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Enterprise Risk Management, Insurer Value Maximization, and Market Frictions

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Enterprise Risk Management

■ ERM

- Managing risk at the enterprise level in order to add value to the firm stakeholders.

- Risk based capital financing volatility rather than real or financial capital used to fund productive activity.

- Risk management focuses mostly on risk based capital.

- Volatility impacts value through frictional costs such as taxes, agency, and financial distress costs.

Insurers and Reinsurers: Capital and Risk Management

- Insurers and banks hold risk based capital to cover enterprise risks (aggregate market, credit, insurance, and operational risks).
- Regulatory requirements such as Basel II, Solvency II, and APRA Prudential Standards have minimum requirements.
- Limited risk mitigation through derivatives, reinsurance, and securitization.
- Insurers and banks generally hold capital at levels well in excess of regulatory capital.

Risk Based Capital and Value Maximization

- Under perfect market assumptions
 - No frictional costs and perfectly competitive markets.
 - No optimal risk based capital.
- With frictional costs, holding excessive capital is not consistent with value maximisation or frictional cost minimization.
- Possible explanations:
 - Imperfectly competitive product market.
 - Customer preference for financial quality.

Literature

- Panning (2006) develops a firm value maximizing model for an insurer based on value added defined as the present value of future after-tax profits allowing for insurer default in excess of surplus.
- Zanjani (2002) formally develops a firm value maximizing model where capital is costly to hold because of frictional costs and policyholders have inelastic demand and care about the financial quality of the insurer.
- D'Arcy and Gorvett (1998) develop a hypothetical but representative insurer in order to examine the impact of varying assumptions on underwriting profit margins.

Literature

- Cummins, Lin, and Phillips (2006) find strong evidence that insurance prices are inversely related to insolvency risk as measured by A.M. Best's financial ratings.
- Cummins and Danzon (1997) analyze firm specific and industry levels of capital and the relationship between prices and loss shocks. They find prices are positively related to capital supply and weak evidence that prices increase in response to an internal negative reduction to capital.
- Doherty and Garven (1986) develop a single-period option pricing framework for insurer pricing and capitalization including default risk and taxation.

Insurer Value Maximizing Model

- Single-period model of a P&C insurer:
 - Insurer writes *multiple* lines of business with claims paid at the end of the period.
 - Similar model set up to Zanjani (2002) and value maximisation similar to Panning (2006)
- Includes frictional costs.
- Imperfectly elastic demand.
- Policyholders care about financial quality.
- Assets and liabilities are joint log-normal (Sherris and van der Hoek, 2006).

Maximizing Enterprise Value Added (EVA)

$$\max_{R_0, p_{i,0}} \{EVA_0\} = \max_{R_0, p_{i,0}} \left\{ \sum_{i=1}^N [p_{i,0} - c'_{i,0} - (1 - d_0) e^{-r} \mu_{i,1}] q_{i,0} - \delta R_0 \right\}$$

- Optimize prices $p_{i,0}$ and capital R_0 .
- $q_{i,0} = q(p_{i,0}, d_0, f)$ = quantity of business sold in the i th line.
- $d_0 = e^{-r} E^Q \left[\max \left(1 - \frac{V_1}{L_1}, 0 \right) \right]$.
- $c'_{i,0}$ = marginal expenses.
- $\mu_{i,1}$ = expected loss at time 1.
- r = risk-free rate.
- $\delta = \frac{(1-e^{-r})\tau_1 + e^{-r}\tau_2}{1-\tau_1}$, where τ_1 = taxes and τ_2 = agency costs of capital.

Price elasticity assumption

- Allowance is made for the number of policies sold with premium revenue at time 0 for sales from the N lines of business determined by

$$P_0 = \sum_{i=1}^N p_{i,0} q_{i,0}$$

- $q_{i,0}$ is assumed to be a function of price, default risk, and bankruptcy costs

$$q_{i,t} = q(p_{i,t}, d_t, f) = \alpha_i \max[1 + \beta_i p_{i,t} + \gamma_i (1 + f) d_t, 0].$$

