

Firm scope, debt and value: a structural model of business groups^{*}

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Abstract

Despite group diffusion, there is no model helping to price the claims issued by affiliated units. We compute the value of a holding company and of its controlled subsidiary, letting them optimally issue both equity and debt against their cash flows, in a model with bankruptcy costs and non-neutral taxation. We then compare them to stand alones and conglomerates. Groups destroy equity value even if they maximize total firm value. The risk and size characteristics of holdings and subsidiaries emerge endogenously.

Keywords: business groups, internal capital market, leverage, bankruptcy costs, limited liability

JEL classification numbers

1 Introduction

Companies are organized as groups in several countries (Khanna and Yafeh, 2006; Barca and Becht, 2001). Despite group diffusion, there is no model helping to price the claims issued by affiliated units. This is a simple task when the irrelevance theorem holds, so that leverage has no consequence on value. It becomes challenging when this is no longer possible, as value is jointly determined with the optimal capital structure of each unit. Our model computes the value of a holding company and of its controlled subsidiary, letting them optimally issue

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both equity and debt against their cash flows. The holding is allowed to transfer funds to its subsidiary through the internal capital market, while enjoying limited liability vis-à-vis the subsidiary's external debt obligations¹. Otherwise our framework mirrors the one used to study stand-alones and conglomerates by Leland (2007). Thus, we focus on purely financial synergies arising from firm combinations and assume exogenous operating cash flows from two production units. And we depart from the Modigliani Miller theorem by postulating bankruptcy costs and the possibility to deduct interests from taxes (Modigliani and Miller 1958, Stiglitz 1969).

In this setting, we show that the total value of group affiliated firms exceeds that of stand-alone companies because of diversification opportunities offered by the internal capital market, which obtain as long as correlation between cash flows is less than perfect. We further show that group value exceeds the conglomerate one. In the latter, one insolvent unit may drag the other healthy one into bankruptcy - the "Sarig effect". If bankruptcy is costly, this may reduce the conglomerate value even below that of the stand alone case (Leland, 2007). In groups this does not happen, because the holding uses its limited liability and lets its subsidiary go bankrupt when its rescue is value reducing.

Surprisingly, groups are value maximizing also when the two units are identical, i.e. when there are no diversification gains brought about by the internal capital market. The reason is that they are able to maximize the tax shield and minimize bankruptcy costs by optimizing joint capital structure. Specifically, the subsidiary levers up more than if it were stand alone, while the holding company raises no debt. Thus the holding never goes bankrupt while contributing to minimize the subsidiary insolvency. In turn, the interest burden on the subsidiary dramatically reduces taxation. Our model thus fits into the literature that highlights the "bright side" of internal capital markets. Our emphasis is however on the ability of groups to optimize the trade off between bankruptcy risk and the tax burden, whereas previous research focuses on their ability to circumvent imperfections arising from asymmetric information (Stein, 1997; Gertner, Scharfstein and Stein, 1994).

Value destruction in groups appears by now as an empirical regularity. In several countries and over different time spans, shareholders' value appears to be lower in groups than in competing organizations even when this cannot be ascribed to worse operating performance ((Bennedsen and Nielsen, 2006; Claessens et al., 2002). One view holds that controlling

¹Khanna and Palepu (2000) observe that Indian group firms assist each other in times of financial distress, while Bertrand et al. (2002) document cash transfers in several forms - from asset sales to internal loans at subsidized rates.

shareholders divert resources to the expense of minority shareholders. Below we propose another explanation, that is able to account for discounts even in countries with strict enforcement of securities regulation and social stigma for diversion. In order to minimize its own bankruptcy probability and to rescue the subsidiary as much as it can afford to, it is optimal for the holding to reduce its leverage. The cash transfer from the holding benefits the subsidiary's debtholders, whose claims increase in value. The equity value of the subsidiary however falls to almost zero because its leverage is much larger than the stand alone one, allowing to exploit the tax shelter but increasing the likelihood of default.

When we allow for different characteristics of the exogenous cash flows, we are able to endogenously characterize optimal organizational form together with leverage in the two units. Consistent with empirical evidence (Robinson, 2006; Bianco and Nicodano, 2006), we find that subsidiaries are riskier than their holding companies. Robinson relates this finding to the inability of guaranteeing funding to highly risky project inside a multidivisional corporation. This prompts the signing of a legally binding contract between two separately incorporated units. In our model, the hierarchical structure matters. The holding will be able to let its subsidiary go bankrupt when it cannot afford paying back both lenders. Moreover, shielding income from taxes by leveraging up the subsidiary has higher value with a riskier cash flow.

We borrow the modelling of tax rates and bankruptcy costs from Leland (2007). In particular, there are no tax refunds being paid to the firm when its income is negative. In the real world, some losses may be carried forward by companies, in order to reduce the asymmetric nature of taxation - which however remains. In this investigation, we do not allow for intercorporate taxation of dividends - advocated by Morck (2004) - that could however be accommodated. Bankruptcy costs are proportional to cash-flows. This is a well accepted assumption in structural models of credit risk.

In our model, the holding company commits to rescue its subsidiary when this is possible without compromising its own solvency. In reality, holding companies write comfort letters assuring subsidiaries' lenders that they would assist them in distress. These do not undermine their limited liability, because they are legally unenforceable and discretionary contracts that allow the holding companies not to honor them when they would not be able to preserve their own integrity (Boot et al, 1993). Such commitment is sustainable because of reputational concerns, and may turn out to be extremely valuable in the case of distressed industries, when acquisitions are not observed and bankruptcy costs are especially

large (Acharya et al., 2005).²

We use structural models of credit risk, that typically assume away agency and strategic problems, to analyse how the internal capital market affects optimal leverage and value. On the contrary several papers study how agency problems in internal capital markets affect product market competition and investment choice³. Cestone and Fumagalli (2005) analyze the specificities of group internal capital market by both assuming limited liability of the holding⁴ and allowing subsidiaries to raise their own debt, as we do. They study how transfers from the holding impact on the conditions obtained by subsidiaries from its outside financiers, when managerial effort cannot be observed. Better credit conditions are the outcome of increased managerial effort, rather than that of reduced tax burden.

Almeida and Wolfenzon (2006) explain that a group emerges when entrepreneurs fund projects indirectly, through another company, rather than directly. Indirect financing is the only equilibrium when the present value of the project - net of diversion - is negative, because part of the burden is shifted onto the minority shareholders of the company. Our theory of business groups does not assume diversion at the expense of non controlling shareholders, and can therefore in principle explain why groups thrive also in countries characterized by high shareholders' protection - such as Sweden - and by limited stakes by minority shareholders. Furthermore, separate incorporation of the subsidiary and the associated limited liability of the holding are a key ingredient of groups in our model, which clearly distinguish their properties from those of a conglomerate. On the contrary, indirect financing could be accommodated through both a pyramid and a conglomerate in their model.⁵

Another related paper, Huizinga et al (2007), studies multinational tax arbitrage that is engineered by raising more debt in high-tax countries. In our model, groups minimize the tax burden through debt even if there is no tax rate differential between the holding and its subsidiary.

The paper is organized as follows. Section 2 presents the set up, and

²In our model, such commitment is ex-ante optimal as lenders, who save on the deadweight cost of bankruptcy, provide better credit conditions. Ex post, both a stand alone firm and group affiliated unit may find it optimal to acquire a distressed one - as in Fluck and Lynch (1999).

³Most focus on aspects, such as cash-flow pooling, that are typical of both conglomerates and groups. See, among others, Rajan Servaes Zingales (2000) and Faure Grimaud and Inderst (2005).

⁴This is a common characteristic across major jurisdictions. See Blumberg (1989) for the US, and Hadden (1996) on Britain, France, Germany and the US.

⁵Both theories are able to accommodate cases with varying degrees of separation of ownership from control, that are commonly observed.

three organizational modes for two activities - stand alone, group and conglomerate. Section 3 analyzes these three cases through a numerical example, so as to understand their respective properties. It then compares optimal leverage, value of debt and equity across the three modes, as the correlation between the cash flow varies. Section 4 numerically examines the case where units differ in mean cash flow and volatility, and further characterizes optimal organizational structure. Section 5 and Appendix A generalizes the group case, allowing the holding to receive dividends from its subsidiary.

