Pi_3), \lambda_2^L, v_2^L)$ ,  $\in [0, 1]^2$ :

$$\begin{aligned} & \max_{\delta_2^L} \mathbb{E}[G^L(Y_3)] - M(\Delta_\lambda, \Delta_v), \text{ s.t.,} \\ & (1) Y_3 = \Pi_3 - \bar{W}(\Pi_3; \kappa_2^L, v_2^L), \quad (2) G^L(Y_3) \leq Y_3, \quad (3) \frac{\mathbb{E}[G^L(\Pi_3)]}{R_f} \geq X_2. \end{aligned} \quad (9)$$

We establish the optimality of  $G^{L*}(Y_3) = Y_3$  through perturbation analysis. Note that if  $G^L(Y_3) = Y_3$ , then the optimal tunneling policy of  $S$  is to set  $W_3 = \frac{\Pi_3}{\phi} (1 + \lambda_2^L)$ . So, consider a perturbation where  $G^L(Y_3) = Y_3 - \varepsilon$  (for  $\varepsilon$  small). The net expected gain from this perturbation is  $\varepsilon \left[ \frac{v_2}{\phi} - 1 \right] < 0$  (since  $v_2^L \leq 1$  and  $\phi > 1$ ). It is also clear that  $\lambda_2^{L*} = 0$  since tunneling is strictly increasing in  $\lambda$ . Furthermore, if  $G^{L*}(Y_3) = Y_3$ , then  $W_3$  is independent of  $v_2$ , and  $v_2^L = v_1$  is (weakly) optimal. Hence, given  $\delta_2^{L*}$ , the present value of the lender's expected payoffs at  $t = 3$  is  $\frac{\theta \bar{R}(\phi - 1)}{R_f \phi}$  and the constraint (3) is satisfied only if  $\theta \geq \frac{X_2 R_f \phi}{\bar{R}(\phi - 1)} \equiv \theta^L$ . ■

**Proof of Proposition 3:** Given any  $(\lambda_2, v_2)$  and piecewise differentiable  $G(Y_3)$ , the optimal  $W_3^*$  is defined implicitly by

$$W_3^* = \frac{\Pi_3}{\phi} (1 - v_2(1 - G'(\Pi_3 - W_3^*)) + \lambda_2). \quad (10)$$

And, incorporating the constraint  $G(Y_3) \leq Y_3$ , the optimization problem is

$$\max_{\delta_2^S} \{ \mathbb{E}[W_3^* + v_2(\Pi_3 - W_3^* - G(\Pi_3 - W_3^*)) - C(\lambda_2, \Pi_3, W_3^*)] - M(\Delta_\lambda, \Delta_v) \} \tag{11}$$

$$\text{s.t., (1) } \frac{\mathbb{E}[G(\Pi_3 - W_3^*)]}{R_f} \geq X_2, \text{ (2) } (\lambda_2, v_2) \in [0, 1]^2. \tag{12}$$

Substituting (10) into (11), we rewrite the optimization problem as a variational problem with an iso-perimetric constraint. Let us denote the right-hand side of (10) as  $Q(G')$ . Using the Lagrange multiplier  $\eta$  for the constraint (1) in (12), the variational problem is

$$\max_{G(\cdot)} \int_0^\infty [Q(G')\{(1 - v_2 + \lambda_2) - \frac{\phi}{2\Pi_3} Q(G')\} + v_2(\Pi_3 - G) + \eta(G - X_2 R_f)] \tilde{f}(\Pi_3 | \theta) d\Pi_3. \tag{13}$$

Noting that  $\frac{\partial}{\partial \Pi_3} (\frac{\partial Q}{\partial G'}) = \frac{v_2}{\phi}$ , the Euler optimality condition can be written as

$$G'(\Pi_3 - W_3) = \left[ \eta - \frac{v_2}{\phi} (\phi + 1 - v_2 + \lambda_2) \right]. \tag{14}$$

Using the boundary condition  $G(0) = 0$ , the solution to (14) is  $G^{S*}(Y_3) = \alpha^S Y_3$ . And, since  $E[G^S(Y_3)] \geq X_2 R_f$  is binding,

$$\alpha^S [\theta \bar{R}(1 - \bar{A}(\kappa_2, v_2, \alpha^S))] = X_2 R_f. \tag{15}$$

