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On The Risk Situation of Financial Conglomerates: Does Diversification Matter?

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1. Introduction

- Increasing consolidation activity in the financial sector
- Financial conglomerate: financial group providing services and products in different sectors of financial markets
- Insurance group: financial group providing services and products in the insurance sector, not necessarily across sectors
- Corporate Diversification is currently of great interest to regulators (cf. Solvency II, Swiss Solvency Test), financial group management and to the management of individual group entities

Financial Conglomerates

- Different conglomerate structures (level of integration, organization form):
 - Holding company
is a representative for the stand-alone case if the entities are separately capitalized and do not have access to each others' cash flow
 - Parent-subsidiary model
subsidiary's market value is asset for the parent
 - Integrated conglomerate
has one consolidated balance sheet and capital is in general fully fungible between the entities

Financial Conglomerates

- Conglomeration leads to
 - Diversification benefit (reduction of risk)
Hererby, capital and risk transfer instruments (CRTIs) increase diversification benefit
 - Conglomerate discount: decrease in shareholder value
- In literature (cf. paper):
 - Diversification benefits are calculated without accounting for the conglomerate discount (same capital structure is assumed before and after conglomeration)

Financial Conglomerates

- But: comprehensive analysis requires competitive situation in a financial conglomerate (risk-adequate returns for shareholder and debtholder)
- Hence: capital structure in group context differs from stand-alone case
- Aim of this paper:
 1. Analyze diversification effects in a competitive setting (account for conglomerate discount)
 2. Consider holding company, parent-subsubsidiary, integrated model

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- Aim of this paper (continued):
- 3. Include capital and risk transfer instruments (CRTIs) in parent-subsiary model (guarantees, intra-group retro-cession)
- Analysis of diversification benefits from different perspectives:
 - Group perspective: diversification benefit, joint default
 - Individual entity perspective: solvency capital, individual default risk

2. Model Framework – Stand-alone Institutions

- Firm with $L(t)$, $A(t)$ = market value of liabilities, assets
- Geometric Brownian motions (under the real-world measure)

$$dA(t) = \mu_A A(t) dt + \sigma_A A(t) dW_A^{\mathbb{P}}(t)$$

$$dL(t) = \mu_L L(t) dt + \sigma_L L(t) dW_L^{\mathbb{P}}(t)$$

$$dW_A dW_L = \rho(A, L) dt$$

Financial Conglomerates

- D_0 = initial payment of debtholders
- E_0 = initial payment of equityholders
- $A_0 = D_0 + E_0$ invested in capital market

- Payoff at $t=1$ (debtholders)

$$D_1 = L_1 - \max(L_1 - A_1, 0)$$

- Payoff at $t=1$ (equityholders)

$$E_1 = A_1 - D_1 = \max(A_1 - L_1, 0)$$



Financial Conglomerates

- A fair (or competitive) situation for equityholder and debtholder is given if

$$E_0 = E^{\mathbb{Q}} \left(\exp(-r) \cdot E_1 \right) = E^{\mathbb{Q}} \left(\exp(-r) \cdot \max(A_1 - L_1, 0) \right)$$

$$D_0 = E^{\mathbb{Q}} \left(\exp(-r) \cdot L_1 \right) - E^{\mathbb{Q}} \left(\exp(-r) \cdot \max(L_1 - A_1, 0) \right) = L_0 - \Pi_0^{DPO}$$

- Hence, the safety level is measured with the Default Put Option (DPO) value

$$\Pi_0^{DPO} = E^{\mathbb{Q}} \left(\exp(-r) \cdot \max(L_1 - A_1, 0) \right)$$

3. Model Framework – Solvency Capital, Shortfall Risk

- For a given firm capital structure (D_0, E_0) :
- Available economic capital (risk-based capital):

$$RBC_t = A_t - L_t$$

- Necessary economic capital (solvency capital SC) = amount of capital needed at $t = 0$ to meet future obligations over a fixed time horizon for a required confidence level (cf. Swiss Solvency Test):

$$SC = TVaR_\alpha = -E^{\mathbb{P}} \left(\exp(-r) \cdot RBC_1 - RBC_0 \mid \exp(-r) \cdot RBC_1 - RBC_0 \leq VaR_\alpha \right)$$