2 The common set up

In this section we review Leland set up and his analysis of stand alone and conglomerate firms. We then extend it to the group case. We consider a no arbitrage environment with two dates $t = \{0, T\}$, where T is the length of time spanned by the dates. There are two activities, and each activity i generates a random future operational (net) cash flow value X_i at time $t = T$. X_i is a continuous random variable. The riskfree interest rate over the time period T is r_T . No arbitrage implies that the value of the operational cash flow at $t = 0$ is its discounted expected value:

$$X_{0i} = (1 + r_T)^{-1} \mathbb{E}X_i \quad (1)$$

where $\mathbb{E}X_i$ is evaluated under the risk neutral measure. The owners can “walk away” from negative cash flows thanks to limited liability. Thus the (pre-tax) value of each activity with limited liability is

$$H_{0i} = (1 + r_T)^{-1} \mathbb{E}X_i^+ \quad (2)$$

where $X_i^+ = \max(X_i, 0)$, and the pre-tax value of limited liability is

$$L_{0i} = H_{0i} - X_{0i} \geq 0 \quad (3)$$

Now consider a tax rate on future cash flows equal to τ_i . The aftertax value of the unlevered firm is

$$V_{0i} = (1 - \tau_i)H_{0i} \quad (4)$$

and the present value of taxes paid by the firm (with no debt) is

$$T_{0i}(0) = \tau_i H_{0i} \quad (5)$$

Firms can issue zero-coupon bonds at time $t = 0$ with principal value P_i due, with absolute priority, at $t = T$. They have an incentive to do so as interest on debt is a deductible expense. However, it will also

increase the probability of default, which is assumed to cost a fraction α_i of cash flows. We let the level of P_i maximize the levered firm value $\nu_{0i}(P_i)$. Let $D_{0i}(P_i)$ denote the value, at $t = 0$, of debt. The promised interest payment is therefore

$$P_i - D_{0i}(P_i) \quad (6)$$

Taxable income is the operational one net of interest payment:

$$X_i - (P_i - D_{0i}(P_i)) \quad (7)$$

The zero-tax level of cash flow, X_i^Z , is then

$$X_i^Z(P_i) = P_i - D_{0i}(P_i) \quad (8)$$

Hereafter the argument P_i of D_{0i} and X_i^Z is often suppressed.

We assume that no tax refunds are paid to the owners of the activity if $X_i < X_i^Z$. It follows that operational cash flows, net of tax payments, are⁶

$$X_i^n = X_i^+ - \tau_i(X_i - X_i^Z)^+ = \begin{cases} 0 & X_i < 0 \\ X_i & 0 < X_i < X_i^Z \\ X_i(1 - \tau) + \tau X_i^Z & X_i > X_i^Z \end{cases} \quad (9)$$

The present value of future tax payments of the levered firm is equal to:

$$T_{0i}(P_i) = \tau_i(1 + r_T)^{-1} \mathbb{E}(X_i - X_i^Z)^+ \quad (10)$$

Similarly to Merton (1974), default occurs when net operational cash flow is smaller than the face value of the debt:

$$X_i^n < P_i \quad (11)$$

Having defined the default threshold X_i^d as

$$X_i^d(P_i) = P_i + \frac{\tau_i}{1 - \tau_i} D_{0i}(P_i) = \frac{P_i - \tau_i X_i^Z}{1 - \tau_i} \quad (12)$$

the default triggering condition (11) can be written in terms of the pre tax cash flows as $X_i < X_i^d$. In the event of default, we assume that bondholders will receive a fraction $(1 - \alpha_i)$ of operational cash flow, X_i , when this is positive.

The value of equity and debt is the expected present value of cash flows accruing to shareholders and lenders respectively, evaluated under the risk neutral measure.

Such cash flows vary with organizational structure, which we analyze below.

⁶Having assumed X_i continuous, we omit the boundary values in this and the following inequalities on payoffs.

2.1 The stand alone case

We now assume that the two activities, $i = 1, 2$, are separately incorporated. Thus the face value of debt in firm i maximizes the value of firm i :⁷

$$\nu_{0i}(P_i) = E_{0i} + D_{0i} \quad (13)$$

The cash flow to shareholders, E_i , is operational cash flow less taxes and the repayment of principal, when the difference is positive:

$$E_i(P_i) = (X_i^n - P_i)^+ \quad (14)$$

By no arbitrage the value of equity is simply⁸

$$E_{0i}(P) = (1 + r_T)^{-1} \mathbf{E}(X_i^n - P_i)^+ \quad (15)$$

The cash flows D_i to lenders at time $t = T$ will equal P_i when $X_i > X_i^d$ and the firm is solvent. Recalling that the government has priority for tax payments before lenders, the latter will absorb a tax liability $\tau_i(X_i - X_i^Z)$ in default when $X_i^Z < X_i < X_i^d$. The payoff to lenders is therefore

$$D_i(P_i) = \begin{cases} (1 - \alpha_i)X_i & 0 < X_i < X_i^Z \\ (1 - \alpha_i)X_i - \tau_i(X_i - X_i^Z) & X_i^Z < X_i < X_i^d \\ P_i & X_i > X_i^d \end{cases} \quad (16)$$

and it can be represented as follows:

Insert here figure 1

Its present value $D_{0i}(P_i)$, the value of zero-coupon debt given the principal P_i , can be written as

$$D_{0i}(P_i) = (1 + r_T)^{-1} \mathbf{E} \left[\begin{array}{l} (1 - \alpha_i)X_i \mathbf{1}_{\{0 < X_i < X_i^Z\}} + \\ [(1 - \alpha_i)X_i - \tau_i(X_i - X_i^Z)] \mathbf{1}_{\{X_i^Z < X_i < X_i^d\}} + \\ + P_i \mathbf{1}_{\{X_i > X_i^d\}} \end{array} \right] \quad (17)$$

⁷This is the objective if the owner sells her activity, as the cash inflow from the sale is precisely the sum of debt and equity. It is also the objective in case she keeps a fraction of equity capital, in which case her cash inflow is reduced by the amount she does not sell.

⁸Notice that E_{0i} is a call option with underlying X_i^n and exercise price P_i . It depends on debt principal both directly and indirectly, through the tax shield X_i^Z that enters the underlying.

where $\mathbf{1}_{\{\bullet\}}$ is the usual indicator function.⁹ Note that (17) is an implicit equation, since X_i^Z and X_i^d are themselves function of D_{0i} through (8) and (12). Numerical methods are required for its solution. Since D_{0i} determines the thresholds and the latter enter the equity value, the solution approach consists in finding a fixed point for D_{0i} and then determine X_i^Z , X_i^d and E_{0i} .

The value increase due to leverage, $\nu_{0i}(P_i) - V_{0i}$, reflects tax savings from interest deduction less default costs. Thus the value of the levered firm can also be expressed as

$$\nu_{0i}(P_i) = V_{0i} + TS_i(P_i) - DC_i(P_i) \quad (18)$$

where $TS_i(P_i)$ is the present value of tax savings, equal to the difference in taxes between the levered and unlevered firm

$$TS_i(P_i) = T_i(0) - T_i(P_i) = \tau_i (1 + r_T)^{-1} [\mathbf{E}X_i^+ - \mathbf{E}(X_i - X_i^Z)^+] \quad (19)$$

and $DC_i(P_i)$ is the present value of the default costs incurred in because of leverage:

$$DC_i(P_i) = \alpha_i(1 + r_T)^{-1} \mathbf{E} \left[X_i \mathbf{1}_{\{0 < X_i < X_i^d\}} \right] \quad (20)$$

As V_{0i} in equation (18) is independent of P_i , the optimal leverage problem can also be posed as choosing the debt level P_i to maximize tax savings less default costs.

2.2 Groups

We now analyze the case where the two activities are separately incorporated, but one of the two - the holding company - transfers cash flows to the subsidiary in order to honour debt obligations when this allows the survival of both. Following the legal literature, we assume that the holding company otherwise enjoys limited liability, being not responsible for the subsidiary's debt obligations if the subsidiary defaults.¹⁰

The initial owner chooses the face value of debt in the holding ($i = h$) and in the subsidiary ($i = s$) so as to maximize levered group ($i = g$) value:

$$\nu_0^g = v_0(P_h, P_s) = E_{0h} + D_{0h} + E_{0s} + D_{0s} \quad (21)$$

⁹Due to default costs and tax savings, debt $D_{0i}(P_i)$ is a portfolio of plain vanilla puts and the present value of the principal.

¹⁰We know that some jurisdictions require minority shareholders to be present in the subsidiary for this to be the case. We however abstract from the identity of shareholders at present.

subject to state contingent cash flow transfers that we now characterize. For the time being, we posit that the holding controls the subsidiary with an infinitesimal equity share. We later remove this simplifying assumption, so as to study what happens when the holding receives dividends from the subsidiary.

