Willis

Managing the Invisible: Measuring Risk, Managing Capital, Maximizing Value

ERM Symposium Session A6

William H. Panning
April 2006

1 What is ERM and how does it benefit my firm?

Enterprise Risk Management (ERM) is a body of knowledge – concepts, methods, and techniques – that enables a firm to understand, measure, and manage its overall risk **so as to maximize the firm's value to shareholders and/or policyholders.**

The benefits of ERM are often assumed rather than demonstrated.

"Better" risk information supposedly leads to "better" risk management which supposedly makes the firm more valuable. But demonstrations and details are scarce.

2 Objective and features of this presentation

Goal: Demonstrate how an insurer can use ERM-generated information about its aggregate risk exposure to identify and choose shareholder/policyholder-value-maximizing combinations of risk and capital.

- Focus on property-casualty insurers
- Focus on surplus as the principal component of a firm's capital
  - Reinsurance, debt, hybrid securities dealt with separately
- Explanatory model (vs. elaborated and calibrated models)

3 Capital Structure Choice in Theory and Practice

- **Theory**: Modigliani-Miller capital structure irrelevance theorem
  - Valid, but under circumstances that are rarely encountered
  - Irrelevant most of the time
  - Their real contribution was arbitrage-based arguments
  - But influence resulted in abandonment of corporate finance
- **Practice**: criteria CFOs use to select their capital structure
  - Maintain roughly the same financial ratios as **peer companies**
  - Maintain financial ratios consistent with **corporate risk tolerance**
  - Maintain financial ratios required for a **target financial rating**
  - Maintain a **target beta and cost of capital**

3 Capital Structure Choice in Theory and Practice (cont.)

- **Proposed Alternative:** for a given set of risk exposures, select the capital structure that maximizes the firm's value to shareholders and/or policyholders

- To implement this alternative we need:
  - A way to estimate the firm's value to shareholders/policyholders
  - One that is based on observable parameters
  - One that is readily understandable (unlike, say, "risk appetite")

4 Valuing a P/C Insurer: cross-sectional approach

Cross-sectional approach

- Start with the insurer's accounting balance sheet
- Adjust for differences between book value and economic value
  - Market value assets
  - Present value liabilities
- Subtract adjusted liabilities from adjusted assets to get current economic value of the firm.

- Problem 1: for some firms, market capitalization exceeds assets
- Problem 2: directly marketed insurance appears to be irrational

4 Valuing a P/C Insurer: Longitudinal approach

Longitudinal or going-concern approach

- Value of a firm is the **default-risk-adjusted present value of its expected future earnings** or cash flows [earnings used here]

- E = expected annual after tax expected earnings absent default
- time discount factor df = 1/(1+y), where y = risk-free rate
- p = yearly probability of survival = 1 – probability of "critical loss"
- Discount factor D = p*df
- Default-risk-adjusted PV of future earnings = E*D/(1-D)
- This includes earnings from policies not yet written

4 Valuing a P/C Insurer: Longitudinal approach (cont.)

Longitudinal value of firm minus cross-sectional value of firm = the firm's **franchise value**, the present value of future business

- Cross-sectional value (or current economic value of the firm) is value of business already written

The **longitudinal approach explains how direct marketing of insurance is economically sensible**

- It increases franchise value (but not cross-sectional value)
- Cross-sectional value based on accounting rules, which exclude renewals since there is no legal obligation to renew

4 Valuing a P/C Insurer: Longitudinal approach (cont.)

The **longitudinal approach also explains how a firm can have market capitalization that exceeds the value of its assets**

- Let G = 1+g, where g is the annual growth rate of the firm
- For modest levels of growth, the default-risk-adjusted present value of future earnings = E*D/(1-G*D)
- This exceeds E*D/(1-D) when G>1 and G*D<1
- Note: high growth rates cannot be sustained indefinitely, and so require a more complex model (e.g., two stages of growth)

5 A Longitudinal Model for Valuing a P/C firm

Key: The paper presents a longitudinal model that uses a firm's aggregate loss distribution to determine its **optimal capital structure**

- How much surplus it should have given its risk exposure?
- Or, equivalently, how much risk it should take given its surplus?
- The model identifies optimal combinations of risk and capital

- The optimal capital structure is one that **maximizes shareholder or policyholder value**

- **Crucial Fact: Maximizing shareholder or policyholder value is not the same as maximizing the equity value of the firm.**