Next, using the optimal tunneling policy (8), the maximand for  $(\lambda_2^{S*}, v_2^{S*}) \in [0, 1]^2$  is

$$\theta \bar{R} \left\{ \frac{(1 + \lambda_2 - v_2(1 - \alpha^S))^2}{2\phi} + v_2(1 - \alpha^S) \right\} - 0.5 [\beta_\lambda (\Delta_\lambda)^2 \mathcal{I}_\lambda + \beta_v (\Delta_v)^2 \mathcal{I}_v], \tag{16}$$

subject to the lender's rationality constraint (15). Substitution in the maximand (16) yields

$$\lambda_2^{S*} = \min \left( \lambda_1 + \frac{\alpha^S \theta \bar{R} - X_2 R_f}{\alpha^S \beta_\lambda}, 1 \right), \quad v_2^{S*} = \min \left( v_1 + \frac{(1 - \alpha^S) X_2 R_f}{\alpha^S \beta_v}, 1 \right). \tag{17}$$

The optimal  $\alpha^{S*}$  is then obtained from (15) upon substitution of (17). Finally, at the optimum, the left-hand side of (15) is increasing in  $\theta$ ; hence, there exists some  $\theta_\ell \leq \theta^S < \theta_h$  such that renegotiation with  $\delta_2^{S*}$  is successful only if  $\theta \geq \theta^S$ . ■

**Proof of Proposition 4:** Let  $V_2^S(\delta_2^{j*} | \theta)$  be the present value of expected payoffs for  $S$  when player  $j = L, S$  makes the offer. From Proposition 2,  $V_2^S(\delta_2^{L*} | \theta) = \frac{\theta \bar{R}}{R_f \phi}$  when  $\theta \geq \theta^L$  and 0 otherwise, while for  $\theta \geq \theta^S$ ,  $V_2^S(\delta_2^{S*} | \theta)$  is the discounted value of (16) evaluated at  $\delta_2^{S*}$  and 0 otherwise. Hence, the expected payoffs for  $S$  in the renegotiating equilibrium are

$$V_2^S(\sigma_2^D = 1 | \theta) = q(\kappa_1) V_2^S(\delta_2^{S*} | \theta) + (1 - q(\kappa_1)) V_2^S(\delta_2^{L*} | \theta). \tag{18}$$

With  $D_2$  and  $(\kappa_1, v_1)$  as given, the unconstrained tunneling policy of  $S$  is  $\bar{W}(\Pi_2, D_2; \kappa_1, v_1)$  (cf. (3)). Clearly, there is no default if  $\Pi_2 > \Pi_2'' \equiv D_2/(1 - A^\ell(\kappa_1, v_1))$ . (Note that  $\Pi_2''$  is independent of  $\theta$ .) Default is unavoidable when  $\Pi_2 < D_2$ . But if  $D_2 \leq \Pi_2 < \Pi_2''$  and  $S$  tunnels the unconstrained amount  $\bar{W}^h(\Pi_2) \equiv \Pi_2(1 - A^h(\kappa_1, v_1))$  (cf. (3)), then a default occurs and  $S$  receives  $\bar{W}^h(\Pi_2) + V_2^S(\sigma_2^D = 1)$ . But if  $S$  reduces the tunneled amount to  $\hat{W}(\Pi_2) = \Pi_2 - D_2$ , it avoids the default and receives  $\hat{W}(\Pi_2) + V_2^S(\sigma_2^D = 0 | \theta)$ , where  $V_2^S(\sigma_2^D = 0 | \theta)$  is the continuation value to  $S$ ; i.e.,

$$V_2^S(\sigma_2^D = 0 | \theta) = (R_f)^{-1} \mathbb{E} \left[ \bar{W}(\Pi_3, D_3; \kappa_1, v_1)(1 + \lambda_1 - v_1) + v_1 \Pi_3 - \frac{\phi \bar{W}^2}{2\Pi_3} \right]. \quad (19)$$

Hence, avoiding default is optimal for  $S$  if and only if  $\hat{W}(\Pi_2) + V_2^S(\sigma_2^D = 0 | \theta) \geq \bar{W}^h(\Pi_2) + V_2^S(\sigma_2^D = 1 | \theta)$ . We define the function  $H(\Pi_2)$  on  $D_2 \leq \Pi_2 \leq \Pi_2''$ , where

$$H(\Pi_2 | \theta) \equiv \hat{W}(\Pi_2) + V_2^S(\sigma_2^D = 0 | \theta) - [\bar{W}^h(\Pi_2) + V_2^S(\sigma_2^D = 1 | \theta)]. \quad (20)$$