- Regulatory requirement:

$$RBC_0 \geq SC$$

- Minimum capital requirement (MCR), derived by Solvency I standards:

$$MCR = 0.4 \cdot SC$$

Field tests shown that MCR is typically between 10% to 40% of the solvency capital SC ; as it is done in Filipovic and Kupper (2007), we choose the upper limit

- Shortfall risk:

$$SP = \mathbb{P}(RBC_1 < 0)$$

4. Corporate Structures

- Group consisting of two firms (P and S)
- Joint shortfall of entities within the group:
 - Exactly one firm defaults

$$P_I = \mathbb{P}(RBC_1^S < 0, RBC_1^P > 0) + \mathbb{P}(RBC_1^S > 0, RBC_1^P < 0)$$

- Both firms default

$$P_{II} = \mathbb{P}(RBC_1^S < 0, RBC_1^P < 0)$$

- Risk diversification:

$$d^{group} = 1 - \frac{SC^{P,group} + SC^{S,group}}{SC^{P,solo} + SC^{S,solo}}$$

Financial Conglomerates

- Capital and risk transfer instruments (CRTIs) in parent-subsubsidiary model (legally binding instruments)

- Guarantee:

$$T^G = \min(DPO^S, \max(A_1^P - L_1^P - MCR^P, 0))$$

Transfer from P to S is limited (available capital in $t = 1$) must be at least above the MCR

- Quota share retrocession:

$$T^R = \min(\beta \cdot L_1^S, \max(A_1^P - L_1^P - MCR^P, 0))$$

- Table: In order to calculate SC, we first need to determine RBC_1 ; RBC_0 is assumed unchanged (and hence does not effect SC)

Financial Conglomerates

Table: Risk-based capital at $t = 0$ and $t = 1$ for different conglomerate structures

	$t = 0$		$t = 1$	
	RBC_0^P	RBC_0^S	RBC_1^P	RBC_1^S
Solo (Holding)	$= A_0^P - L_0^P$	$= A_0^S - L_0^S$	$= A_1^P - L_1^P$	$= A_1^S - L_1^S$
Parent-subsidiary	$= A_0^P - L_0^P$	$= A_0^S - L_0^S$	$= A_1^P - L_1^P$ $+ \max(A_1^S - L_1^S - MCR^S, 0)$	$= \min(A_1^S - L_1^S, MCR^S)$
Parent-subsidiary Guarantee	$= A_0^P - L_0^P$	$= A_0^S - L_0^S$	$= A_1^P - L_1^P$ $+ \max(A_1^S - L_1^S - MCR^S, 0)$ $- T^G$	$= \min(A_1^S - L_1^S, MCR^S)$ $+ T^G$
Parent-subsidiary Retrocession	$= A_0^P - L_0^P$	$= A_0^S - L_0^S$	$= A_1^P - L_1^P$ $+ \max(A_1^S - L_1^S - MCR^S, 0)$ $- T^R$	$= \min(A_1^S - L_1^S, MCR^S)$ $+ T^R$
Integrated	$= A_0^P + A_0^S$ $- L_0^S - L_0^P$	—	$= A_1^P + A_1^S - L_1^S - L_1^P$	—

5. Conglomerate Discount

- Account for decrease in shareholder value
- Safety level (DPO value) is assumed to be unchanged; hence, debtholder always pay the same amount D_0
- Holding company: corresponds to stand-alone case since we assume that no transfer of assets takes place
- Parent-subsidiary model:
 - Subsidiary's equity capital unaffected by group building
 - Fair initial equity capital of parent is reduced

Financial Conglomerates

- Fair initial equity capital of parent is reduced due to group-level diversification

$$\begin{aligned} E_0^P &= E^{\mathbb{Q}} \left(e^{-r} \cdot E_1^P \right) \\ &= E^{\mathbb{Q}} \left(e^{-r} \cdot \max \left(A_1^P - L_1^P + \max \left(A_1^S - L_1^S - MCR^S, 0 \right), 0 \right) \right) \end{aligned}$$

- Integrated conglomerate: Since

$$D_0^P + D_0^S = L_0^P + L_0^S - E^{\mathbb{Q}} \left(e^{-r} \cdot \max \left(L_1^P + L_1^S - A_1^P - A_1^S, 0 \right) \right)$$

only adjust equity capital of firm S such that

$$\Pi_0^{DPO,int} = E^{\mathbb{Q}} \left(e^{-r} \max \left(L_1^P + L_1^S - A_1^P - A_1^S, 0 \right) \right) = \Pi_0^{DPO,S} + \Pi_0^{DPO,P}$$