5 A Longitudinal Model for Valuing a P/C firm (cont.)

A firm can pay earnings to shareholders or add them to surplus

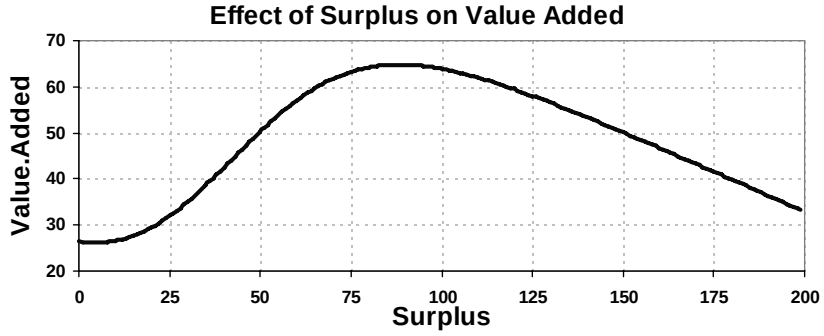
- Each $1 paid to shareholders is worth $1 to them
- Each $1 added to surplus increases shareholder value in two ways:
  - It increases firm's net income; this is worth <$1 due to taxation
  - It increases firm's default-risk-adjusted PV by increasing probability of survival
  - **Key question: are these two effects worth >$1? If so, add to surplus; else pay dividend to shareholders/policyholders**

- **Implication: Shareholder/policyholder value is maximized when value added is maximized**

- **Value added** = **equity value minus surplus**

6 Optimal Capital Structure

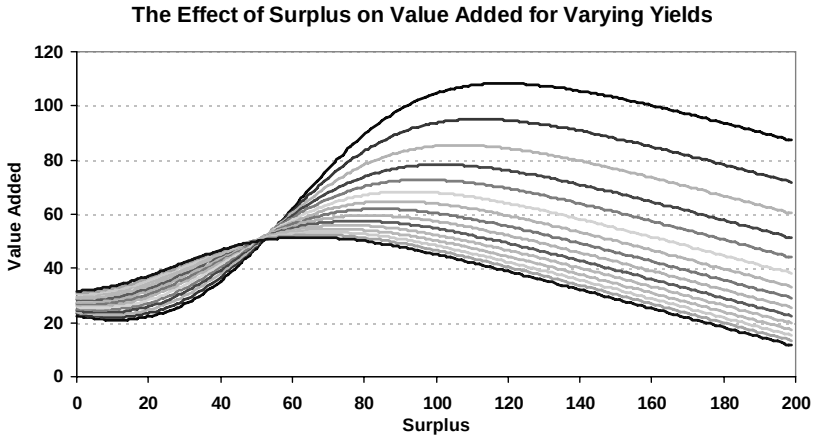
- **Key result**: For a given aggregate risk exposure, there is an optimal level of surplus – one that maximizes value added



6 Optimal Capital Structure (cont.)

- When initial surplus level is low relative to risk exposure, benefit of increased probability of survival exceeds cost of double taxation. Adding surplus increases value added
- As surplus increases, this benefit declines, so that value added reaches maximum and then decreases
- The paper shows detailed effect on optimal capital of changes in expected loss ratio, expense ratio, investment yield, and the standard deviation of expected losses
- It also shows how these as well as combinations of variables can assist strategic decision-making

Example: Optimal surplus for different yields



Conclusion: The model shows how ERM adds value to a firm

- **Making visible what is now invisible**: It makes franchise value visible and quantifiable, and therefore manageable
- **Measuring risk**: It enables a firm to measure its aggregate risk
- **Managing capital**: . . .and thus determine the optimal capital needed . . .
- **Maximizing value**: . . . to maximize its value to shareholders and/or policyholders

. . . and how ERM can answer crucial questions

- Question: How much risk should we take, given our capital?
- Question: How much capital should we have, given our risk?
- **Answer: The amount that maximizes shareholder value**
  - Terms no longer needed: “risk tolerance,” “risk appetite,” utility

Questions or comments?