Note that  $V_2^S(\sigma_2^D = 0 | \theta) - V_2^S(\sigma_2^D = 1 | \theta)$  is independent of  $\Pi_2$ , and  $\hat{W}(\Pi_2) - \bar{W}^h(\Pi_2)$  is a continuous and strictly increasing function on  $D_2 \leq \Pi_2 \leq \Pi_2''$ . Furthermore,  $H(D_2) < 0$ , while  $H(\Pi_2'') > 0$  because  $S$  can avoid default even with maximal tunneling for  $\Pi_2 \geq \Pi_2''$ . Thus, by continuity there exists some  $\Pi_2'(\theta) < \Pi_2''$  such that  $H(\Pi_2' | \theta) = 0$ . We then compute from (20):

$$\Pi_2'(\theta) = \frac{-(V_2^S(\sigma_2^D = 0 | \theta) - V_2^S(\sigma_2^D = 1 | \theta) - D_2)}{1 - A^h(\kappa_1, v_1)} \quad (21)$$

$$\frac{\partial \Pi_2'(\theta)}{\partial \kappa_1} \propto - \left[ \frac{[1 - A^h(\kappa_1, v_1)] \frac{\partial (V_2^S(\sigma_2^D = 0 | \theta) - V_2^S(\sigma_2^D = 1 | \theta))}{\partial \kappa_1} + (V_2^S(\sigma_2^D = 0 | \theta) - V_2^S(\sigma_2^D = 1 | \theta) - D_2) A_1^h(\kappa_1, v_1)}{(V_2^S(\sigma_2^D = 0 | \theta) - V_2^S(\sigma_2^D = 1 | \theta) - D_2) A_1^h(\kappa_1, v_1)} \right]. \quad (22)$$

It can be shown that  $\frac{\partial (V_2^S(\sigma_2^D = 0 | \theta) - V_2^S(\sigma_2^D = 1 | \theta))}{\partial \kappa_1} < 0$  because the expected payoffs of  $S$  in the renegotiation process are more sensitive to variations in  $\kappa_1$  relative to the expected payoffs when there is no default. Meanwhile, it follows from (20) and the fact that  $H(\Pi_2' | \theta) = 0$  that  $(V_2^S(\sigma_2^D = 0 | \theta) - V_2^S(\sigma_2^D = 1 | \theta) - D_2) < 0$ . Furthermore,  $\frac{\partial A^h(\kappa_1, v_1)}{\partial \kappa_1} > 0$ . Hence, we conclude from (22) that  $\frac{\partial \Pi_2'(\theta)}{\partial \kappa_1} > 0$ . A similar series of arguments shows that  $\frac{\partial \Pi_2'}{\partial v_1} < 0$ . Finally, the lender's present value of expected payoffs with  $\delta_2^{L*}$  is  $V_2^L(\delta_2^{L*} | \theta) = \frac{\theta \bar{R}(\phi - 1)}{R_f \phi}$  for  $\theta \geq \theta^L$  and  $X_2$  otherwise, while  $V_2^L(\delta_2^{S*} | \theta) = X_2$ . And, by the definition of  $\theta^L$  (cf. Proposition 2), if  $\theta > \theta^L$ , then  $V_2^L(\delta_2^{L*} | \theta) > X_2$ . Hence, the lender's continuation payoffs in a default  $(V_2^L(\sigma_2^D = 1 | \theta) = q(\kappa_1) V_2^L(\delta_2^{S*} | \theta) + (1 - q(\kappa_1)) V_2^L(\delta_2^{L*} | \theta))$  are decreasing in  $\kappa_1$  (and strictly so for  $\theta > \theta^L$ ) because  $q(\kappa_1)$  is a strictly increasing function. ■

**Proof of Theorem 1:** Using the foregoing characterization of equilibrium at the renegotiation and liquidation stage, we can compute  $V_1^S$  (as a function of  $D_t, t = 2, 3$ ):

$$\begin{aligned} V_1^S(D_2, D_3; \kappa_1, v_1, \theta) &= \\ & (R_f)^{-1} \left[ \int_0^{\Pi_2'(\theta)/\theta} [\theta R_2 A^h(\kappa_1, v_1) + V_2^S(\sigma_2^D = 0 | \theta)] \right. \\ & \left. \times f(R_2) dR_2 + \int_{\Pi_2'(\theta)/\theta}^\infty [I_W(R_2) + V_2^S(\sigma_2^D = 0 | \theta)] f(R_2) dR_2 \right]. \quad (23) \end{aligned}$$