Let us denote with X_s and X_h the pretax operational cash flows of the two units. A necessary condition for the transfer is that the subsidiary is in default and the holding is not. Moreover, limited liability ensures that there is no rescue if the operational cash flows of the subsidiary are negative, as the holding would otherwise bear an operational loss that it could have avoided:

$$\begin{cases} 0 < X_s < X_s^d, \\ X_h > X_h^d \end{cases} \quad (22)$$

where the default thresholds X_i^d , $i = h, s$ and the tax shield X_i^Z correspond to (12) and (8).

A condition ensuring that the transfer honours the subsidiary debt obligations is that the after-tax holding cash flow, net of debt repayment, exceeds the corresponding difference for the subsidiary:

$$X_h^n - P_h > P_s - X_s^n \quad (23)$$

Overall, a transfer will occur if and only if (22) and (23) hold:

$$\begin{cases} 0 < X_s < X_s^d, \\ X_h > X_h^d \\ X_h^n - P_h > P_s - X_s^n \end{cases} \quad (24)$$

In what follows, we denote the occurrence of these conditions as event A and the amount of the transfer as $(P_s - X_s^n)\mathbf{1}_{\{A\}}$.

The cash-flow accruing to shareholders of the holding company is equal to the stand alone one, $(X_h^n - P_h)^+$, less the transfer amount:

$$E_h(P_h, P_s) = (X_h^n - P_h)^+ - (P_s - X_s^n)\mathbf{1}_{\{A\}} \quad (25)$$

It follows that the equity value is

$$E_{0h}(P_h, P_s) = (1 + r_T)^{-1} \mathbf{E} [(X_h^n - P_h)^+ - (P_s - X_s^n)\mathbf{1}_{\{A\}}] \quad (26)$$

The payoff to subsidiary lenders are the same as in the stand alone case, outside the states when a transfer takes place. It must instead be augmented by the transfer in the transfer area, as shown in Figure 2.

Insert here figure 2

Since debt is the present expected value of these final payoffs, it becomes:

$$D_{0s}(P_s, P_h) = (1 + r_T)^{-1} \mathbb{E} \left[\begin{array}{l} X_s(1 - \alpha)\mathbf{1}_{\{B\}} + \\ + [X_s(1 - \alpha) - \tau(X_s - X_s^Z)] \mathbf{1}_{\{C\}} + \\ + P_s [\mathbf{1}_{\{A\}} + \mathbf{1}_{\{X_s > X_s^d\}}] \end{array} \right] \quad (27)$$

where the event B occurs when there is no transfer and $0 < X_s < X_s^Z$, C occurs when there is no transfer and $X_s^Z < X_s < X_s^d$.

The reader can notice that it depends on debt face values of both subsidiary and holding companies, since the transfers, tax shields and default thresholds do. Thus both E_{0h} and D_{0s} depend on both principals P_h and P_s , which must be simultaneously chosen.

The payoffs to lenders of the holding do not change with respect to the stand alone case, as the transfer to the subsidiary occurs only after the service of the holding debt. Similarly, equity holders of the subsidiary are unaffected, as the transfer occurs for the sake of servicing debt. As a consequence equations (17) and (14) still hold for $i = h$ and $i = s$ respectively.

The tax shield enjoyed by the two companies - that together form a group - and their total default costs amount to:

$$TS_g = TS_s + TS_h = \tau(1 + r_T)^{-1} \left[\begin{array}{l} \mathbb{E}X_s^+ - \mathbb{E}(X_s - X_s^Z)^+ + \\ + \mathbb{E}X_h^+ - \mathbb{E}(X_h - X_h^Z)^+ \end{array} \right] \quad (28)$$

$$DC_g = \alpha(1 + r_T)^{-1} \left\{ \mathbb{E} [X_s \mathbf{1}_{\{B\}} + X_s \mathbf{1}_{\{C\}}] + \mathbb{E} [X_h \mathbf{1}_{\{0 < X_h < X_h^d\}}] \right\} \quad (29)$$

2.2.1 Value comparison: groups versus stand alones

The value change with respect to the stand alone case is given by:

$$\Delta \nu_{0g} = \nu_0(P_h, P_s) - \nu_0(P_1) - \nu_0(P_2) = \Delta TS_g - \Delta DC_g \quad (30)$$

where the difference in tax savings and default costs are respectively:

$$\Delta TS_g = TS_s + TS_h - TS_1 - TS_2 \quad (31)$$

$$= \tau(1 + r_T)^{-1} \left[\begin{array}{l} \mathbb{E}(X_1 - X_1^Z)^+ + \mathbb{E}(X_2 - X_2^Z)^+ + \\ - \mathbb{E}(X_s - X_s^Z)^+ - \mathbb{E}(X_h - X_h^Z)^+ \end{array} \right]$$

$$\Delta DC_g = DC_g - DC_1 - DC_2 = \alpha(1 + r_T)^{-1} \times \quad (32)$$

$$\left\{ \begin{array}{l} \mathbb{E} [X_s \mathbf{1}_{\{B\}} + X_s \mathbf{1}_{\{C\}}] + \mathbb{E} [X_h \mathbf{1}_{\{0 < X_h < X_h^d\}}] + \\ - \mathbb{E} [X_1 \mathbf{1}_{\{0 < X_1 < X_1^d\}} + X_2 \mathbf{1}_{\{0 < X_2 < X_2^d\}}] \end{array} \right\}$$

2.3 Conglomerate

A conglomerate obtains when the two activities are incorporated as one company. Its cash flow is the sum of the cash flows of the original activities:

$$X_m = X_1 + X_2 \quad (33)$$

One activity thus subsidizes the other in case of default, as claims are issued against the sum of the two cash flows. The unique choice variable is the face value of debt, P_m , which maximizes

$$\nu_0^m = \nu_0(P_m) = E_0(P_m) + D_0(P_m) \quad (34)$$

where $E_0(P_m)$ and $D_0(P_m)$ are computed according to (14) and (16) with $i = m$.

As in the case of stand alones, the equivalent problem is to maximize tax savings

$$TS_m = \tau(1 + r_T)^{-1} [E(X_m)^+ - E(X_m - X_m^Z)^+] \quad (35)$$

less default costs:

$$DC_m = \alpha(1 + r_T)^{-1} E \left[(X_m) \mathbf{1}_{\{0 < X_m < X_m^d\}} \right] \quad (36)$$

where X_m^Z and X_m^d are defined as in (8) and (12).

2.3.1 Value comparison: conglomerates versus stand alones and groups

Leland (2007) decomposes the total value differential relative to the stand alone case, $\Delta\nu_{0m}$, into a differential value for the unlevered company and a leverage effect:

$$\Delta\nu_{0m} = \nu_0(P_m) - \nu_0(P_1) - \nu_0(P_1) = \underbrace{\Delta V_{0m}}_{\text{Sarig effect}} + \underbrace{\Delta TS_m - \Delta DC_m}_{\text{Leverage effect}} \quad (37)$$

where

$$\Delta V_{0m} = (1 - \tau)(1 + r_T)^{-1} [E(X_1 + X_2)^+ - EX_1^+ - EX_2^+] \quad (38)$$

This term - the "Sarig effect" - can be negative as limited liability for stand alone companies provides a valuable option to walk away from future losses, which is partially given up by joint incorporation.

