

# Leverage, value and credit risk in parent-subsidiary structures

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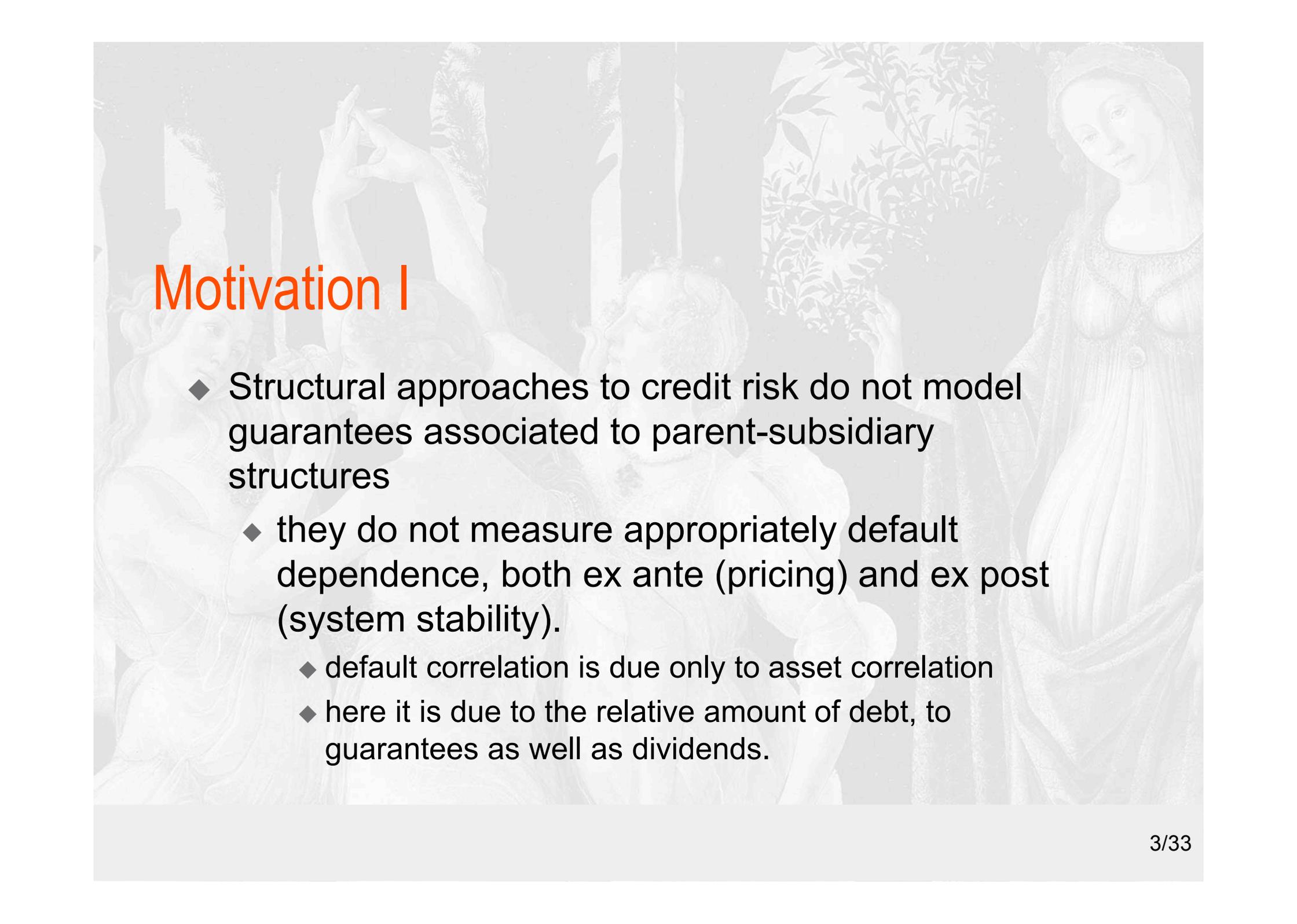
# Purpose

Examine **optimal capital structure and credit risk** of parent-subsidary structures, such as

- ◆ business groups & multinationals,
- ◆ private equity funds, LBOs, MBOs,
- ◆ joint ventures & project financing,
- ◆ financial conglomerates

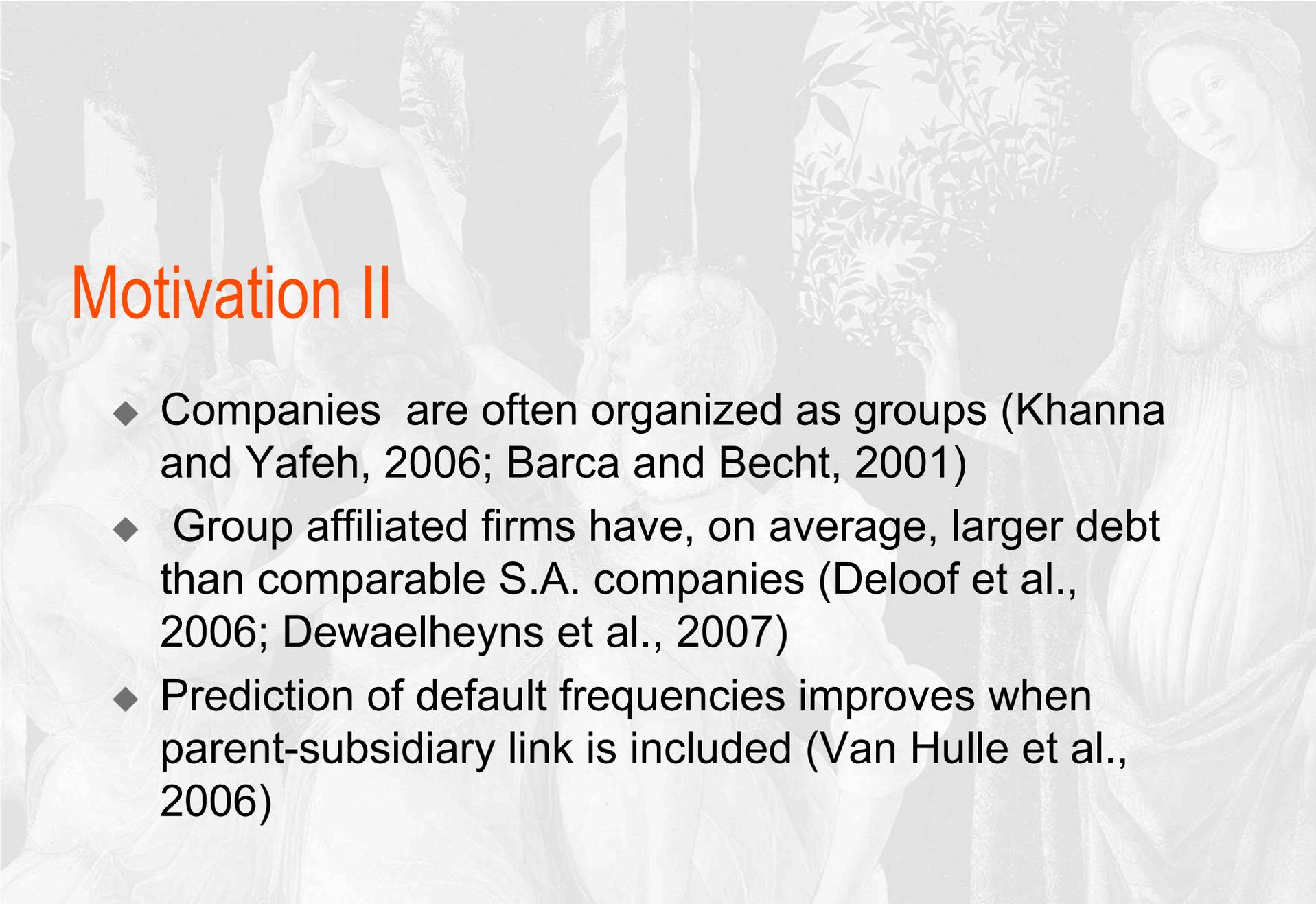
and compare them with both separately incorporated and merged activities.