Here,  $I_W(R_2)$  is an indicator function for the optimal tunneling policy at  $t = 2$ ; i.e.,  $I_W(R_2) = \theta R_2 - D_2$  when  $\Pi_2 \leq \Pi'_2(\theta) < \Pi''_2$  but equals  $\theta R_2 A^\ell(\kappa_1, v_1)$  for  $\Pi_2 \geq \Pi''_2$  (cf. Proposition 4). Then the equilibrium correspondence of debt payments  $D_t$   $t = 2, 3$  is

$$\Gamma(\kappa_1, v_1) = \arg \max_{D_2, D_3} \left\{ V_1^S(D_2, D_3; \kappa_1, v_1, \theta), \right. \\ \left. \text{s.t., } \sum_{t=2}^{t=3} \left( \frac{\mathbb{E}[P_t^*(D_2, D_3) \mid \kappa_1, v_1, \theta]}{R_f^{t-1}} \right) = B \right\}. \quad (24)$$

Suppose that  $\kappa''_1 > \kappa'_1$ . We will establish that  $\Gamma(\kappa''_1, v_1) \subset \Gamma(\kappa'_1, v_1)$ , which will imply that  $\gamma^-(\kappa'_1) < \gamma^-(\kappa''_1)$  because the dual of (24) is to choose  $D_2, D_3$  to minimize  $\gamma^- \equiv (D_2^- R_f + D_3^-)/(B R_f^2)$ , subject to the lender's rationality constraint. Now,  $\Gamma(\kappa''_1, v_1) \subset \Gamma(\kappa'_1, v_1)$  if for any  $D_2, D_3$

$$\sum_{t=2}^{t=3} \left( \frac{\mathbb{E}[P_t^*(D_2, D_3) \mid \kappa''_1, v_1, \theta]}{R_f^{t-1}} \right) < \sum_{t=2}^{t=3} \left( \frac{\mathbb{E}[P_t^*(D_2, D_3) \mid \kappa'_1, v_1, \theta]}{R_f^{t-1}} \right). \quad (25)$$

Then fix any pair of promised payments  $(D_2, D_3)$ . From Proposition 1 we know that, for any history at  $t = 3$ ,  $P_3^*(\Pi_3; \kappa'_1) > P_3^*(\Pi_3; \kappa''_1)$  for each  $\Pi_3$ . Similarly, from Proposition 4 we know that for every  $\Pi_2$ ,  $P_2^*(\Pi_2; \kappa'_1) + \mathbb{E}[P_3^* \mid \Pi_2, \kappa'_1, \cdot] > P_2^*(\Pi_2; \kappa''_1) + \mathbb{E}[P_3^* \mid \Pi_2, \kappa''_1, \cdot]$ . Hence, (25) holds for any  $(D_2, D_3)$ , which completes the proof that  $\gamma^*$  is increasing with  $\kappa_1$ . The argument with respect to variations in  $v_1$  is exactly analogous to the foregoing arguments with respect to the variations in  $\kappa_1$ , except with the opposite sign. ■

**Proof of Theorem 2:** (Sketch) The arguments here follow those used in the proof of Theorem 1. Here, we focus on variations in  $\theta, \bar{R}, X_2$  and the tunneling cost parameter  $\phi$ , while keeping implicit the ownership structure variables. Holding other parameters fixed, let us consider the effects of perturbing  $\theta$ . Then, let  $\theta' > \theta''$ . We need to establish that

$$\sum_{t=2}^{t=3} \left( \frac{\mathbb{E}[P_t^*(D_2, D_3) \mid \theta'']}{R_f^{t-1}} \right) < \sum_{t=2}^{t=3} \left( \frac{\mathbb{E}[P_t^*(D_2, D_3) \mid \theta']}{R_f^{t-1}} \right). \quad (26)$$

Fix any pair of promised payments  $(D_2, D_3)$ . From Proposition 1, we know that, for any history at  $t = 3$ ,  $E[P_3^* \mid \theta'] > E[P_3^* \mid \theta'']$  and, similarly, from Proposition 4 we know that at  $t = 2$ ,  $E[P_2^* + P_3^*/R_f \mid \theta'] > E[P_2^* + P_3^*/R_f \mid \theta'']$ . Since this is true for any  $(D_2, D_3)$ , (26) holds, and it follows that  $\gamma^*$  is strictly decreasing in  $\theta$ . The argument with respect to variations in  $\bar{R}$  and  $X_2$  follows along similar lines. Finally, consider a perturbation that increases  $\phi$  and raises the marginal costs of tunneling, and thereby lowers the optimal tunneled amount. An argument analogous to the one above then shows that  $\gamma^*$  rises ceteris paribus. ■