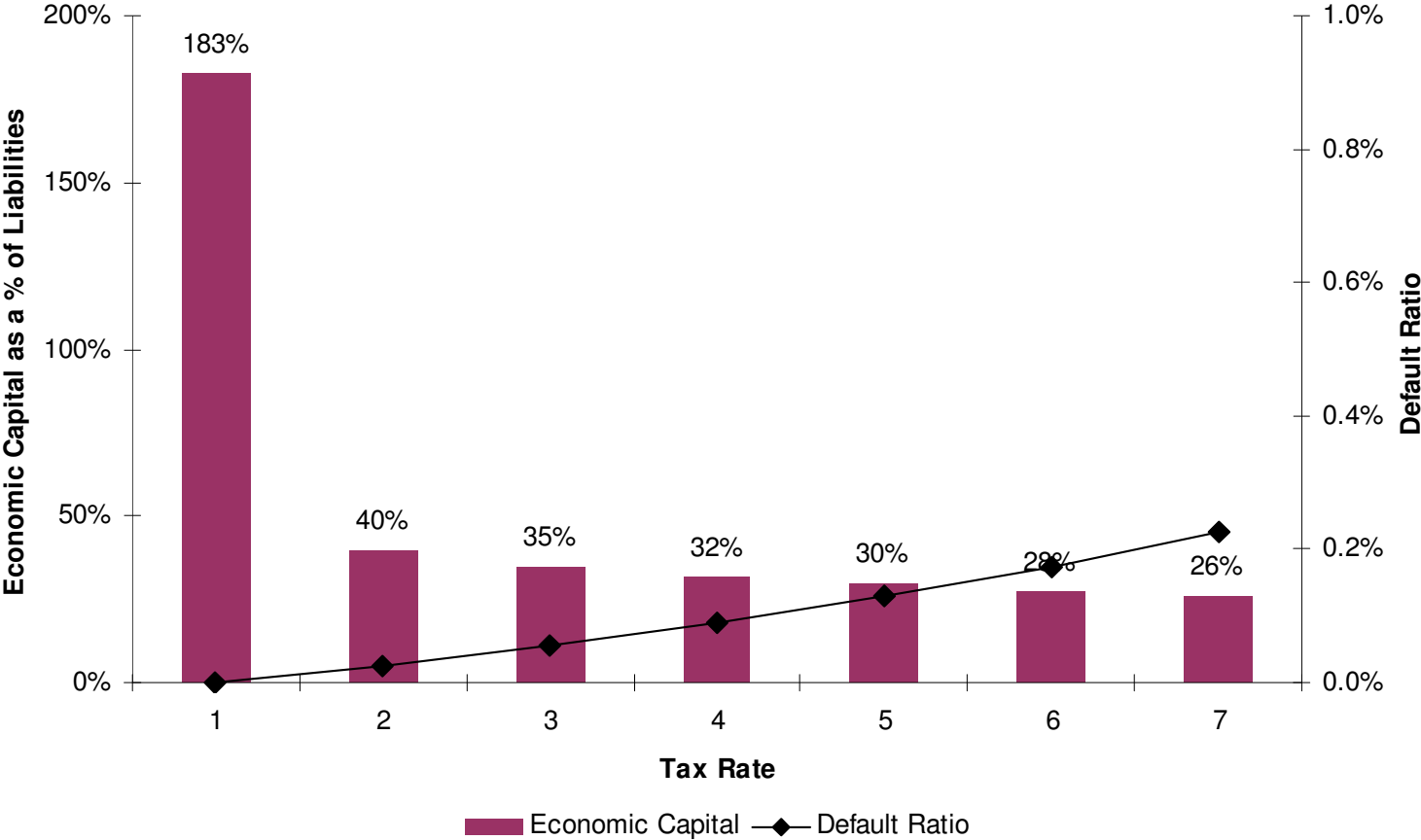
Data and Calibration

- Business portfolio:
 - Motor, household, fire & ISR, liability, and CTP insurance.
- Data sources (1997-2001):
 - APRA's Half Yearly GI Bulletin, business volumes and expenses.
 - Tillinghast Risk Margin Analysis, CVs and correlations.
- Price elasticity of demand:
 - Personal, commercial, or compulsory.
- Solved and optimized using MATLAB and a direct search method.