In turn, the leverage effect is composed of the tax shield ΔTS_m and the change in bankruptcy cost ΔDC_m .

$$\Delta TS_m = TS_m - TS_1 - TS_2 = \quad (39)$$

$$= \tau(1 + r_T)^{-1} \left[\begin{array}{l} -\mathbf{E}(X_m - X_m^Z)^+ + \mathbf{E}(X_1 - X_1^Z)^+ + \\ +\mathbf{E}(X_2 - X_2^Z)^+ + \mathbf{E}(X_m)^+ - \mathbf{E}X_1^+ - \mathbf{E}X_2 \end{array} \right]$$

$$\Delta DC_m = DC_m - DC_1 - DC_2 = \quad (40)$$

$$= \alpha(1 + r_T)^{-1} \left[\begin{array}{l} \mathbf{E} \left[X_m \mathbf{1}_{\{0 < X_m < X_m^d\}} \right] + \\ -\mathbf{E} \left[X_1 \mathbf{1}_{\{0 < X_1 < X_1^d\}} + X_2 \mathbf{1}_{\{0 < X_2 < X_2^d\}} \right] \end{array} \right]$$

We now extend the comparison to a group versus a conglomerate. Tax savings, default costs and value differentials are respectively equal to:

$$\Delta TS_g - \Delta TS_m =$$

$$= \tau(1 + r_T)^{-1} \left[\begin{array}{l} -\mathbf{E}(X_s - X_s^Z)^+ - \mathbf{E}(X_h - X_h^Z)^+ + \\ +\mathbf{E}(X_m - X_m^Z)^+ - \mathbf{E}(X_m)^+ + \mathbf{E}X_1^+ + \mathbf{E}X_2^+ \end{array} \right] \quad (41)$$

$$\Delta DC_g - \Delta DC_m =$$

$$= \alpha(1 + r_T)^{-1} \left\{ \begin{array}{l} \mathbf{E} \left[X_s \mathbf{1}_{\{B\}} + X_s \mathbf{1}_{\{C\}} \right] + \\ +\mathbf{E} \left[X_h \mathbf{1}_{\{0 < X_h < X_h^d\}} \right] - \mathbf{E} \left[(X_m) \mathbf{1}_{\{0 < X_m < X_m^d\}} \right] \end{array} \right\} \quad (42)$$

$$\Delta \nu_0 = \nu_0(P_h, P_s) - \nu_0(P_m) = \Delta \nu_{0g} - \Delta \nu_{0m} = \quad (43)$$

$$\Delta TS_g - \Delta DC_g - \Delta V_{0m} - \Delta TS_m + \Delta DC_m$$

3 Numerical analysis

This section analyzes the properties of different organizational modes through numerical methods assuming that the annual cash flow distribution is Normal. The parameters are borrowed from the base case in Leland (2007), which is consistent with a typical firm that issues BBB-rated unsecured debt. Table 1 reports parameter values. Expected operational cash flow for each activity, $Mu = 127.6$, is chosen such that its present value is $X_0 = 100$. Operational cash flow at the end of 5 years has standard deviation (Std) of 49.2, consistent with an annual standard deviation of cash flows equal to 22.0 ($= 49.2/\sqrt{5}$) if annual cash flows are independently distributed in time. Henceforth we express volatility σ as an annual percent of initial activity value X_0 , e.g. $\sigma = 22\%$. The tax rate $\tau = 20\%$ and the default cost parameter $\alpha = 23\%$ are chosen so as to generate optimal leverage and recovery rates consistent with the BBB choice.

Table 1: Base Case Parameters

Variables	Symbols	Values
Annual Riskfree Rate	r	5.00%
Time Period/Debt Maturity (yrs)	T	5.00
T-period Riskfree Rate	$r_T = (1 + r)^T - 1$	27.63%
Capitalization Factor	$Z = (1 + r_T)/r_T$	4.62
<i>Unlevered Firm Variables</i>		
Expected Future Operational Cash Flow at T	Mu	127.63
Expected Operational Cash Flow Value (PV)	$X_0 = Mu/(1 + r)^T$	100.00
Cash Flow Volatility at T	Std	49.19
Annualized Operational Cash Flow Volatility	$\sigma = Std/T^{0.5}$	22.00
Tax Rate	τ	20%
Value of Unlevered Firm w/Limited Liability	V_0	80.05
Value of Limited Liability	L_0	0.057

Table 2 shows the optimal capital structure for a firm with base-case parameters. The first column reports values for a stand alone. The second and the third refer to holding and subsidiary respectively, while the last column to half of a conglomerate - when the correlation coefficient between the units cash flows is equal to 0.2. In turn, the correlation is chosen as in Leland.

Insert here Table 2

4 Holding and subsidiary versus stand alone

The optimal face value of debt is 57.1 for a stand alone company. When the correlation is 20%, it climbs up to 219 in the subsidiary while the one in the holding is zero. Total debt capacity is thus more than doubled by the group structure, as groups exploit the diversification potential without incurring into the Sarig effect. The yield spread paid by the subsidiary is accordingly very large (8.4 versus 1.2%), because such large debt induces a much larger probability of bankruptcy. However, the spread in the stand alone would be higher if the stand alone raised as much debt as the subsidiary, as it would not receive transfers in case of default.

Such large debt in the subsidiary maximizes the tax advantage of debt¹¹ while, at the same time, zero debt in the holding drives its expected default costs to zero. The tax shield for a subsidiary reaches 14.53, as opposed to 2.32 in a stand alone, while its expected bankruptcy

¹¹We conjecture that loss offset provisions in the fiscal code would reduce the optimal level of debt in the subsidiary.

costs are 7.98, versus 0.89 for a stand alone. The difference between tax savings and expected costs is the value of optimal leverage, that jumps from 2.82 for two stand alones to 6.31 for the group. This jump is a measure of the value of the internal capital market in groups.

One notable result is that these intercorporate links destroy shareholders' value in the subsidiary relative to the stand alone case. Indeed, the value of equity in the stand alone is larger than in the subsidiary (39.01 instead of 0.037), because of its much larger default probability. The value of equity in the holding is however larger than the stand alone one (49.2 versus 39.01). Indeed, while part of its cash flow is being transferred to the subsidiary lenders, the holding has no debt burden.

The beneficiaries of such a transfer are the debtholders in the subsidiary, who therefore charge a lower spread than if it were stand alone with the same face value of debt. Ultimately, though, the beneficiaries of the internal capital market are the initial owners of the two activities, who could sell them for more. The total value of two independent activities is equal to 162.94, while the total value of the group is 165.914.

4.0.2 The case of a regulated subsidiary

Sometimes group affiliated firms are listed on public exchanges. Several jurisdictions impose to subsidiary managers to act in the interest of the subsidiary shareholders, rather than implement what is optimal for the group (Hadden, 1996). In this a case, such a high level of debt and a value of equity close to zero in the subsidiary could be considered as a violation of the rule. We therefore investigate the effects of this policy by imposing a subsidiary debt level equal to the stand alone one, and optimize leverage in the holding.

Preliminary unreported results show that the holding company has positive optimal leverage in this case. Group value still exceeds that of competing organizations, but the differential - obviously - shrinks. Interestingly, the value of equity in the holding falls below the one of a corresponding stand alone, because transfers to the subsidiary are now coupled by an increased default probability.

4.1 Group versus conglomerate

Leland shows that merging the two activities allows the conglomerate to raise higher debt than the two stand alones because of cash flow pooling between the two units, that reduces the probability of default. This brings enhanced tax advantages because of interest deductions, as predicted by Lewellen (1971). It also allows to use the losses from the unit to offset taxable income from the other unit, thus reducing the negative impact of tax asymmetries (Majd and Myers, 1987). However

it makes possible for one unprofitable activity to absorb the cash flows of a profitable one, reducing the value of limited liability for the unlevered company - the "Sarig effect". The value of conglomerates exceeds that of two stand alone activities for a correlation coefficient between cash flows equal to 0.2. These results can be visualized by comparing the first with the last column of Table 2.

We now turn to the comparison between a conglomerate and a group. Our model shows that group debt capacity is far greater than that of conglomerates (219 versus 117.5). The novel reason is that the group is able to exploit the asymmetry of taxation, thanks to the possibility of implementing state-contingent transfers. Indeed, raising more debt from the subsidiary increases the no tax threshold, which reaches 102.32, against a mean cash flow of 127.63. As a consequence, the tax burden in a group falls to 25.36 as opposed to 35.49 in the conglomerate - and the one in the subsidiary is as low as 5.42 compared to 17.74 in a merged unit. However, the default threshold of the subsidiary is pushed up to 248.169. Such a burdensome level of the debt service can be sustained because of transfers from the holding company. At the optimum, there are both larger tax savings (14.53 versus 4.40) and larger default costs (7.98 versus 1.24). However, the value increase thanks to leveraging is twice as large in groups (6.54) than in conglomerates (3.15). As a consequence, the value of a groups, 165.914, exceeds that of a conglomerate, 162.73. Since both have an internal capital market, the value increase is due to the specificities of the group - namely limited liability and separate incorporation.

Figure 2 allows us to understand the optimal leverage strategy of the group. By setting debt to zero in the holding, its default threshold coincides with the horizontal axis. This maximizes the transfer area A , given X_s^d . Raising more debt in the subsidiary ensures that its tax threshold moves to the right - making it less likely that taxes will be paid when the firm is bankrupt. Clearly also X_s^d moves to the right, but the transfers will often make sure that the subsidiary does not default - while enjoying tax privileges.