**Proof of Theorem 3:** We return to the expected utility of  $S$  at  $t = 1$  as a function of the debt payments  $(D_2, D_3)$  and the ownership structure  $(\lambda_1, v_1)$ —namely,  $V_1^S(D_2, D_3; \kappa_1, v_1, \theta)$  defined in (23). The optimal ownership structure is the solution to

$$\max_{(\lambda_1, v_1) \in [0, 1]^2} V_1^S(D_2, D_3; \frac{\lambda_1}{v_1}, v_1, \theta) - 0.5 \left[ \beta_\lambda (\Delta_\lambda)^2 \mathcal{I}_\lambda + \beta_v (\Delta_v)^2 \mathcal{I}_v \right]. \quad (27)$$

Applying the implicit function theorem on the optimality conditions for  $(\lambda_1^*, v_1^*)$  shows that  $\text{sign}\left(\frac{\partial \kappa_1^*}{\partial \theta}\right) \propto \text{sign}\left(\frac{\partial^2 V_1^S(D_2, D_3; \kappa_1, v_1, \theta)}{\partial \kappa_1 \partial \theta}\right)$ . However,

$$\begin{aligned} \frac{\partial^2 V_1^S(D_2, D_3; \kappa_1, v_1, \theta)}{\partial \kappa_1 \partial \theta} &\propto \left\{ \int_0^{\Pi_2'(\theta)/\theta} \left[ R_2 \frac{v_1}{\phi} + \frac{\partial^2 V_2^S(\sigma_2^D = 1 \mid \theta)}{\partial \kappa_1 \partial \theta} \right] \right. \\ &\quad \times f(R_2) dR_2 + \int_{\Pi_2'(\theta)/\theta}^{\infty} \\ &\quad \left. \times \left[ \frac{\partial^2 I_W(R_2)}{\partial \kappa_1 \partial \theta} + \frac{\partial^2 V_2^S(\sigma_2^D = 0 \mid \theta)}{\partial \kappa_1 \partial \theta} \right] f(R_2) dR_2 \right\} \end{aligned} \quad (28)$$

(where the definition of  $I_W(R_2)$  is given in (23)). The integrand in (28) is positive because (i)  $\gamma^*$  is decreasing in  $\theta$  (cf. Theorem 2), (ii)  $\frac{\partial^2 \bar{W}(\Pi, D; \kappa, v)}{\partial \kappa \partial \theta} > 0$ , and (iii)  $\frac{\partial \kappa_2^*}{\partial \kappa_1} > 0$  (cf. (17)). Hence,  $\frac{\partial \kappa_1^*}{\partial \theta} > 0$ . The arguments to establish the positive effects of  $\bar{R}$  and  $X_2$  on  $\kappa_1^*$  are similar. Finally, ceteris paribus, it follows from (27) that  $\frac{\partial \kappa_1^*}{\partial \beta_\lambda} < 0$ . ■

### Appendix B: Comparative Statics with the Nash Bargaining Solution

In this appendix, we argue that the comparative statics results of Theorems 1–3 will continue to apply if the debt renegotiation outcome is determined through the Nash (1950) bargaining solution. As noted above, in the debt renegotiation situation, the threat point of the lender is  $X_2$ , while for the dominant shareholder the threat point is zero. Since the comparative statics in our model will apply for any increasing payout function (for the lender)  $G(Y_3)$ , for notational ease we will take  $G(Y_3) = \alpha Y_3$ ,  $0 < \alpha \leq 1$ . Hence, the outcome of the bargaining in the debt renegotiation is  $\delta_2 = (\alpha, \lambda_2, v_2)$  and the Nash bargaining equilibrium  $\delta_2^*$  is the solution to

$$\max_{\delta_2 \in [0,1]^3} \left\{ \left( V_2^S(\delta_2 \mid \theta) \right) \left( \frac{V_2^L(\delta_2 \mid \theta)}{R_f} - X_2 \right) - 0.5 \left[ \beta_\lambda (\Delta_\lambda)^2 \mathcal{I}_\lambda + \beta_v (\Delta_v)^2 \mathcal{I}_v \right] \right\}, \quad (29)$$

where (using  $\bar{A}(\kappa_2, v_2, \alpha)$  defined in (3)),  $V_2^L(\delta_2 \mid \theta) = \alpha \theta \bar{R}(1 - \bar{A}(\kappa_2, v_2, \alpha))$  and

$$V_2^S(\delta_2 \mid \theta) = (R_f)^{-1} \left[ \theta \bar{R} \left\{ \frac{(1 + \lambda_2 - v_2(1 - \alpha))^2}{2\phi} + v_2(1 - \alpha) \right\} \right]. \quad (30)$$