**Key role of** internal capital markets in exploiting tax savings-default costs trade off



## Motivation I

- ◆ Structural approaches to credit risk do not model guarantees associated to parent-subsidiary structures
  - ◆ they do not measure appropriately default dependence, both ex ante (pricing) and ex post (system stability).
    - ◆ default correlation is due only to asset correlation
    - ◆ here it is due to the relative amount of debt, to guarantees as well as dividends.

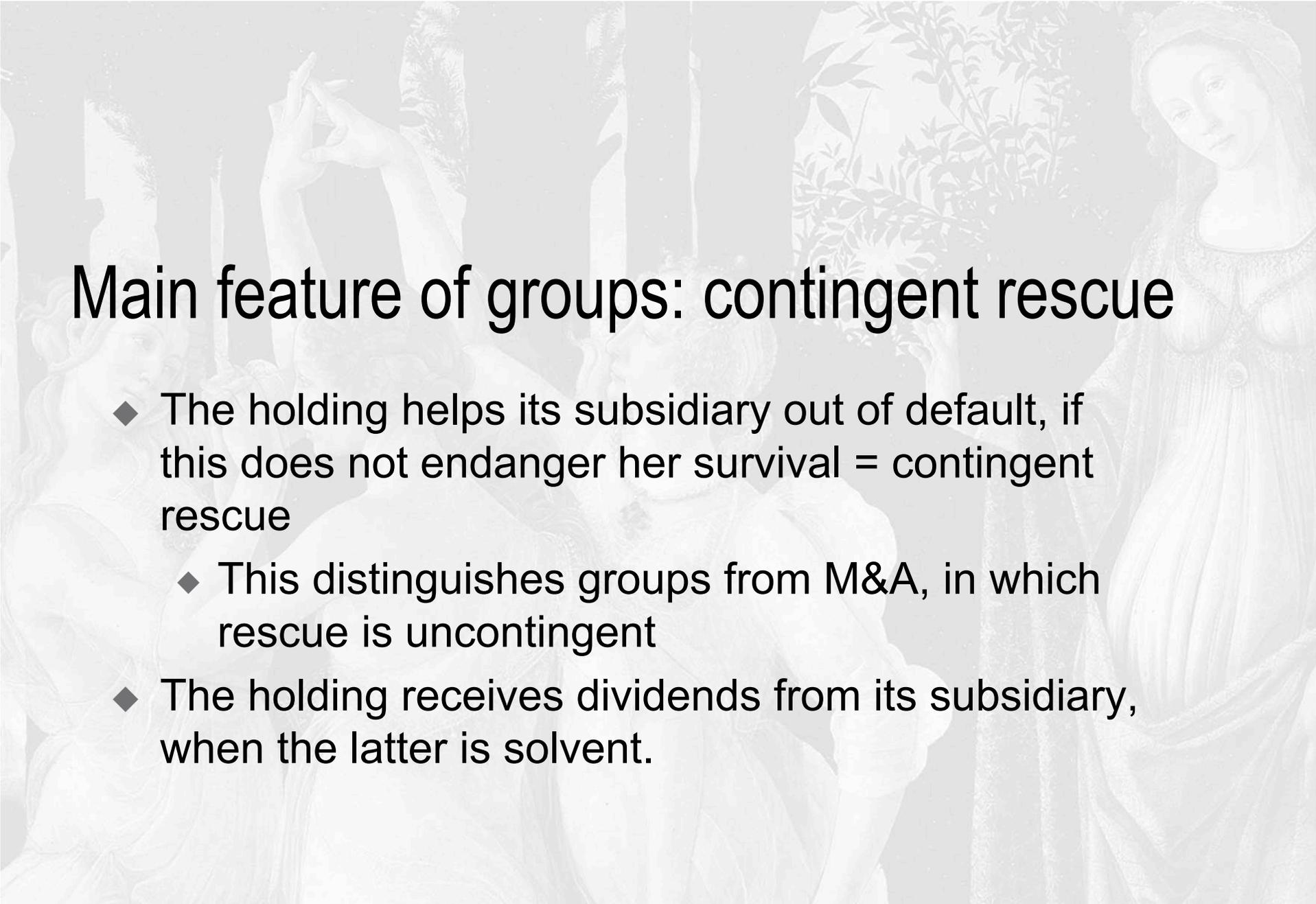


## Motivation II

- ◆ Companies are often organized as groups (Khanna and Yafeh, 2006; Barca and Becht, 2001)
- ◆ Group affiliated firms have, on average, larger debt than comparable S.A. companies (Deloof et al., 2006; Dewaelheyns et al., 2007)
- ◆ Prediction of default frequencies improves when parent-subsidary link is included (Van Hulle et al., 2006)

## And above all...

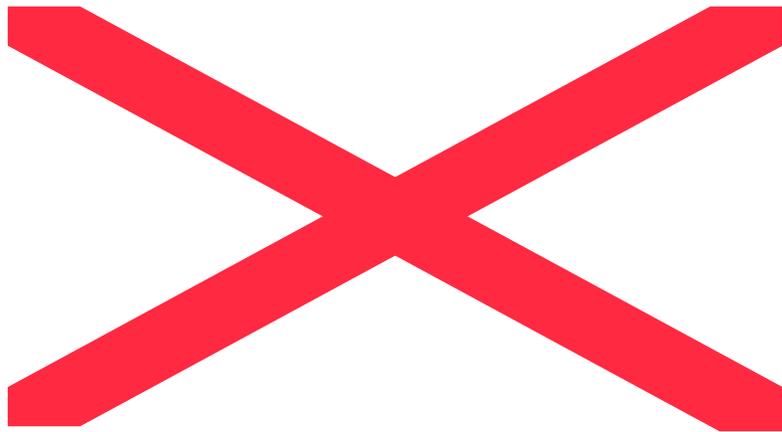
- ◆ The holding may transfer funds to its subsidiary
  - ◆ Khanna and Palepu (2000) document transfers in Indian groups
  - ◆ Bertrand et al. (2002) document cash transfers in several forms - from asset sales to internal loans at subsidized rates
- ◆ Holding enjoys limited liability vis-à-vis the subsidiary's debt
  - ◆ Hadden (1986): common characteristic across major jurisdictions
  - ◆ Boot et al. (1993): holding writes comfort letters assuring subsidiaries' lenders
    - legally unenforceable
    - not honored when holding would be unable to survive