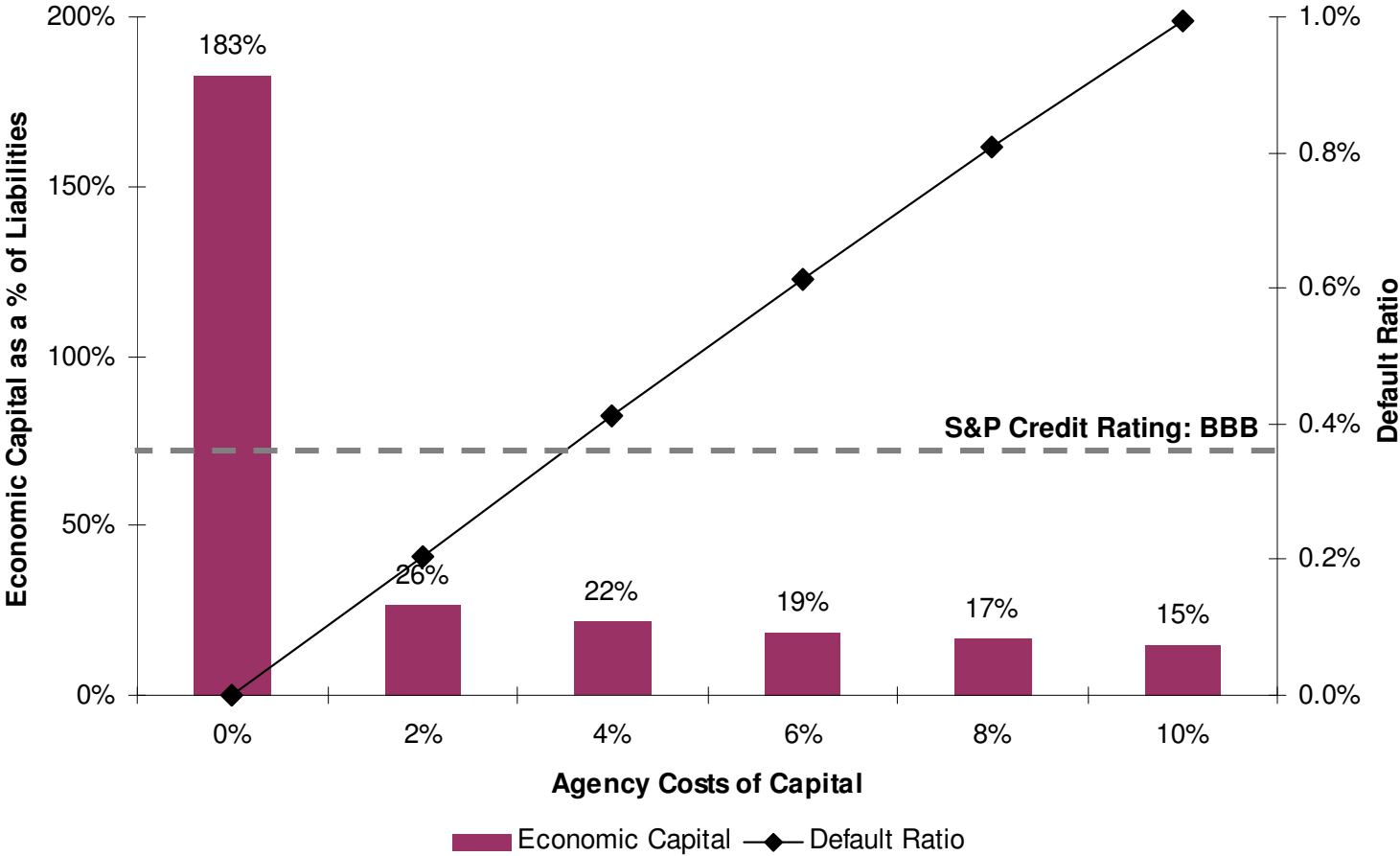
The Impact of Market Frictions

- Sensitivity analysis:
 - Taxes, agency costs, and bankruptcy costs.
- What is the impact?
 - Capitalization and financial quality.
 - Prices by line of business.
 - Shareholder and policyholder wealth.