Applying the implicit function theorem on the optimality conditions for (29) then yields  $\frac{\partial \lambda_2^*}{\partial \lambda_1} \geq 0$ , and  $\frac{\partial v_2^*}{\partial v_1} > 0$  for every  $\theta$ . It follows, therefore, from the fact that  $\bar{A}(\kappa_2, v_2, \alpha)$  is increasing in  $\kappa_2$  and decreasing in  $v_2$ , that  $\frac{\partial V_2^L(\delta_2^* \mid \theta)}{\partial \kappa_1} \propto \frac{\partial V_2^L(\delta_2^* \mid \theta)}{\partial \lambda_1} \leq 0$  while  $\frac{\partial V_2^L(\delta_2^* \mid \theta)}{\partial v_1} > 0$ .

Note next that the qualitative features of the dominant shareholder’s optimal tunneling policy at  $t = 2$  do not change from those described in Proposition 4 even if the Nash bargaining solution is used in the renegotiation game. Specifically, there exists  $D_2 \leq \bar{\Pi}'_2(\theta) < \Pi''_2$  such that the firm defaults whenever  $\Pi_2 < \bar{\Pi}'_2(\theta)$  and  $S$  uses the unconstrained optimal tunneling policy  $\bar{W}$ , but there is no default whenever  $\Pi_2 \geq \bar{\Pi}'_2(\theta)$ . If  $\Pi_2 \leq \bar{\Pi}'_2(\theta) < \Pi''_2$ , then  $S$  tunnels  $\hat{W}(\Pi_2) = \Pi_2 - D_2$ , while if  $\Pi_2 \geq \Pi''_2$ , then  $S$  again tunnels  $\bar{W}$ . It can be shown that w.r.t.  $\Pi_2(\theta)$

defined in Proposition 4,  $\Pi_2'' > \tilde{\Pi}_2'(\theta) \geq \Pi_2'(\theta)$  because  $V_2^S(\delta_2^* | \theta) < V_2^S(\delta_2^* | \theta)$ ; that is, the expected payoffs of  $S$  in the Nash outcome are strictly less than the corresponding payoffs when  $S$  makes the take-it-or-leave-it offer, and hence the incentives to avoid default are lower with the Nash bargaining outcome ceteris paribus. In particular,  $\frac{\partial \tilde{\Pi}_2'(\theta)}{\partial \kappa_1} > 0$ . And, since  $\frac{\partial V_2^L(\delta_2^* | \theta)}{\partial \kappa_1} \leq 0$ ,  $\frac{\partial V_2^L(\delta_2^* | \theta)}{\partial v_1} > 0$ , Proposition 4 continues to hold with the Nash bargaining solution. It follows then that Theorem 1 also continues to apply. Meanwhile, the comparative statics results of Theorems 2 and 3 are unaffected because these parameters have qualitatively similar effects on  $V_2^S(\delta_2^* | \theta)$  and  $V_2^L(\delta_2^* | \theta)$ , as they do with respect to the bargaining equilibrium considered above.

### Appendix C: Estimation Details of EW-GMM

For notational ease, we rewrite the system (5)–(6) as

$$\gamma_i = \kappa_i A + z_i B^\dagger + \Phi_i + \varepsilon_i \tag{31}$$

$$\kappa_i = z_i C^\dagger + \Phi_i + v_i, \tag{32}$$

where  $B^\dagger \equiv (B, 0)'$  and  $C^\dagger \equiv (C, 0)'$  (where 0 is a vector of zeros of appropriate dimension). The reduced form of (31) is given by

$$\gamma_i = \Phi_i A^* + z_i B^* + \varepsilon_i^*, \tag{33}$$

where  $B^* = B^\dagger + AC^\dagger$  and  $A^* = (1 + A)$ ,  $\varepsilon_i^* = (Av_i + \varepsilon_i)$ . The population regression of  $\kappa_i$  on  $z_i$  is  $\mu_\kappa = E(z_i' z_i)^{-1} E(z_i' \kappa_i)$ . Using Equation (32), denote the regression of  $\Phi_i$  on  $z_i$  by  $\mu_\Phi = E(z_i' z_i)^{-1} E(z_i' \Phi_i) = \mu_\kappa - C^\dagger$ . It is assumed that  $z_i$  is exogenous and observable by the econometrician. Subtracting  $z_i \mu_\kappa$  from both sides of (32) gives