In the following section we assess whether these patterns hold when diversification opportunities change.

4.2 Capital structure and value with changing correlation

One may expect that, as correlation among cash flow increases, the transfers from the holding to the subsidiary will become less likely and hence the optimal face values of debt will converge to the stand alone level. The first part of this reasoning is correct: as the correlation coefficient ρ

increases, the probability of a transfer from the holding to the subsidiary halves as the correlation coefficient goes from -0.8 to 0.8. The second part of the argument is however incorrect: debt in the holding continues to be zero, because this allows to eliminate the holding bankruptcy costs. The other surprising result is that the optimal face value of debt in the subsidiary increases in ρ , as evident in the upper left panel of Table 3. In conglomerates the opposite holds: as diversification opportunities vanish, debt gets as risky as the one of stand alones and converges to the same value- as the probability of paying twice bankruptcy costs increases. On the contrary, in groups the holding company never incurs into bankruptcy costs. Clearly, the market value of subsidiary debt dramatically falls as correlation increases (see upper right panel of Table 3) as lenders required spread grows from 0.017 for $\rho = -0.8$ to 0.104 for $\rho = 0.8$.

Group equity value ($E_1^* + E_2^*$) is lower than in the case of both independent companies and conglomerates, confirming shareholders' value destruction in business groups for all correlation coefficients (lower left panel of Table 3). This is due to the transfer of cash flows to the benefit of debt-holders. Finally, and most importantly, the total value of the group exceeds that of stand alones and conglomerates (Bottom right panel of Table 3) whether or not diversification benefits exist. Moreover, the value differential increases as correlation between cash flows increases above -0.5. This is because the tax burden onto stand alones is constant, the one on conglomerates increases while the one on groups falls. While it is true that default costs increase as well, it must be observed that the difference between the default threshold and the no tax threshold in the subsidiary shrinks as correlation increases. In Figure 2, the area A' gets larger relative to A'' . Thus the states of nature when the subsidiary defaults and pays taxes occur less frequently.

We can summarize the results obtained so far in the following proposition.

Proposition 1 : *assume positive bankruptcy costs, fiscal deductability of interest and the ability of holding company to commit to state contingent transfers to its subsidiary. Then the value of a group exceeds the value of conglomerates and stand alone companies. The value of equity claims is lower, while that of debt claims is larger than in other organizations.*

So far, groups have higher value than conglomerates and stand alones. This may explain why groups are so widespread in the world. Equity value destruction is an empirical regularity, which is already implied

by our model. However, our analysis is still too preliminary to address other observable implications. In particular, groups do not always raise all of their debt from subsidiaries. Faccio and Lang (2003) do document that debt is positively correlated with the separation of ownership from control in Asia - and subsidiaries are typically characterized by higher separation. However such correlation does not hold for European firms. This is also confirmed by Bianco and Nicodano (2006) with Italian data, who show that holdings have higher leverage than their subsidiaries. They argue that fear of risk shifting by non-related subsidiary lenders and the associated high interest rates may induce holding to raise debt. While this and other reasons - such as fiscal arbitrage and regulation - may change group capital structure, we want to understand whether this may happen endogenously in this model. We therefore proceed to examine the case where companies are different.

5 Characterizing holding and subsidiaries

So far numerical results refer to two symmetric activities. We ran some simulations for the cases when they differ in volatility, size and bankruptcy costs. This allows to endogenously derive the relative characteristics of holding and subsidiaries that maximize group value.

Consistent with empirical evidence (Robinson, 2006; Bianco and Nicodano, 2006), we find that subsidiaries are riskier than their holding companies in the optimal group structure. The holding will be able to let its subsidiary go bankrupt when it cannot afford paying back their lenders. Moreover, a riskier holding would suffer more from the asymmetric nature of taxation. Conversely, the tax shield has higher value with a riskier cash flow.

Activities with relatively larger bankruptcy costs should be holding companies. This is because, under the optimal capital structure, they never pay them.

Finally, some preliminary results show that smaller companies should be subsidiaries, as a large subsidiary could not always be rescued by a small holding. Consequently, it would raise less debt with a corresponding reduction in the tax shield.

6 Capital structure and intercorporate dividends

The initial owner of the two activities may want the holding to keep a fraction of the subsidiary shares, which is what we normally observe in practice. Thus $w = 1$ corresponds to a wholly owned subsidiary, while $w = 0$ - the case we analyzed above - corresponds to extreme separation between ownership and control. Thus, the holding is entitled

to a fraction w of the total payoff to subsidiary equityholders, that may in principle allow it to avoid default in some states. The Appendix characterizes the state contingent flow of dividends to the holding, as well as its new default thresholds.

The face value of debt in the two companies maximize what can be realized a group sale, which is equal to:

$$\nu_0^g = \nu_0(P_h, P_s) = E_{0h} + D_{0h} + (1 - \omega)E_{0s} + D_{0s} \quad (44)$$

Preliminary unreported results for $w = 0.5$ and $w = 1$ show that dividends do not affect optimal group capital structure, and the highly levered subsidiary pays small dividends very rarely. Results on comparative value of groups carry over to this generalized case.

7 Concluding comments.

This paper contributes to our understanding of groups in two ways. First, it provides a pricing model for group affiliated companies in a setting without agency problems vis à vis lenders and minority shareholders¹². Second, it shows that groups are value maximizing arrangements in environments where bankruptcy costs and non-neutral taxation make firm financial policy relevant. It is worth stressing that our calibration of expected default costs is conservative as they have been recently estimated to be as large as 4.5% of pre-distressed firm value in an efficient environment such as the U.S. (Almeida and Philippon, 2006). Our results may thus explain why groups are such a resilient organizational structure worldwide. They may also shed some light on the reason why they are emerging again in innovative industries in the U.S. (Allen, 1998; Sahlman, 1990), where the risk of activities is larger.

In contrast with previous literature on groups, we do not assume the extraction of private benefits by controlling shareholders. However our framework lends itself to a theoretical examination of the nature of private benefits, once one allows for differences between shareholders. We conjecture that there would be no difference in the price of majority and minority shares as long as minority shareholders invest the same stake in both the subsidiary and holding company. The benefits of transfers from one company to the other would in fact be equally shared by both minority and controlling equityholders. A wedge would appear when stakes differ, because the transfer to subsidiary's debtholders would not benefit the minority shareholders in the holding. Such a wedge would endogenously become a private benefit from control. Such reasoning may

¹²This paper does not consider the comparative credit risk properties of stand alones, conglomerates and groups for reasons of space. We analyze these in a companion work, which focuses on selective versus joint defaults of group affiliated firms.

contribute to explain why the voting premium in holding companies is larger than in subsidiaries (Nicodano, 1998).

An empirical investigation of the explanatory power of this new hypothesis would be useful, also in view of the policy stance against groups that is prevailing in Europe. Dismantling groups would cause a welfare loss for the corporate sector, with redistributions from lenders to equity-holders - if this hypothesis holds. However, a full-blown picture of group value and capital structure requires data on both ultimate holdings and ultimate subsidiaries - that are often non listed. Moreover, the standard comparison between group-affiliated and stand-alone companies appears not to be viable in the light of this model. Indeed, Tobin's q is not a substitute for firm value; and leverage cannot be considered as a control variable, being endogenously determined.

We however envisage two simpler applications of our structural model, once relevant features of the tax system are accommodated. Indeed, a calibration of cash-flow parameters should be able to assess whether it is able to replicate the observed holding company discount (Cornell and Liu, 2001) and price effects of carve-out announcements (Lamont and Thaler, 2003; Schipper and Smith, 1986).

This model may finally turn out useful to the understanding of several other institutions which are characterized by separate incorporation and yet linked by an internal capital market, such as financial conglomerates, project financing and closed-end funds.

8 Appendix A- Groups with finite ownership

Whenever the ownership share of the holding is not infinitesimal, dividend flows from the subsidiary to the holding must be added to the previous picture.