Email me at Bill.Panning@Willis.com

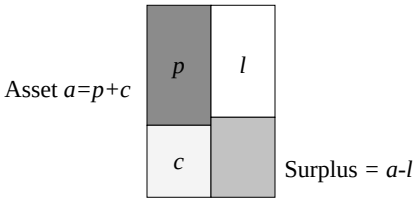
Economic Impact of Capital Level in an Insurance Company

Kevin Zhang, Ph.D., FCAS
CNA Insurance Companies

The model

- A one-period model (*t: 0 →1*)
- Shareholders contribute capital *c*
- Company insures a block of business, with random loss *L*; present value of loss l = *V(L)*
  - *V(L) = 1/(1+r) E(L), r* – risk adjusted discount rate.
- Premium *p* (net of expenses)
- Fair premium = l; actual premium may be higher or lower than l, depending on the market cycle

Initial balance sheet



- Market value balance sheet, not statutory or GAAP
- Assume asset *a* invested in capital market, random rate of return = *R*
- Will study impact of capital *c*, not surplus *a-l*

Goal: to study impact of capital *c*

- on premium *p*
- on insurance profit
- on shareholder return
  - without frictional cost of capital
  - with frictional cost of capital

Impact of capital level on premium

- If company is default-free, it charges full premium
- As *c* decreases to certain level, risk of default exists; so policyholders demand premium credit
- Lower *c* => higher credit => lower *p*
- Insurance profit defined as

  $$Y = p(1+R) - L$$

  – profit generated by premium; in traditional terms

  Y = U/W profit *(p-L)* + investment gain from premium *(pR)*

- Lower *c* => lower *Y* — if firm is weak at *t=0*, then it is even weaker at *t=1*, compared with more adequately capitalized firms

Profit from shareholders' standpoint

- If a firm is not default-free, it doesn't pay full claims at default; so actual liability is lower

  Unpaid claim: $D = L - (p+c)(1+R)$, if default

  Actual liability: $L' = L - D < L$

- Actual insurance profit: $Y' = p(1+R)-L'$

  $= -c(1+R)$, if default; $= p(1+R)-L$, otherwise

- As *c* decreases, both *p* and *L'* decrease
- Question: does the present value of profit, *V(Y')*, stay the same or decline?

Propositions

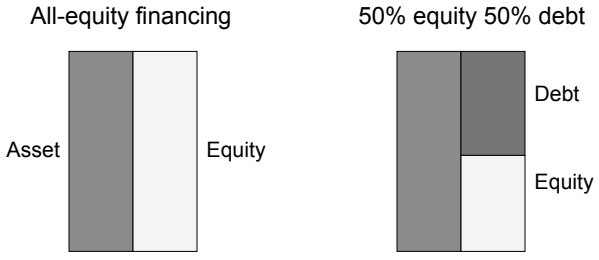
At default, unpaid claim D is a cost to policyholders

1. (Ideal Case) If the only default cost to policyholders is the unpaid claims, D, then $\Delta p = \Delta l$. $V(Y')$ remains unchanged

2. (Real Case) However, default cost usually is greater than unpaid claims D (also including delayed recovery, legal costs, etc), so $\Delta p > \Delta l$. $V(Y')$ declines

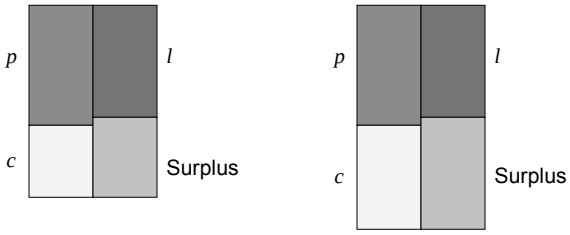
Impact of capital level on shareholder return

- Modigliani-Miller (MM) for non-financial firms: capital structure is irrelevant
- Shareholders can construct "home-made leverage" to offset any position taken by the firm



MM in insurance firms

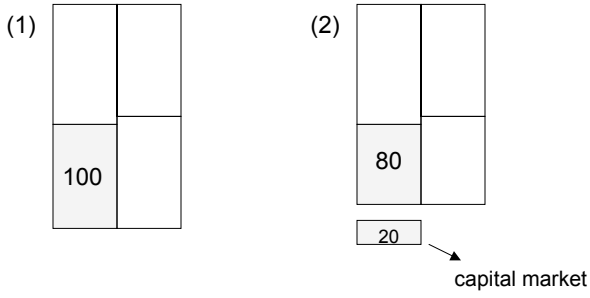
- Insurance firms are different
  - Assuming same set of insured policies
  - More capital, more investible asset ($a = p+c$)
  - Premium p varies with c
  - Liability L is risky, and is the major contributor to firm risk
- But exist irrelevance results similar to MM