6. Numerical Analysis

- Compare diversification effects with and without accounting for conglomerate discount
- Input parameter: $\alpha = 1\%$, $r = 3.5\%$, $\beta = 5\%$
- Firms have same safety level, same size, same asset and liability structure

$$L_0^S = L_0^P = 100$$

$$D_0 = L_0 - \Pi_0^{DPO} = 100 - 0.1 = 99.9$$

$$E_0 = 30.1 \quad (\text{fair initial equity capital})$$

- **Assets and Liabilities:**

$$\mu_A = 0.09 \quad \sigma_A = 0.10$$

$$\mu_L = 0.01 \quad \sigma_L = 0.10$$

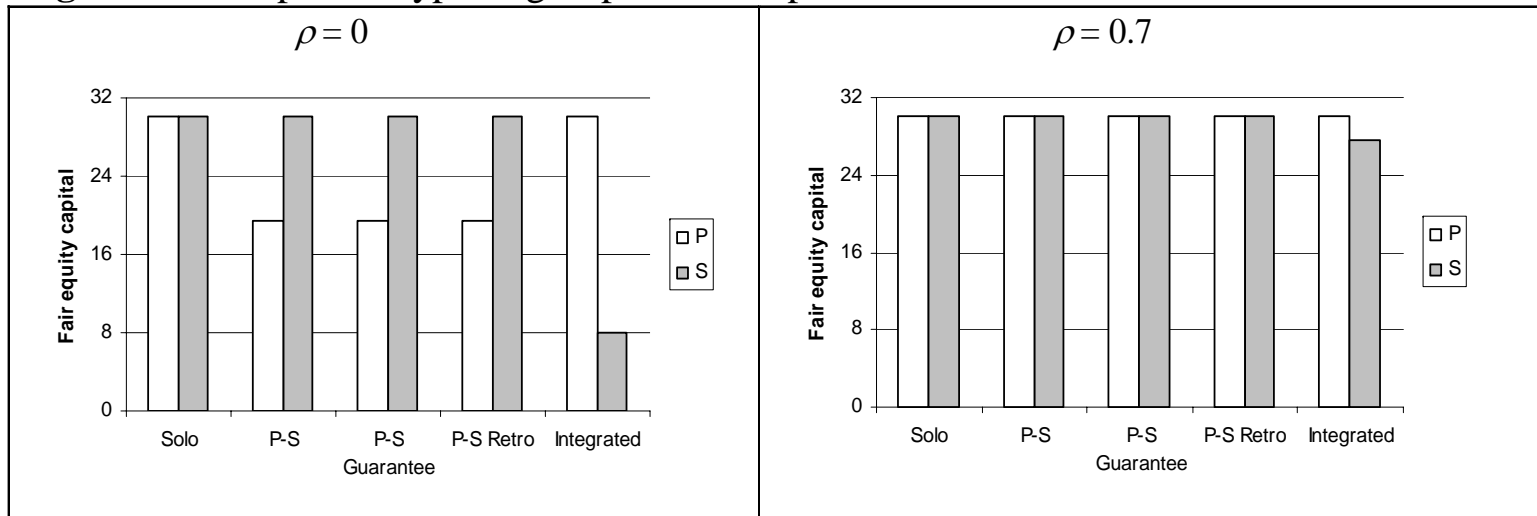
$$\rho(A_1^P, L_1^P) = \rho(A_1^S, L_1^S) = 0.2$$