# Main feature of groups: contingent rescue

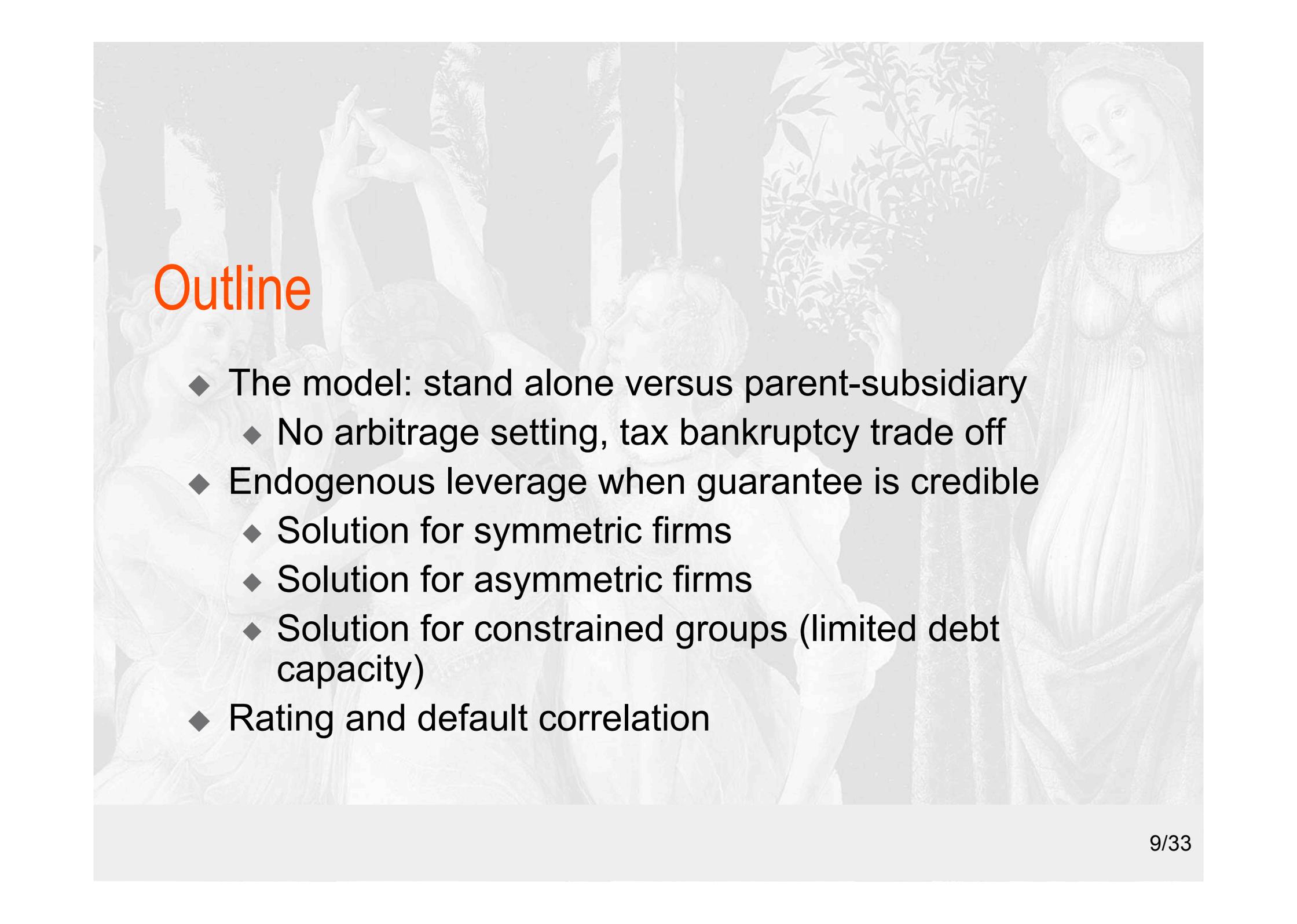
- ◆ The holding helps its subsidiary out of default, if this does not endanger her survival = contingent rescue
  - ◆ This distinguishes groups from M&A, in which rescue is uncontingent
- ◆ The holding receives dividends from its subsidiary, when the latter is solvent.

# Complexity in parent subsidiary structures



# This paper forgets complexity

- ◆ 1 parent, 1 subsidiary
- ◆ parent offers conditional guarantee to subsidiary
- ◆ Questions:
  - ◆ How much debt will they have?
  - ◆ How will the value of equity and debt be affected?
  - ◆ How will their joint default probability and default correlation change?



## Outline

- ◆ The model: stand alone versus parent-subsidary
  - ◆ No arbitrage setting, tax bankruptcy trade off
- ◆ Endogenous leverage when guarantee is credible
  - ◆ Solution for symmetric firms
  - ◆ Solution for asymmetric firms
  - ◆ Solution for constrained groups (limited debt capacity)
- ◆ Rating and default correlation

# Model

Two firms with cash flows  $X_i$

- ◆ Taxes paid when
- ( tax shield)

no tax refunds received  
otherwise

- ◆ Default if

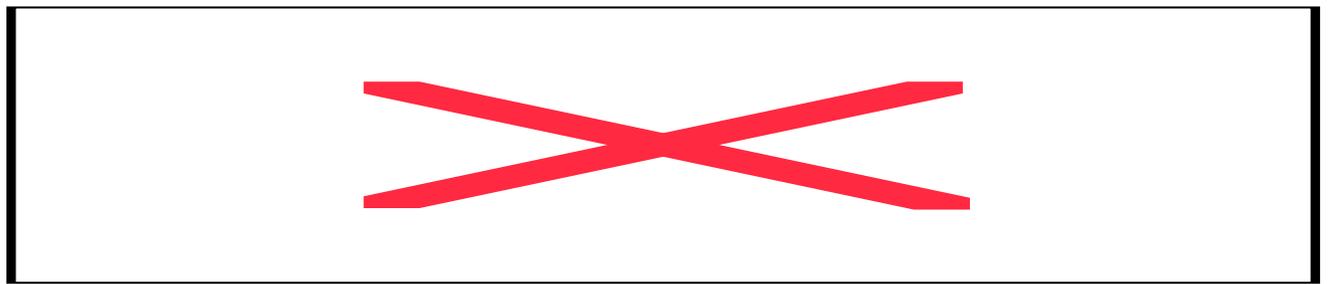
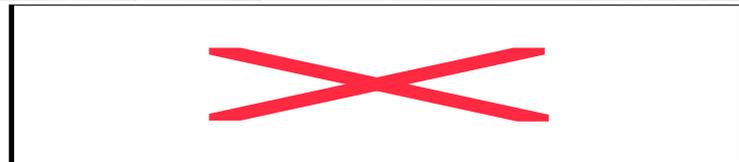
- ◆ Proportional bankruptcy  
cost  $\alpha X_i$



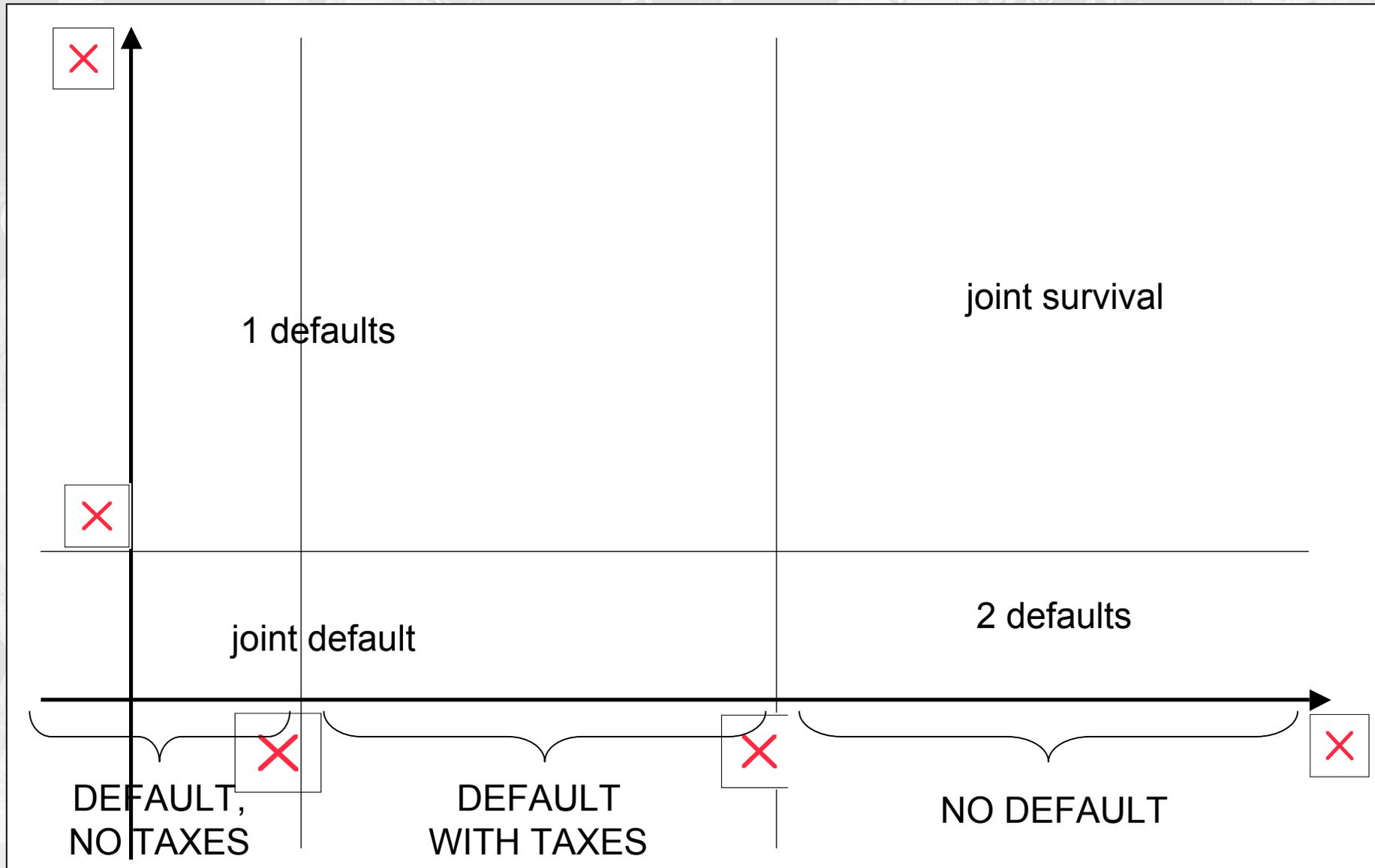
# Model: Two S.A.