Proposition – capital irrelevance

If a firm is default-free, then shareholders are indifferent to the capital level

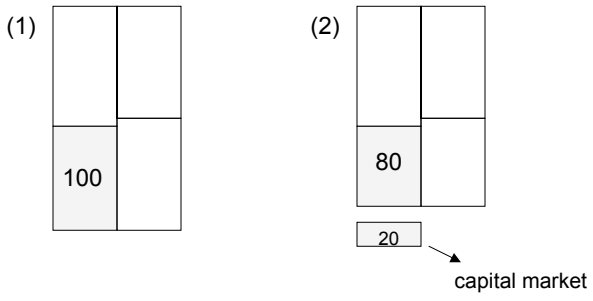
If an investor has $100, he may (1) invest $100 to the firm; or (2) invest $80 to the firm and $20 in the capital market to earn the same return (R) as the asset



Capital is not irrelevant if firm is not default-free

Shareholders of firm (2) assume less liability (but also charge less premium)

- (Ideal case) If $\Delta p = \Delta l$, the present value of shareholder return is unchanged
- (Real case) Usually, $\Delta p > \Delta l$; present value of shareholder return declines



Return on capital

Insurance profit: $Y = p(1+R) - L'$

Value of firm at the end of period:

$S = (p+c)(1+R) - L'$

Return on capital:

$ROC = (S-c)/c = R + Y/c$

Capital market return

Insurance return on capital

Excess ROC

$$\text{ROC} - R = Y/c$$

- Return on capital in excess of capital market rate R varies in reverse proportion to c : lower c => higher excess return
- However, this does not mean the less capital the better off the shareholders
  - reducing c by half doubles the excess return, but also doubles the risk—similar to the CAPM

Total excess return

$$c \cdot (\text{ROC} - R) = Y$$

$$c \cdot V(\text{ROC} - R) = V(Y)$$

- Total excess return = insurance profit
- Shareholders can invest in capital market themselves, so the only reason for investing in insurance firms is to receive insurance profit
- In real world, lower c => lower Y and $V(Y)$, so better-off investing in financially strong firms
- Two remedies for weak firms
  - Avoid competition (write specialized markets)
  - Inject new capital

Frictional costs of capital

- Previous results ignore frictional costs of capital
- Frictional costs include double taxation, agency costs….
- Higher *c* => higher frictional costs
- Different from the cost of capital–usually means the shareholder required return
  - Cost of capital → shareholders
  - Frictional costs → government, employees, agents, etc
  - From shareholders' point of view, the frictional cost is the only true cost, and should be minimized

Costs of financial distress

- Lower *c* => lower frictional costs
- However, reducing *c* increases costs of financial distress
  - dealing with auditors and regulators, defending lawsuits
  - keeping up employee morale
  - maintaining customer relationship, retaining business
  - obtaining external funding
  - upon default, direct bankruptcy costs (legal, accounting, filing, administrative)

Total costs

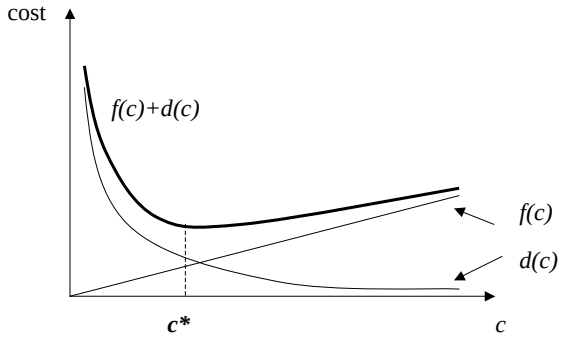
- Total frictional cost of capital, *f(c),* is an increasing function of capital

  e.g. *f(c)* = constant • *c*
- Total cost of financial distress, *d(c),* is a decreasing function of capital

  e.g. *d(c)* = constant • *V(D)*
- Total cost: *f(c) + d(c)*

- **Proposition**: There is an optimal capital level, *c*,* that minimizes the total cost *f(c)+d(c)*

Optimal capital level



Future research: to determine *f(c)* and *d(c),* and estimate *c**

Proposition – optimal capital level

There is an optimal capital level that minimizes the total cost

$$f(c) + d(c)$$

- Extension of Perold (2005) *J. Applied Corporate Finance*
- The optimal level is affected by the relative size of *f(c)* and *d(c).* If *d(c)* is more dominant, then the optimal level is higher.
- Future research: to determine *f(c)* and *d(c),* and estimate the optimal *c*