$$\rho(A_1^P, L_1^S) = \rho(A_1^S, L_1^P) = 0$$

$$\rho = \rho(A_1^P, A_1^S) = \rho(L_1^P, L_1^S) = 0 \quad / \quad 0.7$$

Financial Conglomerates

Figure: The impact of type of group on fair capital structure



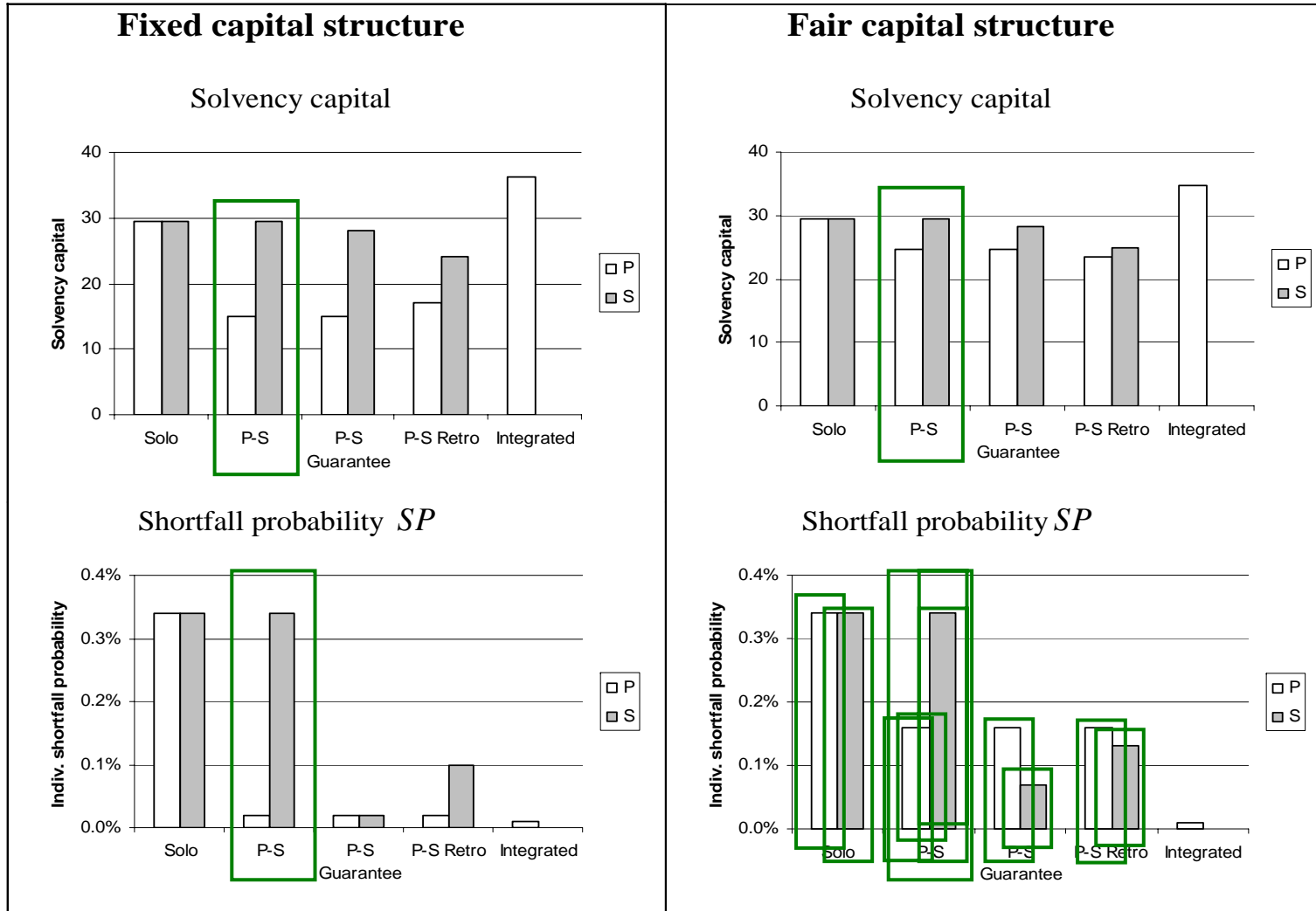
Notes: Solo = stand-alone case/holding company model; P-S = parent-subsidary model without CRTIs; P-S Guarantee = P-S with guarantee; P-S Retro = P-S with retrocession.