$$\kappa_i - z_i \mu_\kappa = \Phi_i + z_i (C^\dagger - \mu_\kappa) + v_i = \Phi_i^* + v_i, \tag{34}$$

where  $\Phi_i^* = \Phi_i - z_i \mu_\Phi$ . By construction, the residuals  $\Phi_i^*$  from the regression  $\Phi_i$  on  $z_i$  have an expectation of zero. Similarly, using Equation (33),  $\mu_\gamma = E(z_i' z_i)^{-1} E(z_i' \gamma_i) = A^* \mu_\Phi + B^*$ . Subtracting  $z_i \mu_\gamma$  from both sides of (33) yields

$$\gamma_i - z_i \mu_\gamma = A^* \Phi_i + z_i (B^* - \mu_\gamma) + \varepsilon_i^* = A^* \Phi_i^* + \varepsilon_i^*. \tag{35}$$

Note that for the reduced-form model in (34) and (35) it holds that  $E(\Phi_i^*) = E(\varepsilon_i^*) = E(v_i) = 0$ ,  $E(\varepsilon_i^* v_i) = \sigma_{\varepsilon v}$ , and  $\Phi_i^*$  is independent of  $\varepsilon_i^*$  and  $v_i$ .

The estimation of  $A$  can be obtained in two steps (e.g., Erickson and Whited 2002). First, an estimate for the population means  $\mu_\gamma$  and  $\mu_\kappa$  can be obtained from the least square estimates  $\hat{\mu}_\gamma = [\sum_i z_i' z_i]^{-1} [\sum_i z_i' \gamma_i]$  and  $\hat{\mu}_\kappa = [\sum_i z_i' z_i]^{-1} [\sum_i z_i' \kappa_i]$ . Subsequently, these results can be substituted in the expression for  $\gamma_i - z_i \hat{\mu}_\gamma$  and  $\kappa_i - z_i \hat{\mu}_\kappa$ . A GMM approach can then be applied to estimate  $\hat{A}_{GMM}^*$  using high-order sample moments of  $\gamma_i - z_i \hat{\mu}_\gamma$  and  $\kappa_i - z_i \hat{\mu}_\kappa$ , from which  $\hat{A}_{GMM}$  is obtained using the expression  $\hat{A}_{GMM} = \hat{A}_{GMM}^* - 1$ . The estimates for  $B^\dagger$  and  $C^\dagger$  are obtained from several simultaneous relations. Substituting  $\hat{A}_{GMM}^*$  and  $\mu_\Phi = \mu_\kappa - C^\dagger$  into  $\hat{\mu}_\gamma = \hat{A}_{GMM}^* \mu_\Phi + B^*$ , we obtain

$$\hat{\mu}_\gamma - (1 + \hat{A}_{GMM}) (\hat{\mu}_\kappa - C^\dagger) - B^* = 0. \tag{36}$$

We next use Equations (34) and (35) along with  $E(\Phi_i^*) = E(\varepsilon_i^*) = E(v_i) = 0$ . Taking expectations of (34) and (35), we obtain  $E\Phi_i + Ez_i(C^\dagger - \mu_\kappa) + Ev_i = 0$  and  $EA^*\Phi_i + Ez_i(B^* - \mu_\gamma) + E\tilde{\varepsilon}_i = 0$ , and solving them simultaneously we get

$$Ez_i(\hat{A}_{GMM} + 1) \left[ (C^\dagger - \hat{\mu}_\kappa) - (B^* - \hat{\mu}_\gamma) \right] = 0. \tag{37}$$

We substitute for  $B^* = B^\dagger + \hat{A}_{GMM}C^\dagger$ ,  $\hat{\mu}_\kappa = [\sum_i z'_i z_i]^{-1} [\sum_i z'_i \gamma_i]$ ,  $\hat{\mu}_\gamma = [\sum_i z'_i z_i]^{-1} [\sum_i z'_i \kappa_i]$  and the sample average of  $n^{-1} \sum_i z_i$  for  $Ez_i$ . Subsequently, we have two unknowns ( $B^\dagger$  and  $C^\dagger$ ) and two equations, (36) and (37), to get the estimates of  $C^\dagger$  and  $B^\dagger$ .