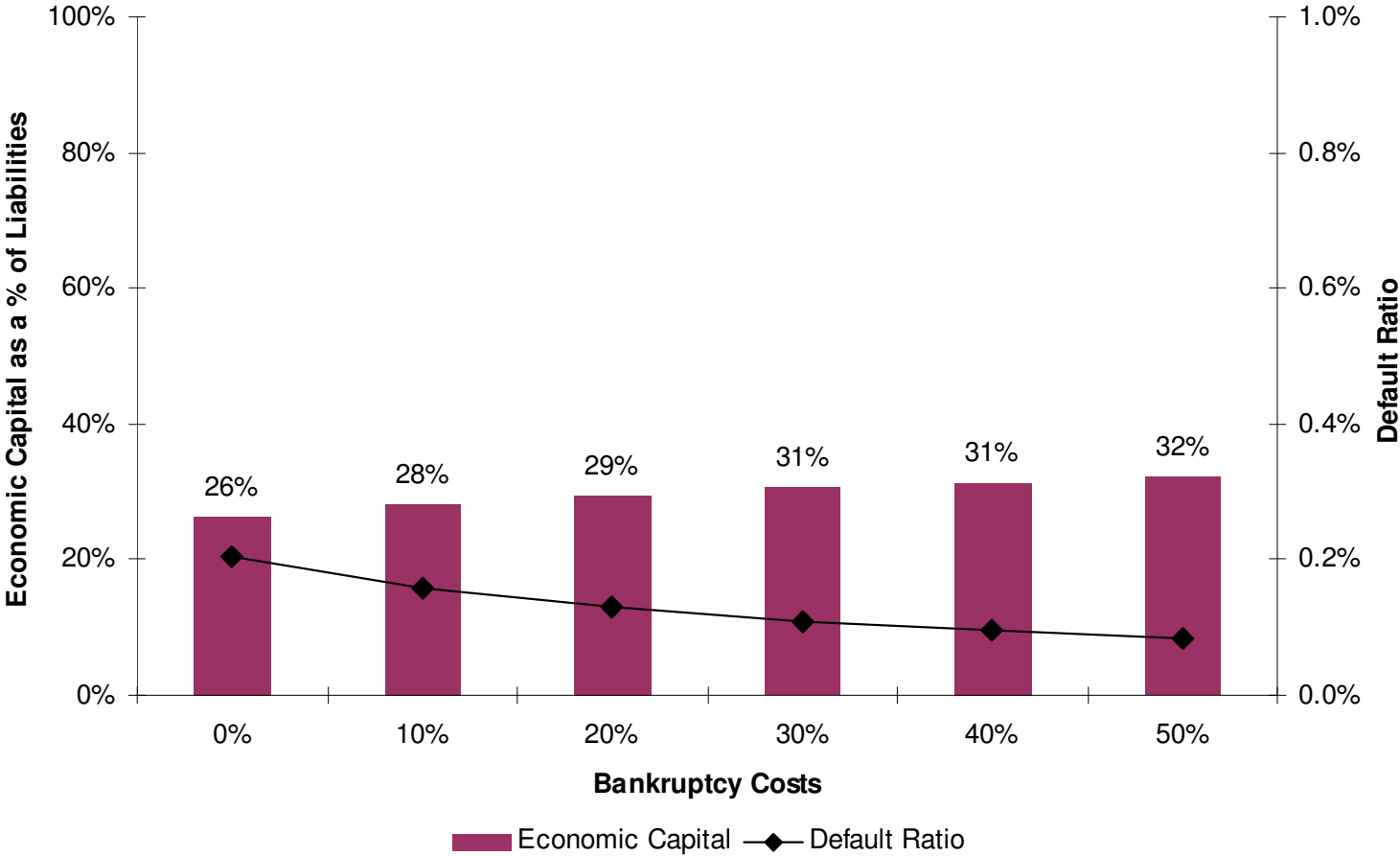
Lower value maximizing capital for higher tax rates