$$\max (D_{0i}(P_i) + E_{0i}(P_i)) \quad i=1,2$$

w.r.t face value of zero coupon debt  $P_i$  given the distribution of cash flows  $X_i$



# Model: Two S.A.

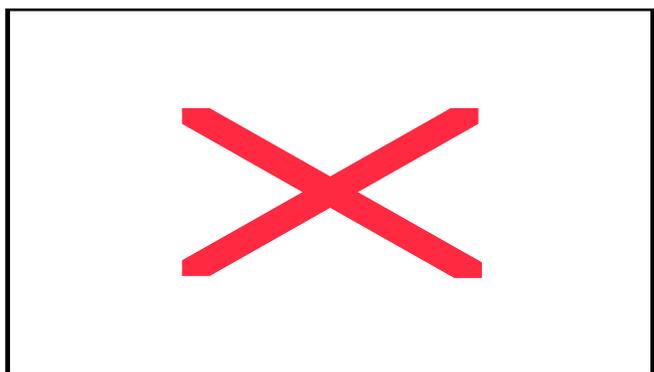


# Model: H and S

$$\max (D_{0h} + D_{0s} + E_{0h} + E_{0s})$$

w.r.t. the face values of debt ( $P_h, P_s$ )

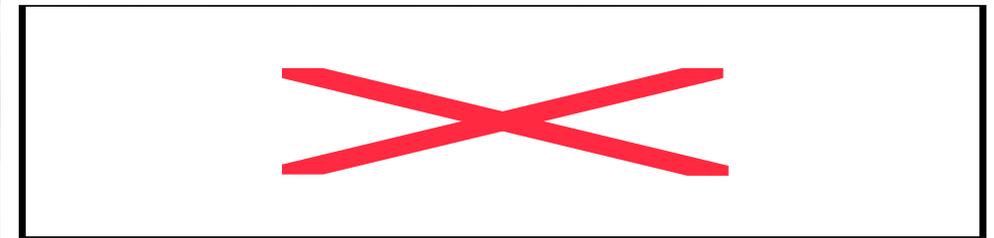
s.t. state contingent transfer, occurring iff



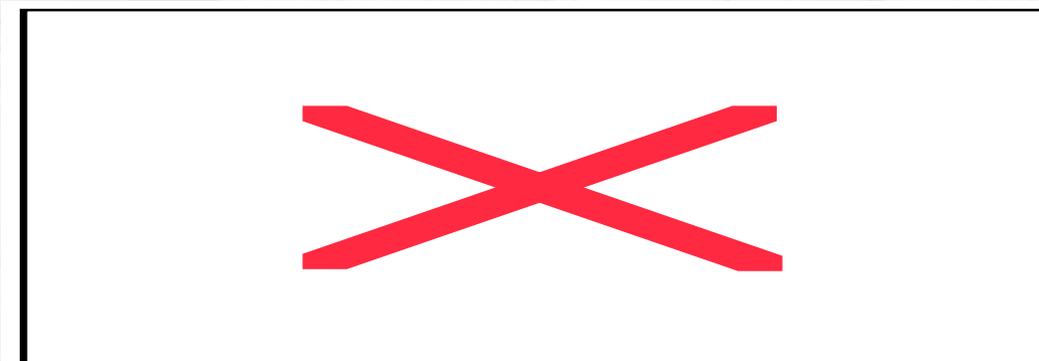
Denote this event by A

# Model: H and S

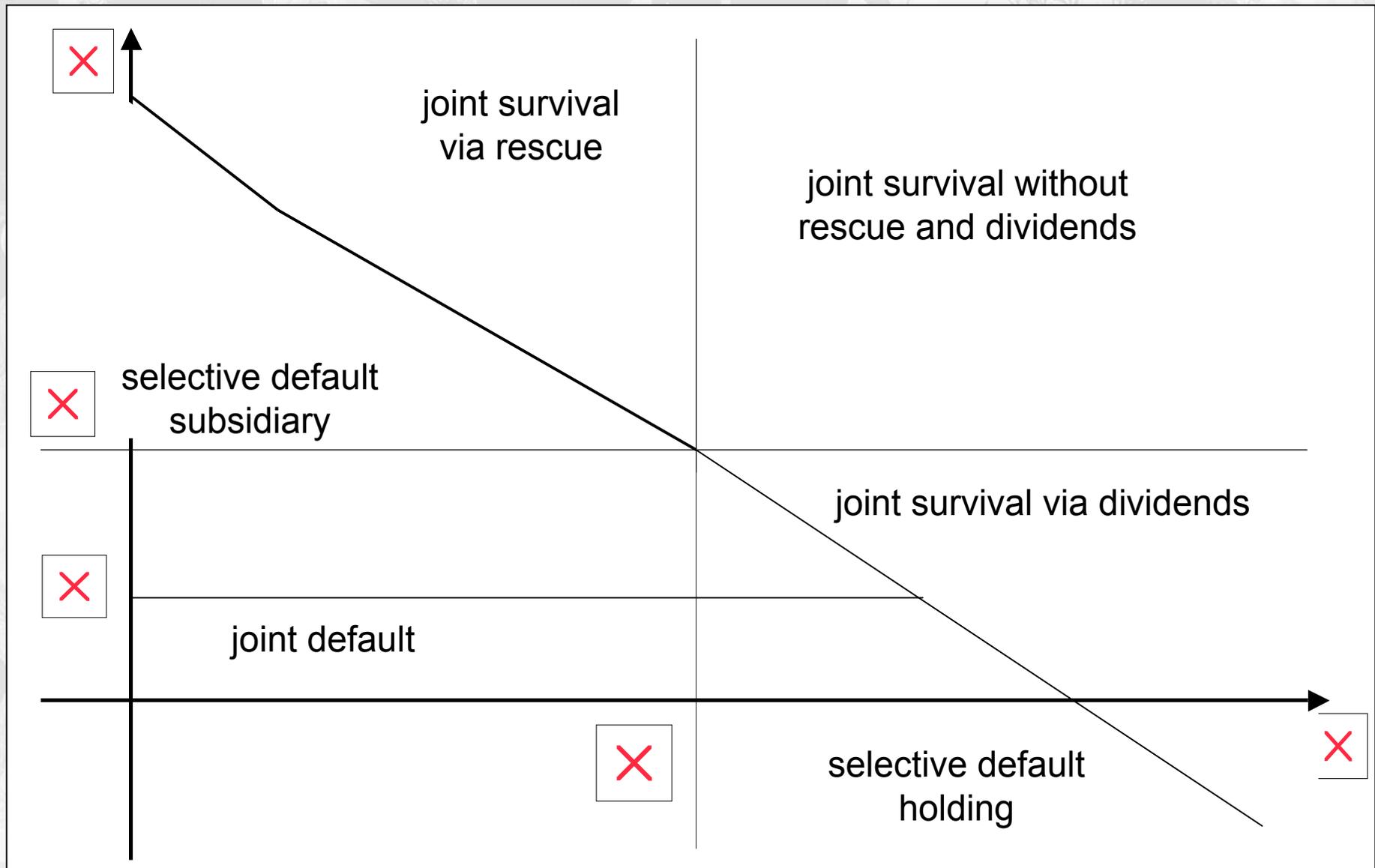
- ◆ Due to conditional transfer, future payoffs
  - ◆ to H shareholders fall



- ◆ To S lenders increase



# Model: H and S



# Optimality problem

max value = debt + equity

Or, equivalently:

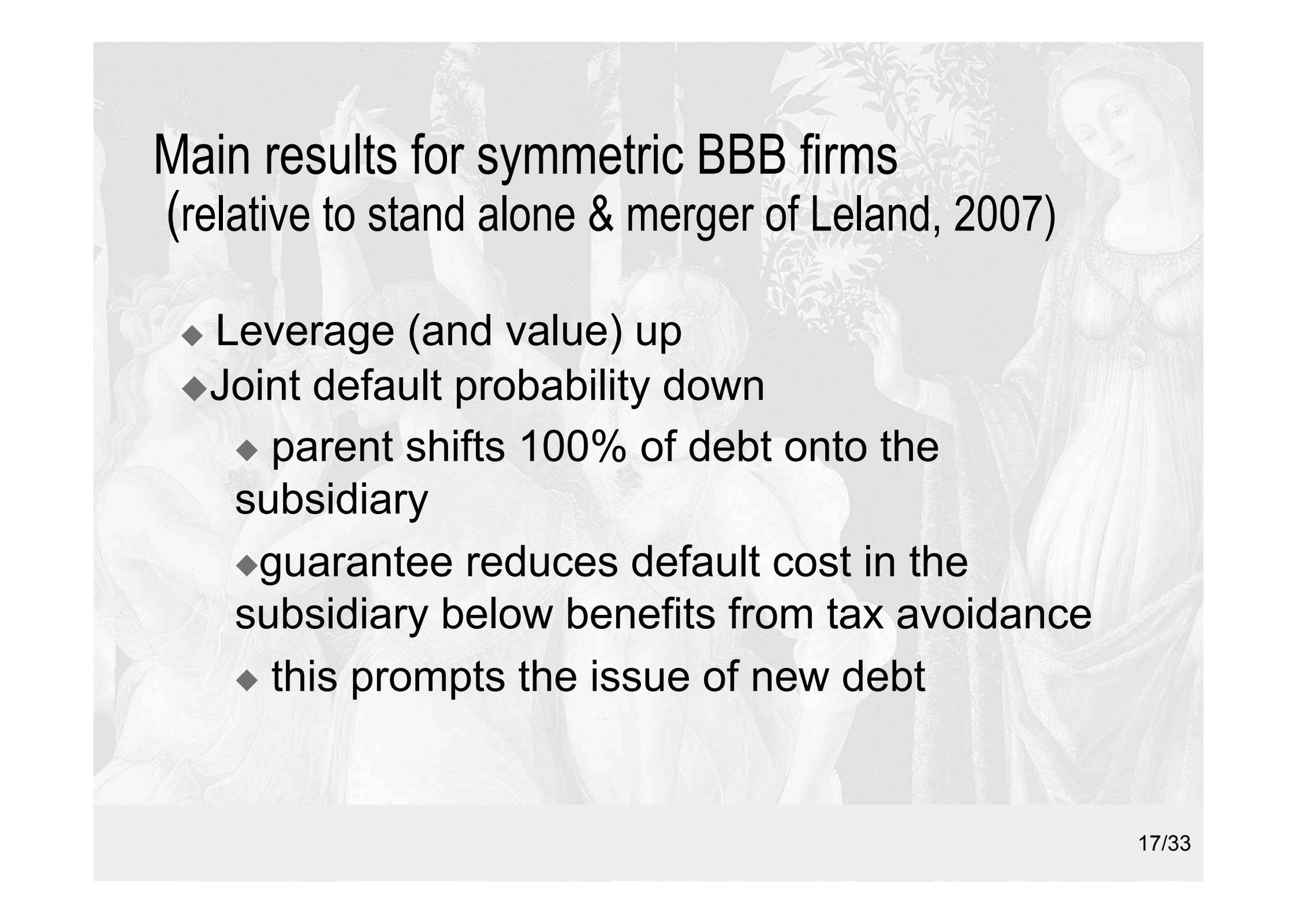
min (default costs – tax savings)

using debt policy  $(P_h, P_s)$ .

EXOGENOUS cash flow distributions  $(X_h, X_s)$ , tax rates & default costs

ENDOGENOUS

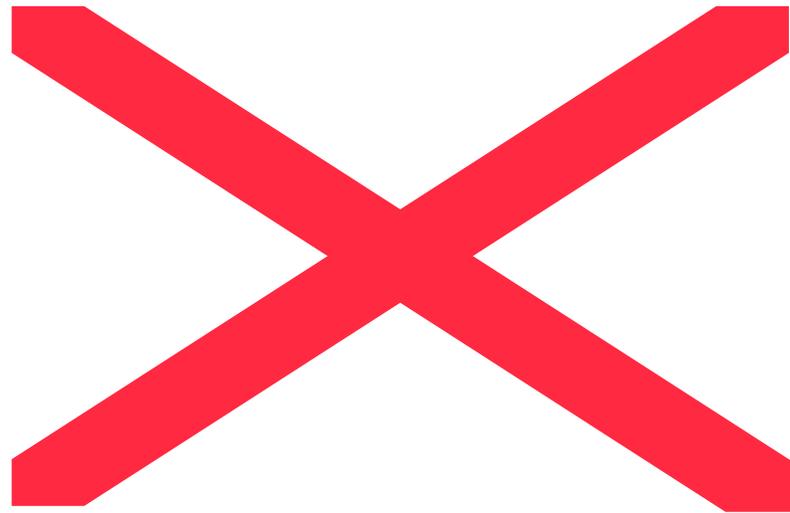
- Optimal tax shield and default threshold  $(X^z, X^d)$
- Current values of optimal debt  $(D_h, D_s)$  and equity  $(E_h, E_s)$
- Default and rescue probabilities
- Recovery rates
- Spreads
- Value maximizing ownership structure



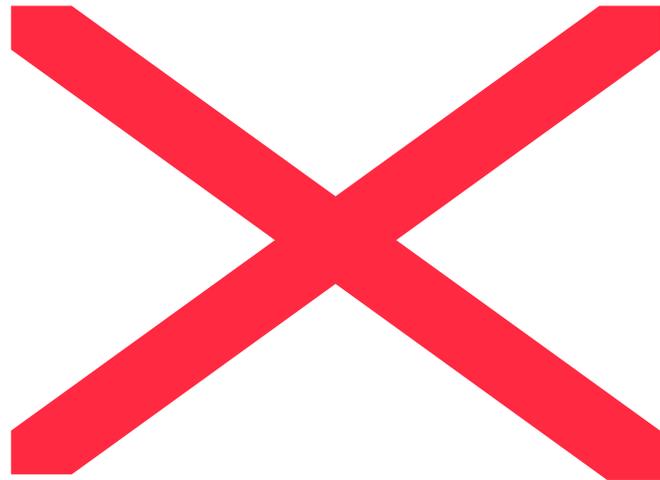
## Main results for symmetric BBB firms (relative to stand alone & merger of Leland, 2007)

- ◆ Leverage (and value) up
- ◆ Joint default probability down
  - ◆ parent shifts 100% of debt onto the subsidiary
  - ◆ guarantee reduces default cost in the subsidiary below benefits from tax avoidance
  - ◆ this prompts the issue of new debt