Since dividends are paid only in non default states, the cash flows to all stakeholders do not change as long as $X_s < X_s^d$, i.e. $X_s^n < P_s$. In the opposite case, cash flow for the holding includes both operational earnings and dividends. If we denote as ω the ownership share of the holding ($\omega \in (0, 1]$) and we exclude double taxation, these cash flows are

$$X_h^n + \omega(X_s^n - P_s)^+ \quad (45)$$

The holding cash flows may exceed or fall short its own tax shield. Below we distinguish between four cash flow states, depending on whether they are smaller or greater than the tax shield and on whether dividends are

being paid out or not:

$$\left\{ \begin{array}{ll} X_a = X_h & X_s^n < P_s, X_h < X_h^Z \\ X_b = X_h - \tau(X_h - X_h^Z) & X_s^n < P_s, X_h > X_h^Z \\ X_c = X_h + \omega [X_s - \tau(X_s - X_s^Z) - P_s] & X_s^n > P_s, X_h < X_h^Z \\ X_d = X_h - \tau(X_h - X_h^Z) + \omega [X_s - \tau(X_s - X_s^Z) - P_s] & X_s^n > P_s, \\ & X_h > X_h^Z \end{array} \right. \quad (46)$$

In states a and c the subsidiary does not pay out any dividend, while it does in the other two contingencies. In states b and d (and c), the holding does not pay any taxes. These cash flows can be negative when $X_h < 0$ and no dividend is distributed, and when $X_h < -\omega [X_s - \tau(X_s - X_s^Z) - P_s]$ and dividends are received by the holding. When cash flows are positive, by absolute priority they first repay debt, up to its face value P_h , then equity holders.

The payoff to lenders is then

$$\left\{ \begin{array}{ll} 0 & X_h^n + \omega(X_s^n - P_s)^+ < 0 \\ (1 - \alpha) [X_h^n + \omega(X_s^n - P_s)^+] & 0 < X_h^n + \omega(X_s^n - P_s)^+ < P_h \\ P_h & X_h^n + \omega(X_s^n - P_s)^+ > P_h \end{array} \right. \quad (47)$$

It follows from the previous expression that X_h^d , the holding default threshold with infinitesimal ownership, remains the default threshold here only if dividends are not received. Otherwise the default threshold, \bar{X}_h^d , is the level of operational cash flows, net of taxes but gross of dividends, that equals P_h :

$$\bar{X}_h^d - \tau(\bar{X}_h^d - X_h^Z)^+ - P_h + \omega(X_s - \tau(X_s - X_s^Z) - P_s) = 0 \quad (48)$$

Considering that this new default threshold depends on the subsidiary cash flow X_s , and in particular that it can be either greater or smaller than the tax shield X_h^Z , we get the following expression:

$$\bar{X}_h^d = \left\{ \begin{array}{ll} X_h^d - \omega(X_s - X_s^d) & X_s < X_s^\circ \\ P_h - \omega(1 - \tau)(X_s - X_s^d) & X_s > X_s^\circ \end{array} \right. \quad (49)$$

where

$$X_s^\circ = \frac{X_h^d - X_h^Z}{\omega} + X_s^d \quad (50)$$

It can be shown that the new default threshold is greater than the tax shield, $\bar{X}_h^d > X_h^Z$, and therefore entails tax payments, as long as $X_s < X_s^\circ$. It is smaller in the opposite case. Some algebra allows us to rewrite the holding default occurrence in terms of the subsidiary cash flows as

follows:

$$\left\{ \begin{array}{l} X_h < X_h^d, X_s < X_s^d \\ X_h^Z < X_h < X_h^d, X_s^d < X_s < X_s^d - (X_h - X_h^d)/\omega \\ 0 < X_h < X_h^Z, X_s^d < X_s < X_s^d - \frac{X_h - P_h}{\omega(1-\tau)} \end{array} \right. \quad (51)$$

We visualize the default threshold and the corresponding cash flows in figure 3.

Insert here figure 3

As for the holding equity holders, they receive no dividends below the default threshold. Above it, they receive the same cash flows as with infinitesimal ownership share, if the subsidiary does not pay dividends. If the latter does, they have right to them, as soon as the holding debt holders have been fully repaid. Figure 5 summarizes the payoffs to equity holders.

Insert here figure 4

The equity and debt value in the holding obtain by discounting the expectation of cash flows to shareholders and lenders, respectively. The problem is complicated by the fact that they now depend also on the face value of the subsidiary debt.

As for debt and equity of the subsidiary, they are not affected by the payment of dividends to the holding: therefore, they can be represented as in (16) and (14).

Tax changes wrt the stand alone case have the same expression as with infinitesimal ownership, since there is no double taxation. However, the holding default threshold is not the same as in the infinitesimal case. As a consequence, we have:

$$\Delta DC'_g = \alpha(1 + r_T)^{-1} \left\{ \begin{array}{l} \mathbb{E} \left[X_s \mathbf{1}_{\{0 < X_s < X_s^Z, X_h < k - X_s / (1-\tau)\}} \right] + \\ + X_s \mathbf{1}_{\{X_s^Z < X_s < X_s^d, X_h < K - X_s\}} \\ + X_h \mathbf{1}_{\{0 < X_h < X_h^d, X_s < X_s^d\}} + \\ + \max\{0, X_c\} \mathbf{1}_{\{0 < X_h < \bar{X}_h^d, X_s > X_s^d\}} + \\ - \mathbb{E} \left[X_1 \mathbf{1}_{\{0 < X_1 < X_1^d\}} + X_2 \mathbf{1}_{\{0 < X_2 < X_2^d\}} \right] \end{array} \right. \quad (52)$$

9 References

Acharya, V.V., S.T. Bharath and A. **Srinivasan**, (2005), Does Industry-wide Distress Affect Defaulted Firms? Evidence from Creditor Recoveries, mimeo

Allen, J.W.,(1998), Capital Markets and Corporate Structure: The Equity Carve-Outs of Thermo Electron, *Journal of Financial Economics*, 48, 99-124

Almeida H. and T. Philippou, (2007), The Risk Adjusted Cost of Financial Distress, forthcoming *Journal of Finance*

Almeida, H. and D. Wolfenzon, (2006), A Theory of Pyramidal Ownership and Family Business Groups, *Journal of Finance*, 79,2637-2680

Barca, F. and M. Becht (eds.), (2001), The Control of Corporate Europe, (Oxford, Oxford University Press).

Bennedsen, M. and K.M. Nielsen, (2006), The Principle of Proportional Ownership, Investor Protection and Firm Value in Western Europe, ECGI WP. 134/2006

Bertrand M., Metha P. and S. Mullainathan, (2002), Ferreting Out Tunneling: An Application to Indian Business Groups, *Quarterly Journal of Economics*, 117, 121-148

Bianco, M. and G. Nicodano, (2002), Business Groups and Debt, *European Economic Review*

Blumberg Phillip I., (1989), The Law of Corporate Groups, Boston: Little, Brown and Company

Boot, A.W.A., S.I. Greenbaum and A.V. Thakor, (1993), Reputation and Discretion in Financial Contracting, *The American Economic Review*, 83(5), 1165-1183

Cestone, G., and C. Fumagalli, (2005), The Strategic Impact of Resource Flexibility in Business Groups, *Rand Journal of Economics*, 36, 193-214

Claessens, S., Djankov S., Fan J.P.H. and L.H.P. Lang, (2002) Disentangling the Incentive and Entrenchment Effect of Large Shareholders, *Journal of Finance*, 57,2741-71

Cornell, B. and Q. Liu, (2001), The Holding Company Puzzle: When Is the Whole Worth Less Than One of the Parts?, *Journal-of-Corporate Finance*, 7(4), 341-66

Faccio M., (2003), L.H.P. Lang and L.Young, Debt and Expropriation, www.ssrn.com

Faure-Grimaud, A. and R. Inderst, (2005), Conglomerate Entrenchment under Optimal Financial Contracting, *American Economic Review*,

Fluck, Z. and A., Lynch, (1999), Why Do Firms Merge and Then Divest? A Theory of Financial Synergy, *The Journal of Business*, (72)

3

Gertner R.H., Scharfstein D.S., and J. Stein, (1994), Internal versus External Capital Market, *Quarterly Journal of Economics*, 109, 1211-1230