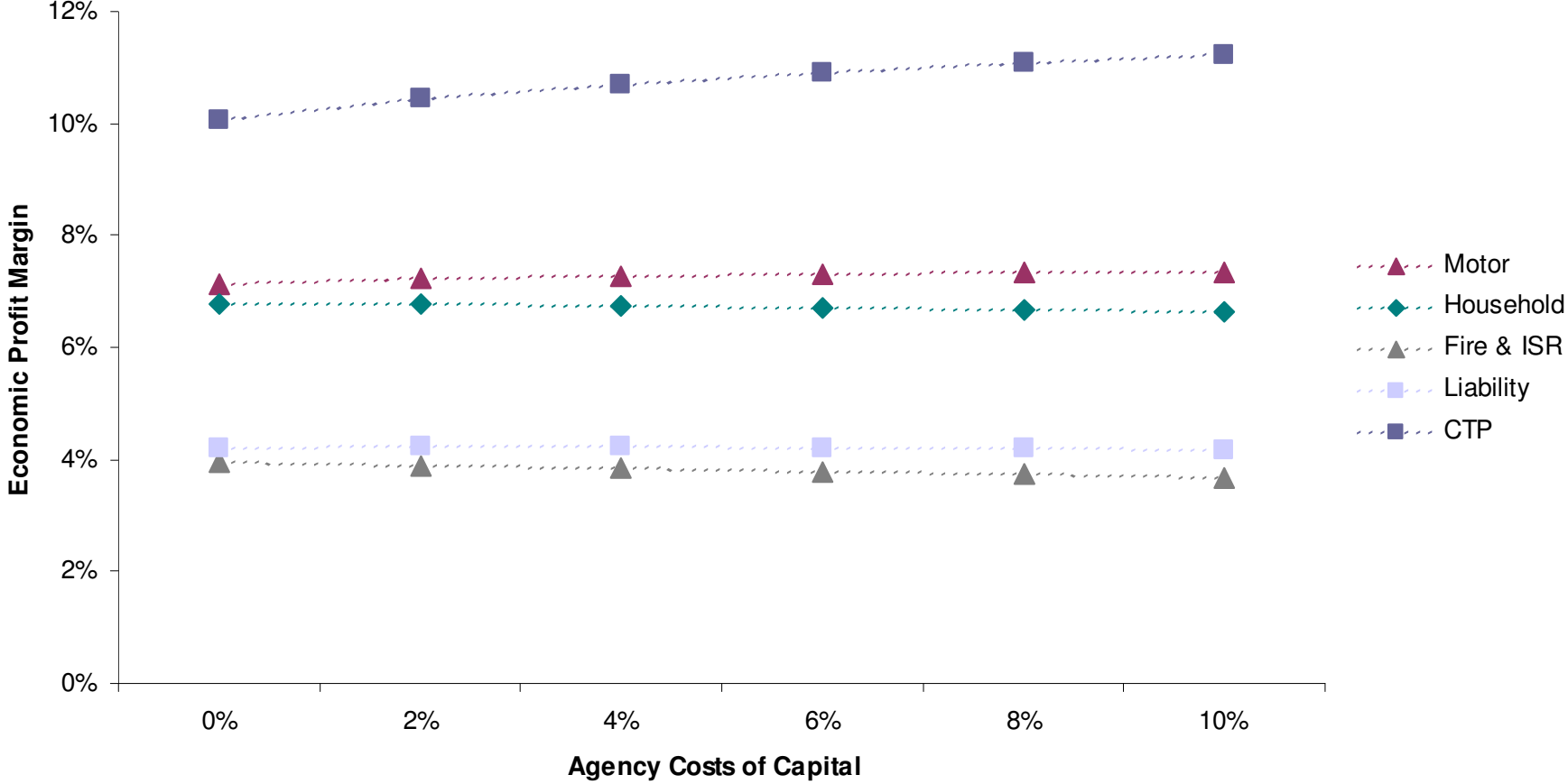
Lower optimal capital for higher agency costs