Base case



# Base case: the role of correlation



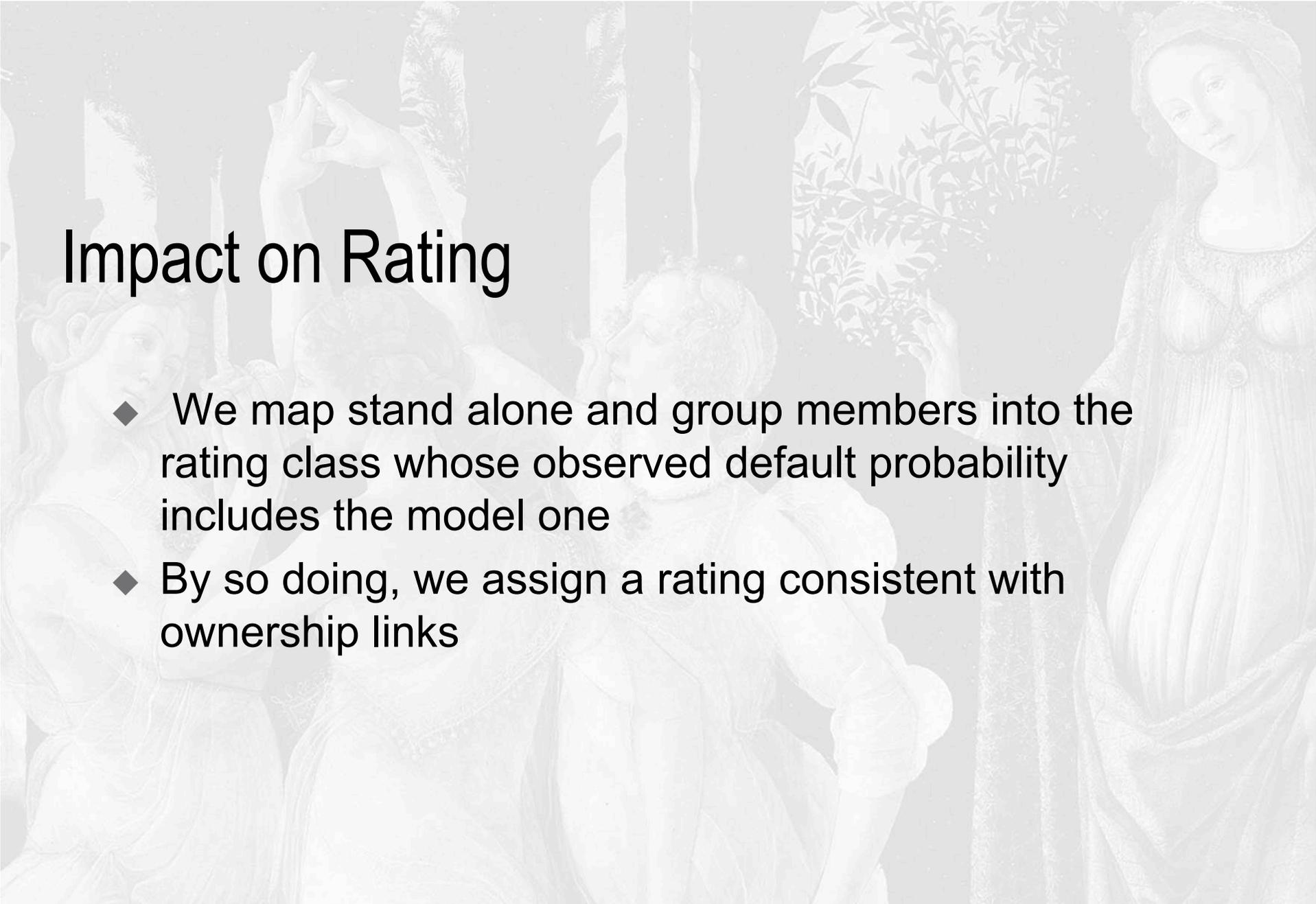


## Asymmetric BBB firms (costs, volatility & size)

- ◆ Selective default increases and credit worthiness of the subsidiary deteriorates with its size and risk
- ◆ With asymmetric size the holding becomes optimally **levered**

# Constrained leverage

- ◆ Regulatory constraints: subsidiary cannot raise more debt than a stand alone
- ◆ The optimal holding leverage is close to the subsidiary one
- ◆ The holding leverage is increasing in ownership share

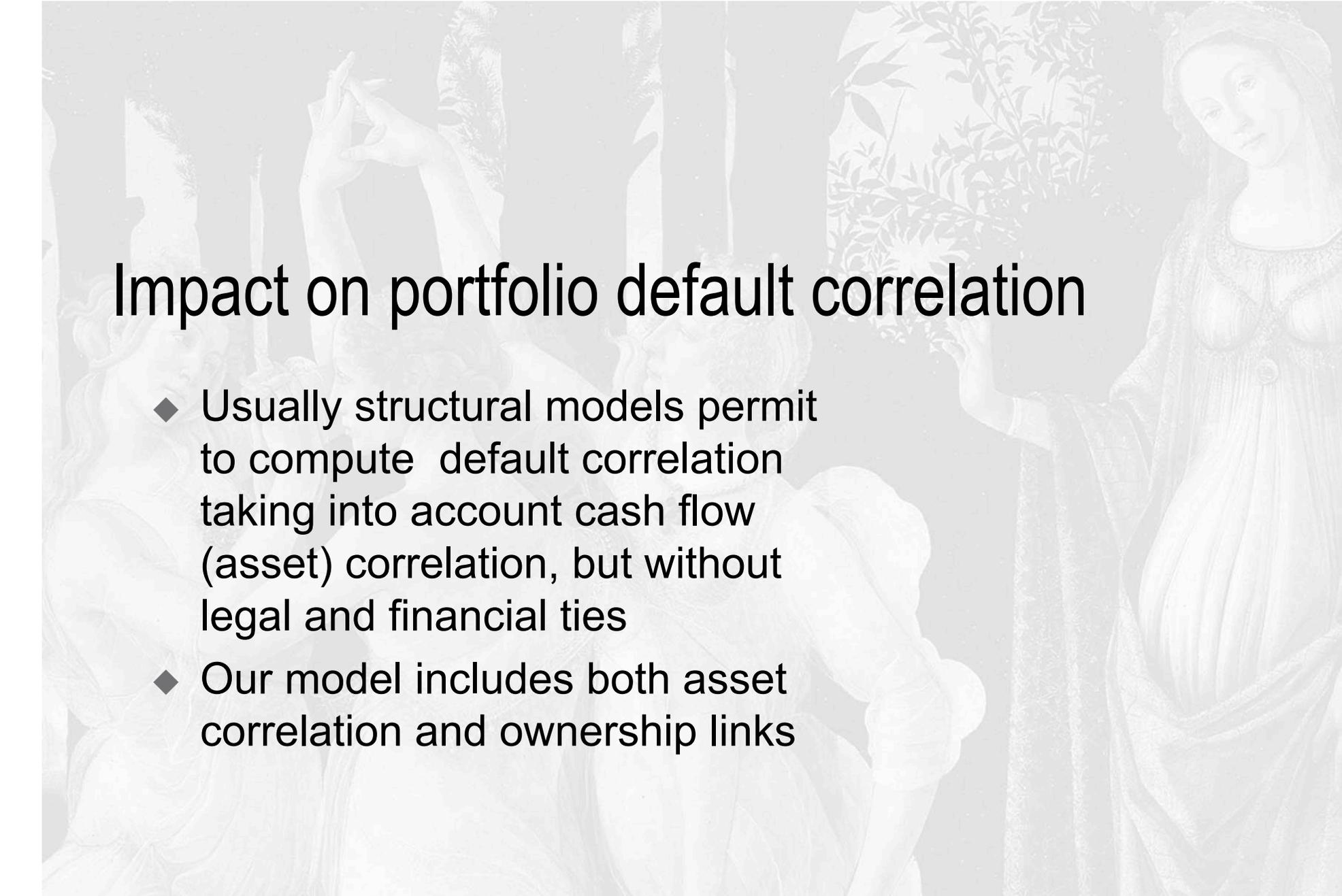


# Impact on Rating

- ◆ We map stand alone and group members into the rating class whose observed default probability includes the model one
- ◆ By so doing, we assign a rating consistent with ownership links