Hadden Thomas, Liabilities in Corporate Groups, in Rossi Guido et

- al. eds., (1996), I Gruppi di Società, Proceedings of the International Conference on Business Groups, Venice, Milano: Giuffrè, 1361-1388
- Huizinga H., Laeven L. and G. Nicodème, Capital Structure and International Debt Shifting, IMF February 2007
- Khanna, T, and K. Palepu, (2000), Is Group Membership Profitable in Emerging Markets? An Analysis of Diversified Indian Business Groups, *Journal of Finance*, 55, 867-891
- Khanna, T., and Y. Yafeh, (2006), Business Groups in Emerging Markets: Paragons or Parasites?, ECGI Working Paper.
- Lamont, O.A. and R. H. Thaler, (2003), Can the market add and subtract? Mispricing in tech stock carve-outs, *Journal of Political Economy*, 111, 227-268
- Leland, H., (2007), Purely financial synergies and the optimal scope of the firm: implications for mergers, spin offs, and structured finance, *Journal of Finance*, 62, 765-807
- Lewellen, W., (1971), A Pure Financial Rationale for the Conglomerate Mergers, *Journal of Finance*, 26, 521-537
- Majd, S. and S.C. Myers, (1987), Tax Asymmetries and corporate income tax reform, in M. Feldstein, ed., Effects of taxation on capital accumulation (University of Chicago Press, Chicago, IL)
- Mansi, S.A. and D.M.Reeb, (2002), Corporate Diversification: What Gets Discounted?, *Journal of Finance*, 57(5), 2167-83
- Merton, R.C., (1974), On the pricing of corporate debt: The risk structure of interest rates, *Journal of Finance*, 449-70
- Modigliani, F., and M.H. Miller, (1958), The Cost of Capital, Corporation Finance and the Theory of Investment, *American Economic Review*
- Morck, R., (2004), How to Eliminate Pyramidal Business Groups – The Double Taxation of Inter-Corporate Dividends and Other Incisive Uses of Tax Policy, NBER Working Paper No. 10944.
- Nicodano, G., (2004), La ripartizione del rischio d’insolvenza nei gruppi d’imprese, in M. Bagella (ed.) Finanza e Crescita, Bologna: Il Mulino
- Rajan, R., H. Servaes, and L. Zingales, (2000), The Cost of Diversity: The Diversification Discount and Inefficient Investment, *Journal of Finance*, 55, 35-80.
- Robinson D.T., (2006), Strategic Alliances and the Boundaries of the Firm, Duke University,
- Sahlman, W.A., (1990) The Structure and Governance of Venture-Capital Organizations, *Journal of Financial Economics*, 473-521
- Schipper, K. and A. Smith, (1986), A comparison of equity carve-outs and seasoned equity offerings: share price effects of corporate restruc-

turing, *Journal of Financial Economics*, 15, 153-186.

Stein, J.C., (1997), Internal Capital Markets and the Competition for Corporate Resources, *The Journal of Finance*, 111-113

Stiglitz, J.E., (1969), A Re-Examination of the Modigliani-Miller Theorem, *American Economic Review*,

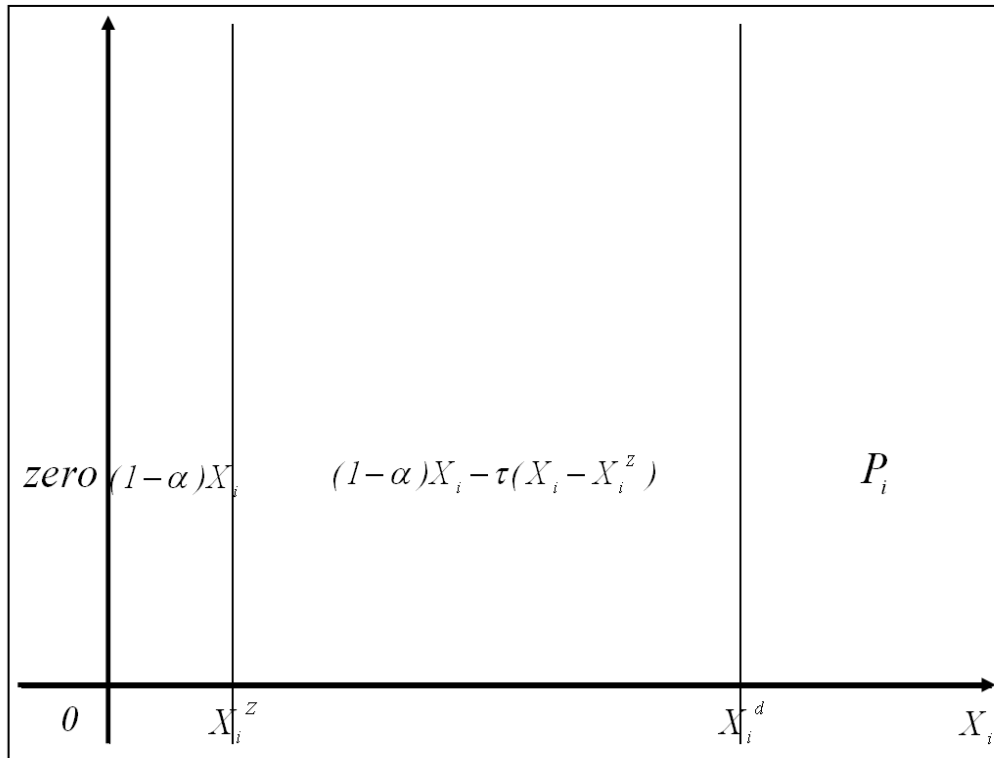


Figure 1: This figure represents the payoff to the lenders of a stand alone company. Lenders are fully reimbursed (P) when cash flow X_i exceeds the default threshold X_i^d . They receive a fraction $(1 - \alpha)$ of positive cash flows when this is smaller than X_i^z , the tax threshold. When the stand alone defaults and its cash flow exceeds the tax threshold X_i^z , debtholders pay taxes on top of bankruptcy costs.

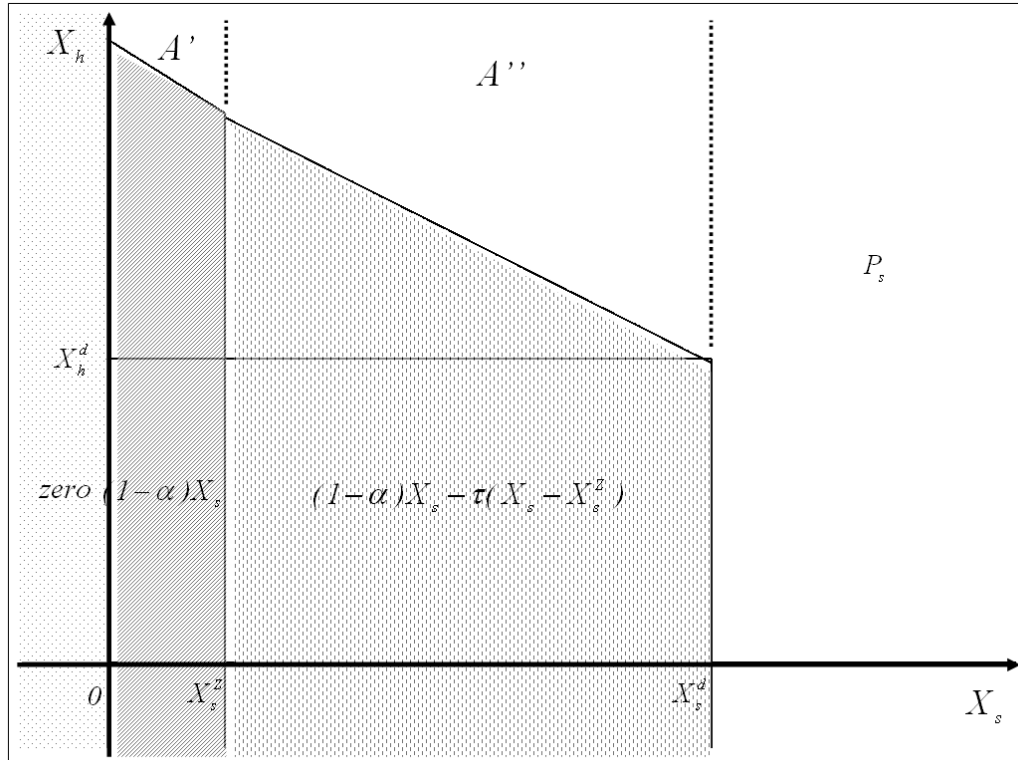


Figure 2: This figure represents the payoffs to subsidiary lenders as a function of the subsidiary cash flows (on the horizontal axis) and of the holding cash flows (on the vertical axis) for the case of infinitesimal ownership share. The figure is similar to the case of stand alones when X_h is lower than the holding default threshold X_i^d , as in this case the holding is unable to help its subsidiary. The area of the transfer is $A = A' \cup A''$. In A'' , the subsidiary does not default thanks to the transfer, but it pays taxes. In A' , the subsidiary saves on both default costs and taxes thanks to the transfer.