*Moment Conditions:* To estimate  $\hat{A}_{GMM}$ , we use several moment conditions. Let  $\dot{\gamma}_i = \gamma_i - z_i \hat{\mu}_\gamma$  and  $\dot{\kappa}_i = \kappa_i - z_i \hat{\mu}_\kappa$ . Our GMM estimator is based on equations expressing the moments of  $\dot{\gamma}_i$  and  $\dot{\kappa}_i$  as functions of  $A$  and the moments of  $\Phi_i^*$ ,  $\varepsilon_i^*$ , and  $v_i$ . Moment conditions involve (a.1)  $\mathbb{E}(\dot{\gamma}_i^2) = A^{*2} \mathbb{E}(\Phi_i^{*2}) + \mathbb{E}(\varepsilon_i^{*2})$ , (a.2)  $\mathbb{E}(\dot{\gamma}_i \dot{\kappa}_i) = A^* \mathbb{E}(\Phi_i^{*2})$ , and (a.3)  $\mathbb{E}(\dot{\kappa}_i^2) = \mathbb{E}(\Phi_i^{*2}) + \mathbb{E}(v_i^2)$ . The left-hand-side quantities in these conditions can be estimated consistently, but there are three equations and four unknown parameters on the right-hand side. To overcome this underidentification problem, we use the third-order product moment equations, which consist of two equations and two unknowns: (a.4)  $\mathbb{E}(\dot{\gamma}_i^2 \dot{\kappa}_i) = A^{*2} \mathbb{E}(\Phi_i^{*3})$ , (a.5)  $\mathbb{E}(\dot{\gamma}_i \dot{\kappa}_i^2) = A^* \mathbb{E}(\Phi_i^{*3})$ . The system of the form (a.1)–(a.5) now has five equations and five right-hand-side unknowns.  $A^*$  can be obtained from (a.4) and (a.5) when  $\mathbb{E}(\Phi_i^{*3}) \neq 0$  and  $A^* \neq 0$ . Given  $A^*$ , all of the system can be solved for the other parameters. We obtain an overidentified equation by combining (a.1)–(a.5) with the fourth-order product moment equations:

$$\begin{aligned} \text{(a.6)} \quad & \mathbb{E}(\dot{\gamma}_i^3 \dot{\kappa}_i) = A^{*3} \mathbb{E}(\Phi_i^{*4}) + 3A^* \mathbb{E}(\Phi_i^{*2}) + \mathbb{E}(\varepsilon_i^{*2}) \\ \text{(a.7)} \quad & \mathbb{E}(\dot{\gamma}_i^2 \dot{\kappa}_i^2) = A^{*2} [\mathbb{E}(\Phi_i^{*4}) + \mathbb{E}(\Phi_i^{*2}) \mathbb{E}(v_i^2)] + \mathbb{E}(\varepsilon_i^{*2}) [\mathbb{E}(\Phi_i^{*2}) + \mathbb{E}(v_i^2)] \\ \text{(a.8)} \quad & \mathbb{E}(\dot{\gamma}_i \dot{\kappa}_i^3) = A^* [\mathbb{E}(\Phi_i^{*4}) + 3A^* \mathbb{E}(\Phi_i^{*2}) \mathbb{E}(v_i^2)]. \end{aligned}$$

The resulting system now has eight equations and six unknowns  $\Psi \equiv [A, \mathbb{E}(\Phi_i^{*2}), \mathbb{E}(\varepsilon_i^{*2}), \mathbb{E}(v_i^2), \mathbb{E}(\Phi_i^{*3}), \mathbb{E}(\Phi_i^{*4})]'$ . Overall, (a.1)–(a.8) can be written as  $\mathbb{E}[f_i(\mu)] = c(\Psi)$ , where  $\mu \equiv \text{vec}(\mu_\gamma, \mu_\kappa)$ ,  $f_i(\mu)$  are the distinct elements of  $\dot{\gamma}_i^{r_0} \dot{\kappa}_i^{r_1}$  (with  $r_0$  and  $r_1$  non-negative integers), and the elements of  $c(\Psi)$  are the corresponding right-hand sides of (a.1)–(a.8). The sample analogue of  $f_i(\mu)$  can be written as  $g_i(\hat{\mu}) = n^{-1} \sum_{i=1}^n f_i(\hat{\mu})$ . Suppose that we have a positive definite matrix  $\hat{W}$ . Then, the GMM estimator is obtained by numerically minimizing a quadratic form:  $\hat{\Psi}_{GMM} = \arg \min_{\varphi \in \Psi} (g_i(\hat{\mu}) - c(\varphi))' \hat{W} (g_i(\hat{\mu}) - c(\varphi))$ . We use the Gauss-Newton algorithm to solve this recursive minimization problem and pool the cross-section estimates using a minimum distance estimator (e.g., Holtz-Eakin, Newey, and Rosen 1988; Arellano and Bond 1991).

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