Higher optimal capital for increasing bankruptcy costs



Shareholders bear most of the frictional costs

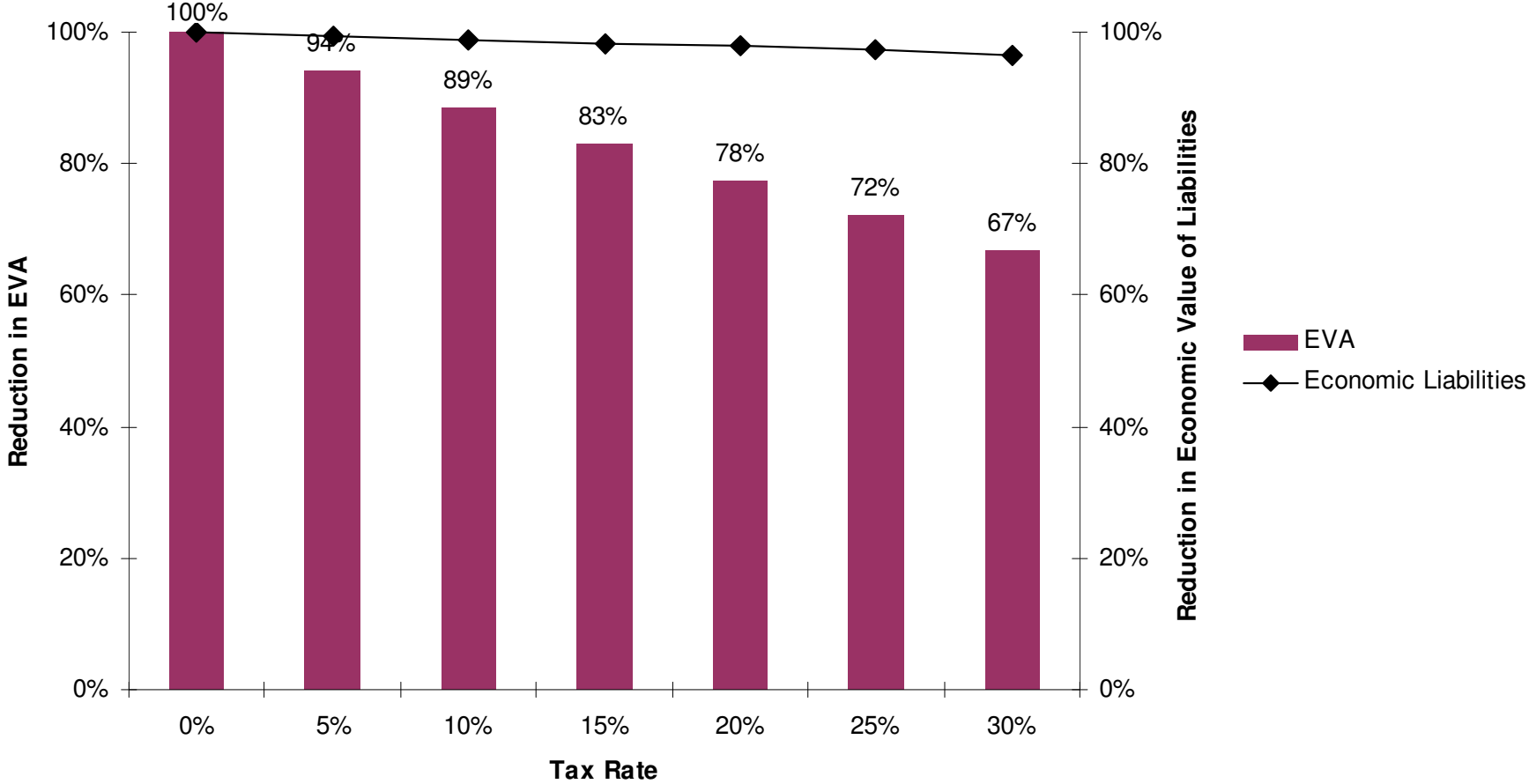


Price elasticity of demand

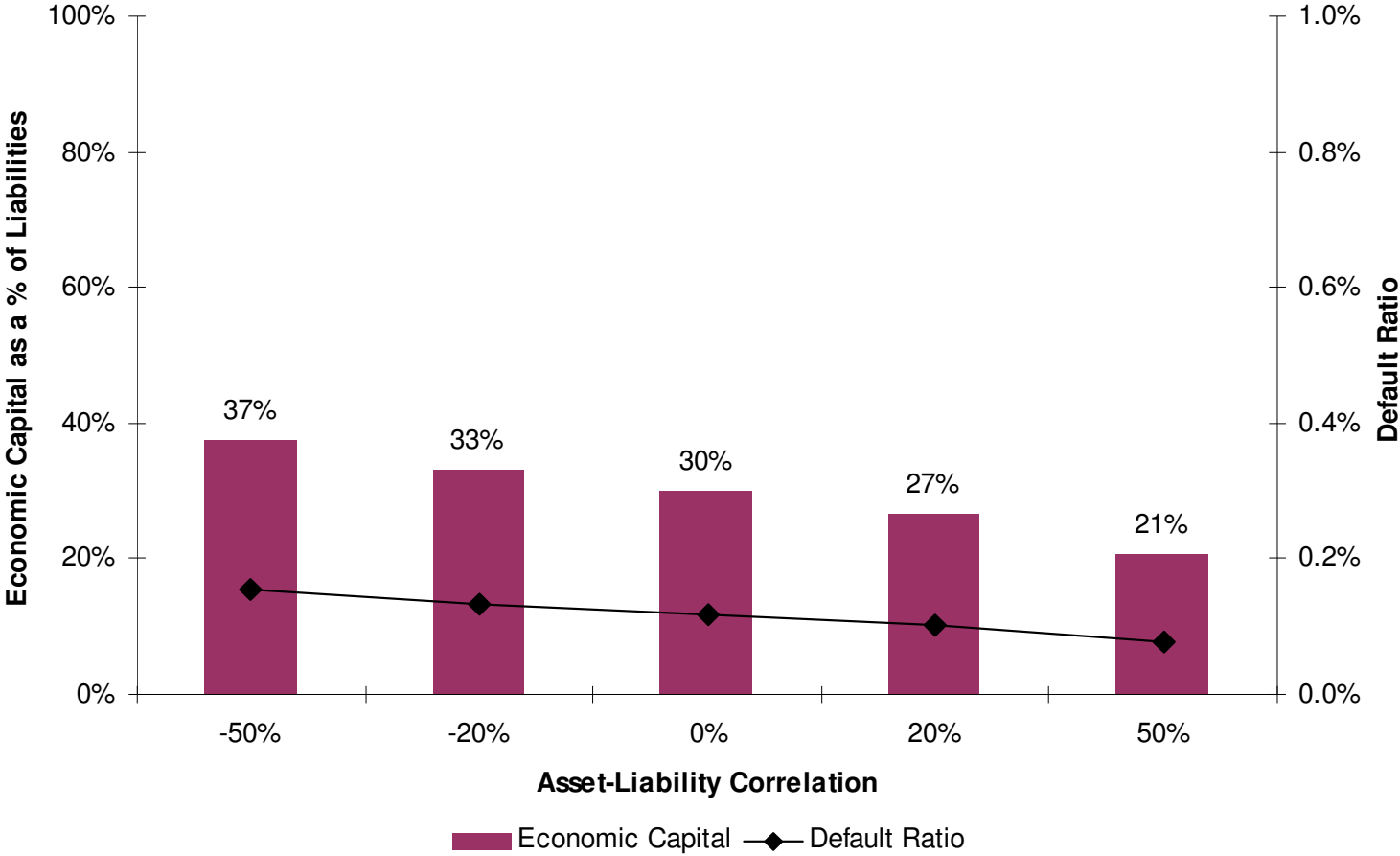
Lines	Price Elasticity of Demand	Default Risk Elasticity of Demand
Motor	15.6	0.48
Household	16.4	0.50
Fire & ISR	26.1	0.78
Liability	24.8	0.74
CTP	11.7	0.37

- No industry studies available. Published research studies needed.
- We assume the insurance industry is relatively competitive.
- Elasticities drive profit margins, more than risk loading.