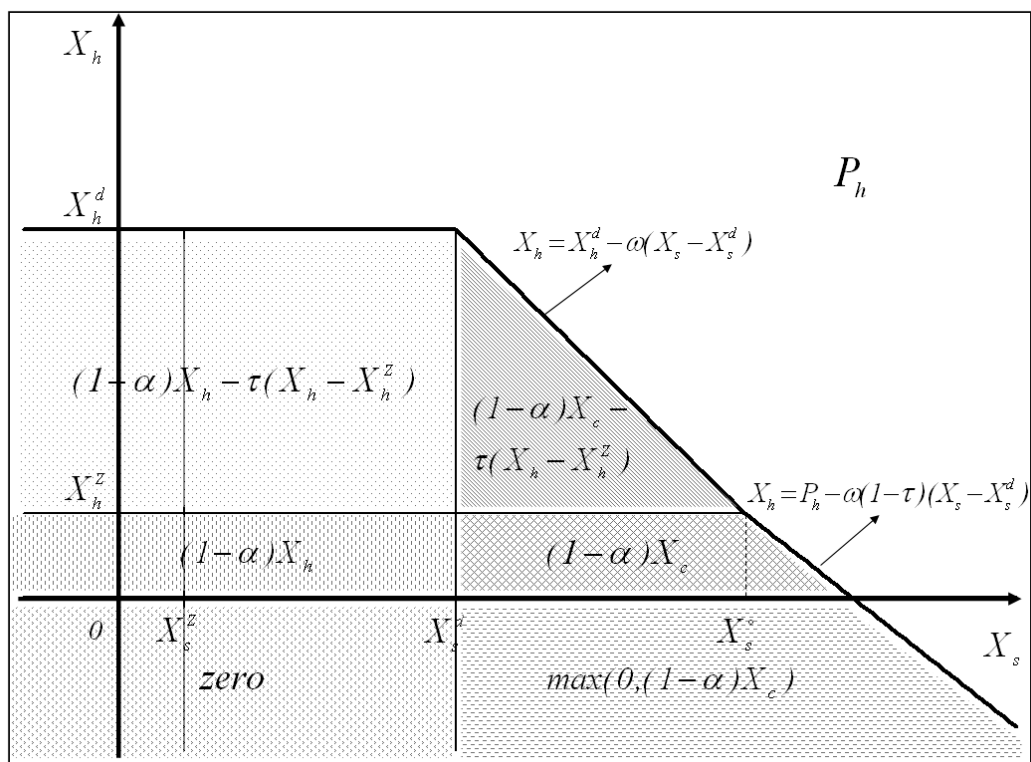


Figure 3: Payoffs to D_h , non infinitesimal ownership

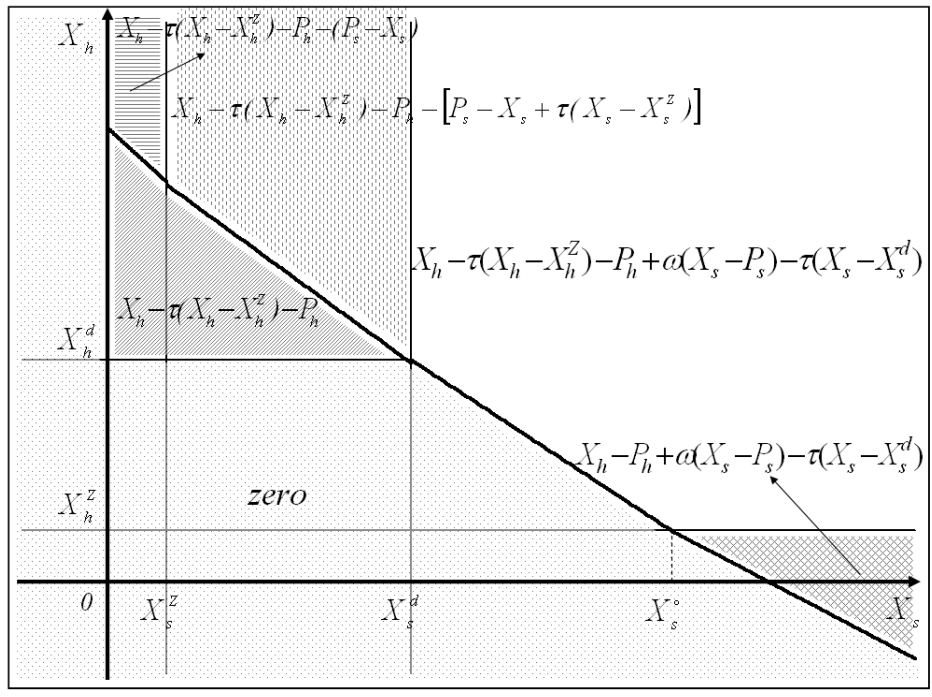


Figure 4: Payoffs to E_h , non infinitesimal ownership

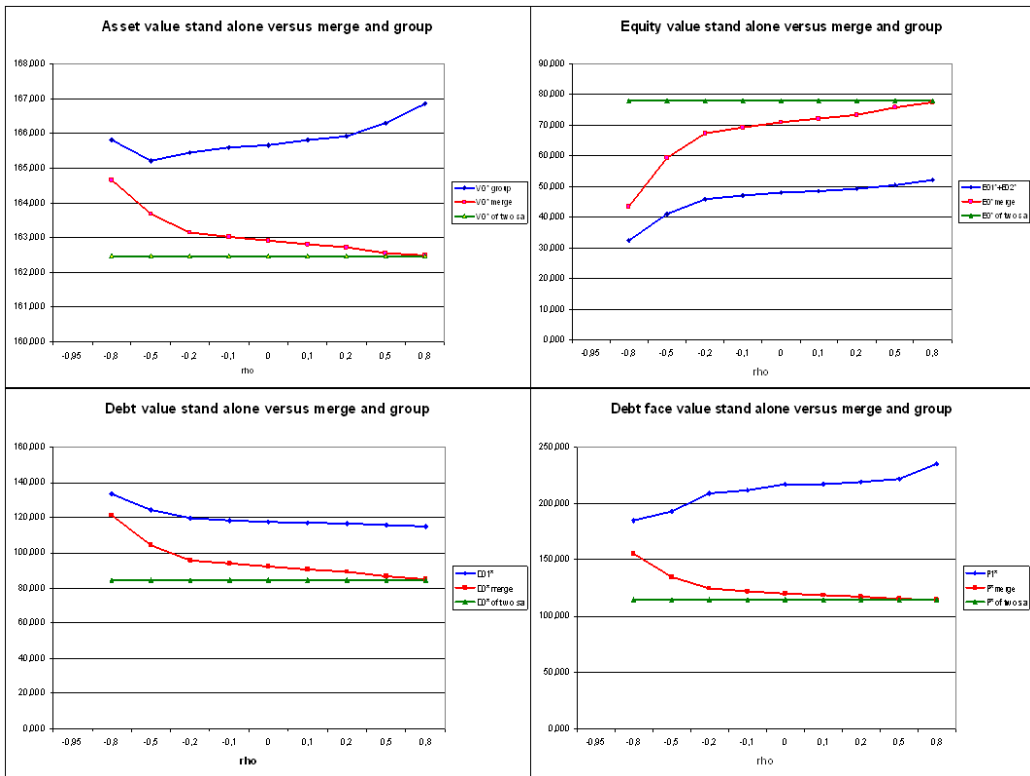


Table 3

Table 2: Optimal Capital Structure

	Values			
Symbols	Stand Alone	Holding	Subsidiary	1/2Conglomerate
Default Costs	23%	23%	23%	23%
Optimal Face Value of Debt	57.1	0	219	58.75
Default Value	67.7	0	248.169	69.92
Breakeven Profit Level	14.9	0	102.32	14.08
Value of Optimal Debt	42.2	0	116.68	44.67
Optimal Leverage Ratio	0.52	0	0.999	0.55
Annual Yield Spread of Debt (%)	$(P^*/D_0)^{1/T} - 1 - r$	//	8.4%	0.6%
Value of Optimal Equity	39.26	49.2	0.037	36.70
Optimal Levered Firm Value	81.47	49.2	116.71	81.37
Tax Burden	17.70	19.95	5.42	17.74
Tax Savings of Leverage (PV)	2.32	0	14.53	2.20
Expected Default Costs (PV)	0.89	0	7.98	0.62
Value of Optimal Leveraging	1.42	-30.60	36.91	1.58
Capitalized Value of Optimal Leverage	8.21%	-1.77	2.14	