# Impact on rating

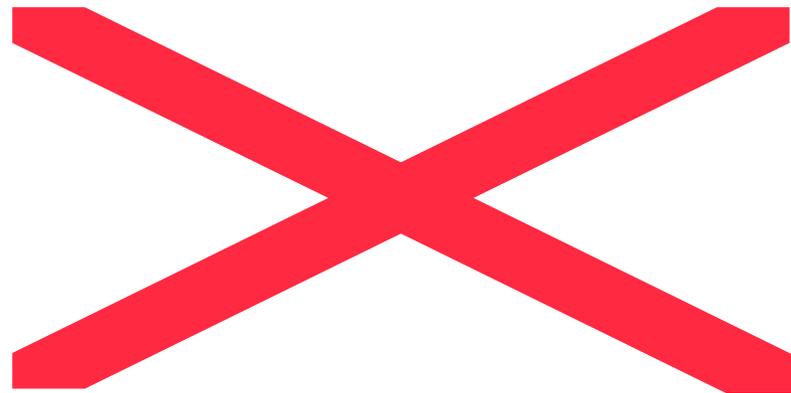
correlation					
	-0.8	-0.2	0	0.2	0.8
<b>unconstrained subsidiary</b>					
hist def prob	0.30%	13.80%	19.35%	22.13%	32.02%
closest implicit rating	Aa1	Ba3	B2	B3	Caa-C
model spread (bp)	174	683	805	842	1040
<b>constrained subsidiary</b>					
hist def prob	0.00%	0.14%	0.36%	0.74%	2.30%
closest implicit rating	Aaa	Aaa	Aa1	A3	Baa2
model spread (bp)	16	36	47	58	98
<b>constrained holding</b>					
hist def prob	3.96%	3.76%	3.76%	3.39%	2.89%
closest implicit rating	Baa3	Baa3	Baa3	Baa3	Baa3
model spread (bp)	125	121	121	112	100



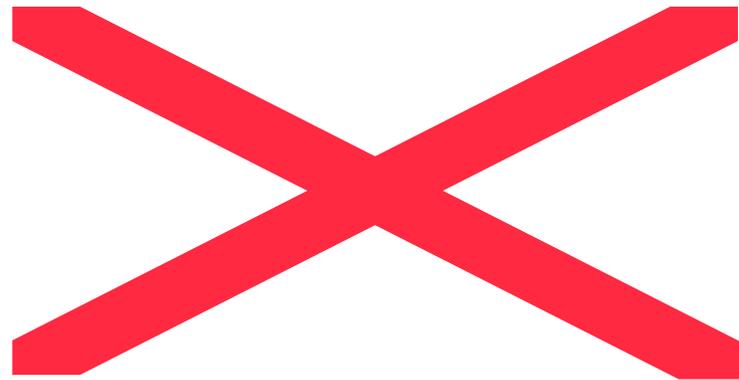
# Impact on portfolio default correlation

- ◆ Usually structural models permit to compute default correlation taking into account cash flow (asset) correlation, but without legal and financial ties
- ◆ Our model includes both asset correlation and ownership links