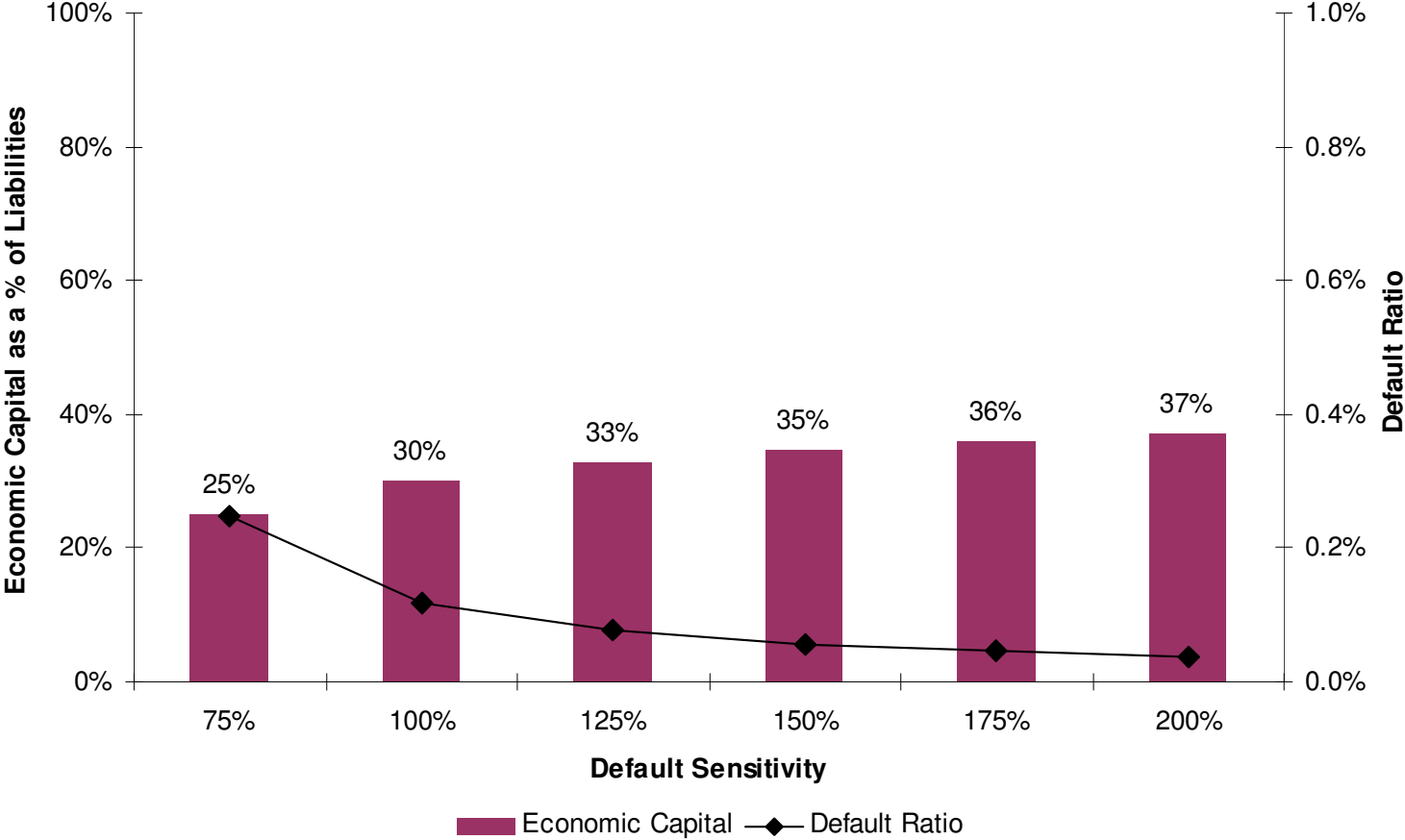
Frictions reduce shareholder and policyholder wealth



Asset-liability management (ALM)



Policyholder default sensitivity



Summary of Results

	Taxes	Agency	Bankruptcy
Capital structure	↓	↓↓	↑
Financial quality	↓	↓↓	↑
Pricing	-	-	-
Policyholder value	↓	↓↓	↓
Shareholder value	↓↓	↓	↓

- Market frictions generate optimal capital structure in risk management and value maximization.
- ALM and risk management improves firm value.
- Policyholder preferences for financial quality supports higher optimal capital structures

Summary

- Value maximisation framework – considering both capitalization and pricing.
- Cost of capital, pricing, and VaR. (Yow and Sherris, Geneva Papers, 2007)
- Frictional costs and imperfect demand in insurance markets are important determining factors for optimal risk based capital.
- More public research and deeper understanding is needed of price elasticity and policyholder preferences for financial quality.
- Further work on model analytics and alternative assumptions.