Conglomerate discount is stronger with increasing level of integration

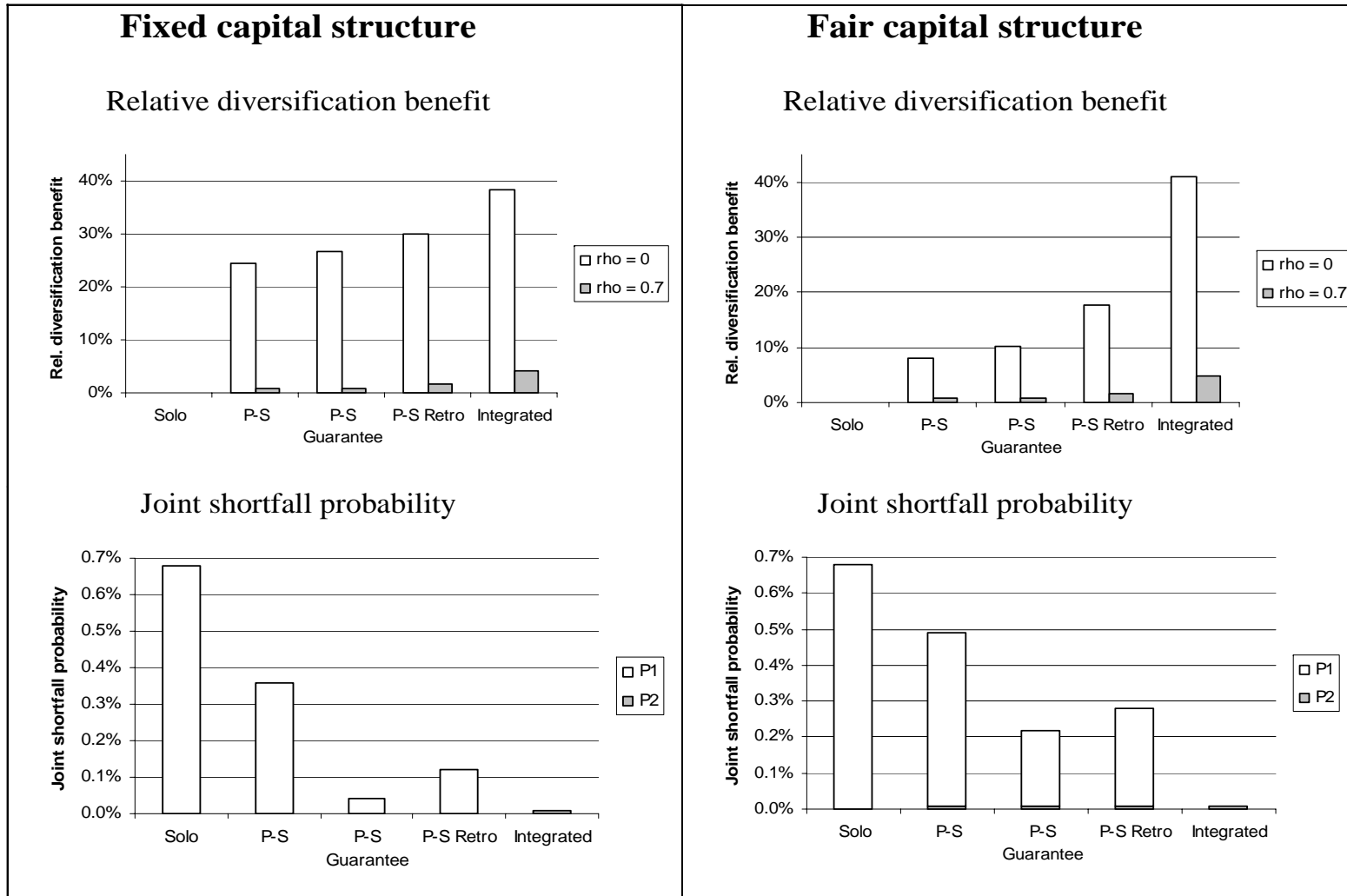
Capital and risk transfer has no impact on fair capital structure

Effects substantially reduced for highly correlated cash flows

Financial Conglomerates



Financial Conglomerates



7. Summary

- Financial conglomerates:
 - Group solvency requirements decrease with increasing level of integration
 - Diversification effects and conglomerate discount alleviated when cash flows are highly correlated
- Parent-subsidiary model:
 - Ownership relation:
Parent's shortfall probabilities reduced compared to solo case

Financial Conglomerates

- Ownership relation (continued):

Subsidiary's shortfall risk unaffected by ownership relation

- Capital and risk transfer instruments from parent to subsidiary:

Do not affect parent's insolvency risk or capital structure (but increase in solvency capital requirements)

Reduce subsidiary's shortfall risk and solvency capital requirements

Financial Conglomerates

- In summary:
 - Important to account for the conglomerate discount when
 - ... measuring diversification benefits in groups
 - ... analyzing impact of capital and risk transfer instruments
 - Diversification effects are much lower when the conglomerate discount is taken into account, especially for high correlations
 - Important information for regulators and group management