Default correlation, unconstrained case



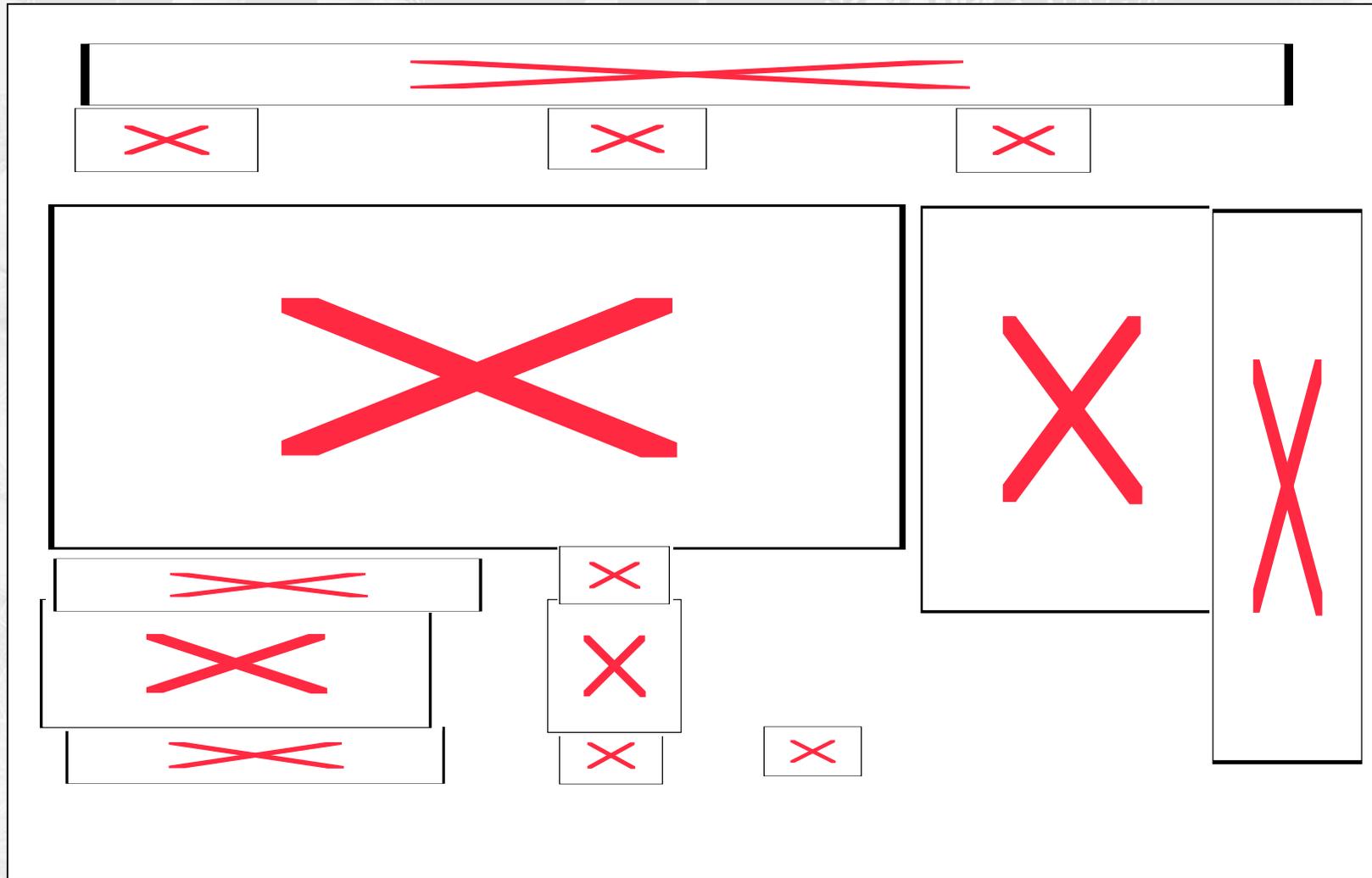
# Default correlation, constrained case



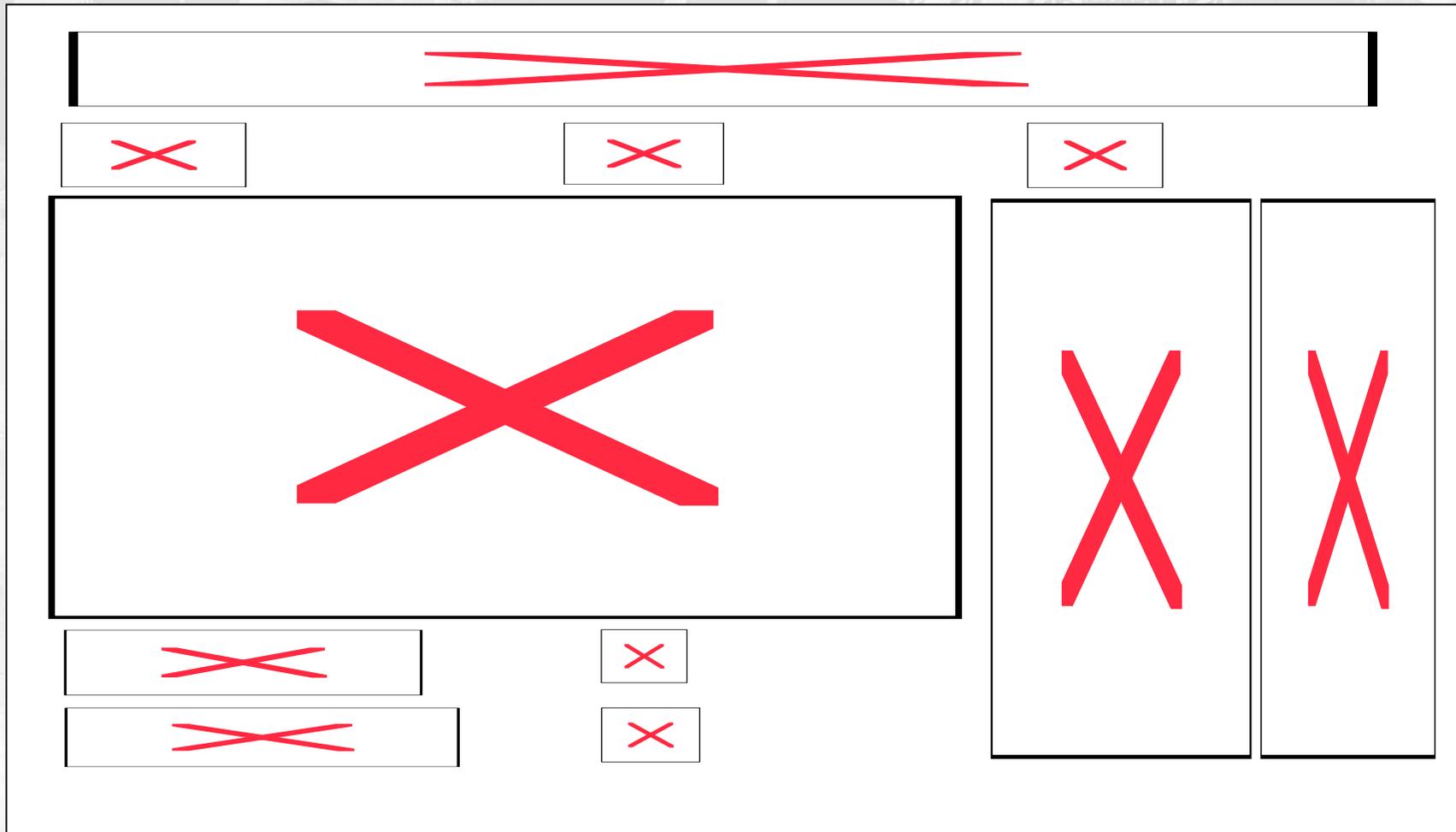
# Contribution and Limits

- ◆ This structural model helps explaining how and why observed leverage and credit risk features, including joint default occurrence, differ in parent subsidiary structures
- ◆ However, it stops to one holding and one subsidiary...

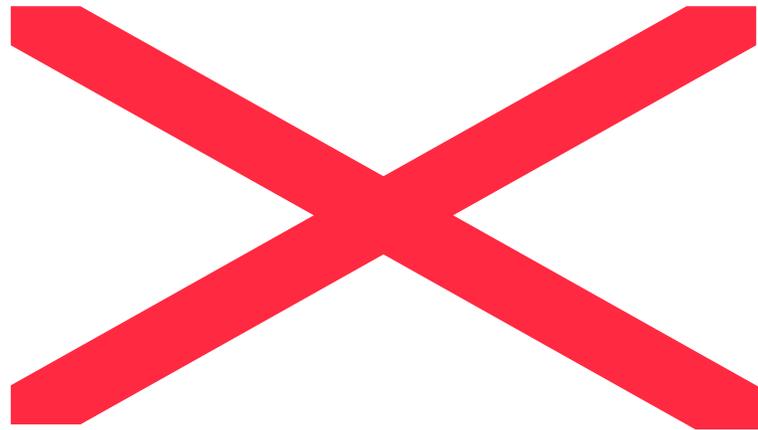
# BBB case: group versus stand alone



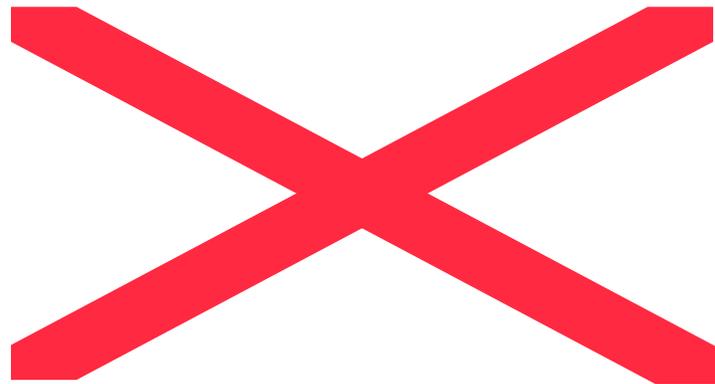
# BBB case: group versus conglomerate



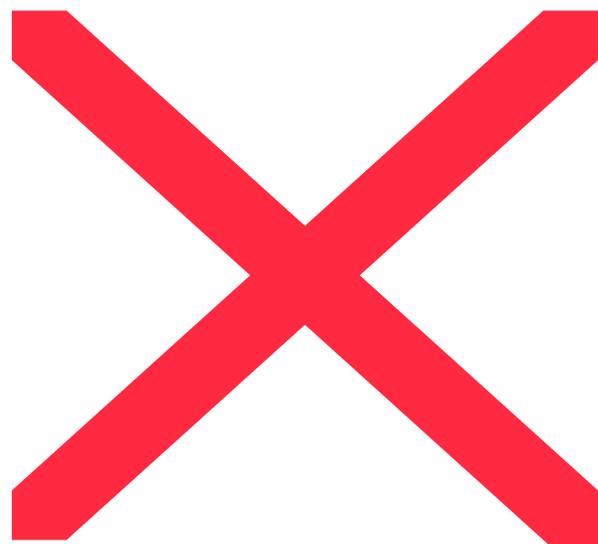
Constrained leverage, infinitesimal ownership: optimal debt values and leverage as a function of correlation



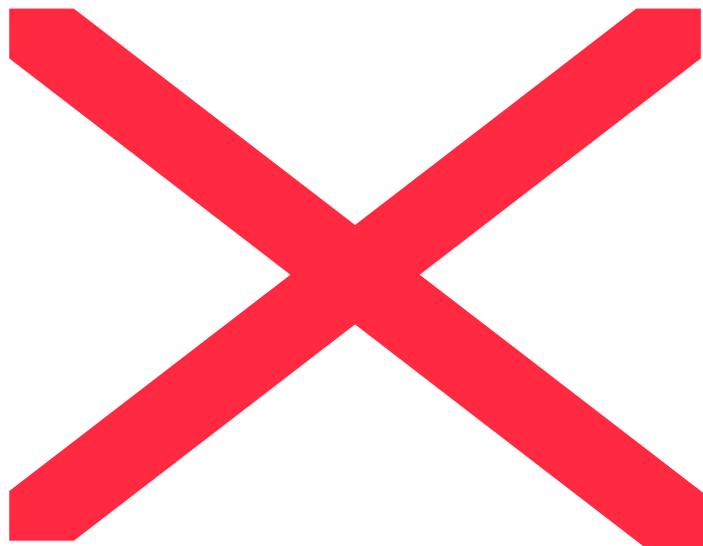
Constrained leverage, the role of ownership:



# Constrained leverage, infinitesimal ownership



# Constrained leverage, the role of ownership:



correlation					
	-0.8	-0.2	0	0.2	0.8
<b>unconstrained subsidiary</b>					
hist def prob	0.30%	13.80%	19.35%	22.13%	32.02%
closest implicit rating	Aa1	Ba3	B2	B3	Caa-C
model spread (bp)	174	683	805	842	1040
observed spread (bp)	Aa: 65 HH	Ba:320 HH	B: 470 HH	B: 470 HH	B: 470 HH
<b>constrained subsidiary</b>					
hist def prob	0.00%	0.14%	0.36%	0.74%	2.30%
closest implicit rating	Aaa	Aaa	Aa1	A3	Baa2
model spread (bp)	16	36	47	58	98
observed spread (bp)	Aaa: 55 HH	Aaa: 55 HH	Aa: 65 HH	A: 96 HH, 74 EG	Baa: 158 HH, 121 EG
<b>constrained holding</b>					
hist def prob	3.96%	3.76%	3.76%	3.39%	2.89%
closest implicit rating	Baa3	Baa3	Baa3	Baa3	Baa3
model spread (bp)	125	121	121	112	100
observed spread (bp)	Baa:158 HH,121 EG	Baa:158 HH,121 EG	Baa:158 HH,121 EG	Baa:158 HH,121 EG	Baa:158 HH,121 EG