A Multi-Stakeholder Approach to Capital Adequacy

ERM Symposium

Chicago, IL

April 23-25, 2006

Robert Painter and Dan Isaac

Conning Asset Management

Hartford, Connecticut

CONNING

Swiss Re Group

Evolution of Capital Adequacy Measures

- Leverage Ratios
- RBC
- BCAR and S&P CAR
- Economic Capital

Economic Capital Model Traits

- Customized
  - Recognizes unique risk profile
  - Not universally understood
- Robust view of risk – *considers all risks*
- Economic

Continued improvement over previously developed capital adequacy measures

Economic Capital Model Weaknesses

- Produces a single measure of required capital
  - Single time horizon – *short-term*
  - Single risk tolerance – *solvency focus*
- No external consequences – *potentially changing*
- Difficult to calibrate
  - TVaR risk measure – *unlike VaR tolerances not observable*
  - Uncertainty of extreme tail – *significant parameter risk*

This does not represent all views of "capital adequacy"

“Capital Adequacy” Has Different Meanings for Different Stakeholders

Stakeholders have varying objectives. As a result, they have different definitions of “appropriate” capitalization levels. “Capital adequacy” can be defined more broadly than solvency.

- Policyholders
- Regulators
- Debtholders
- Rating agencies
- Shareholders and equity analysts
- Company management
  - Must weigh different stakeholders objectives with their own
  - Must weigh economic indications with real life business constraints
  - “Failure-to-Thrive”

“Capital Adequacy” Has Different Meanings for Different Stakeholders

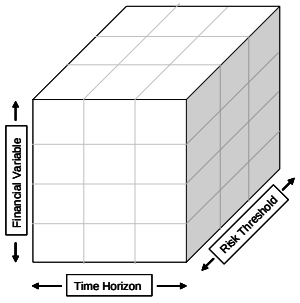
These different definitions of capital adequacy manifest themselves through different:

- Key financial variables
  - Economic
  - Financial
  - Rating agency
  - Regulatory
- Time horizons
  - Short-term / long-term
  - Risk diversification
  - Ability to react/raise capital
- Risk thresholds/tolerances
  - Solvency
  - Default
  - Downgrade / “Failure-to-Thrive”

The Multi-Stakeholder Approach to Capital Adequacy

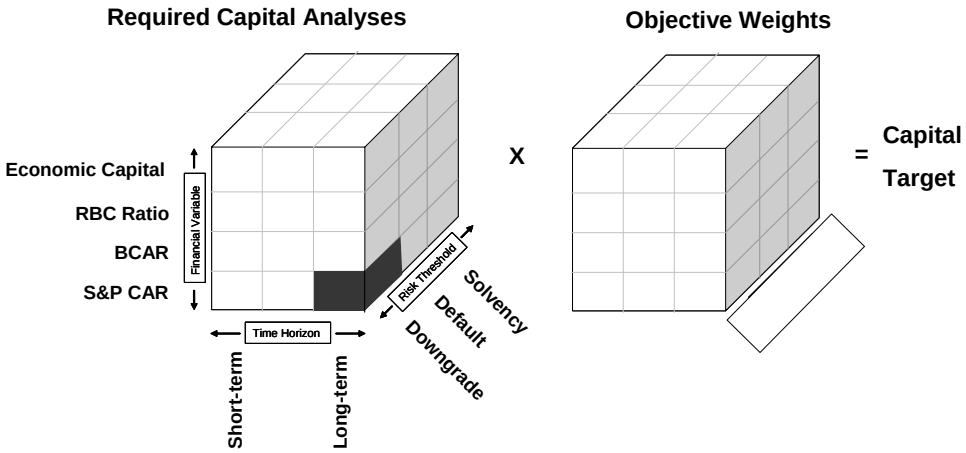
"Each of the individual "cubes" within the larger box represents an independent analysis of "capital adequacy" based on the financial variables, time horizon and risk threshold defined by the objectives of the stakeholders."

The Multi-Objective Decision-Making Framework:



The stakeholder's objectives and capital "requirements" are ranked and weighed to select a single capital target.

The Multi-Stakeholder Approach to Capital Adequacy



Required Capital Calculation Illustrated: "Financial Rating Risk Replication" Technique

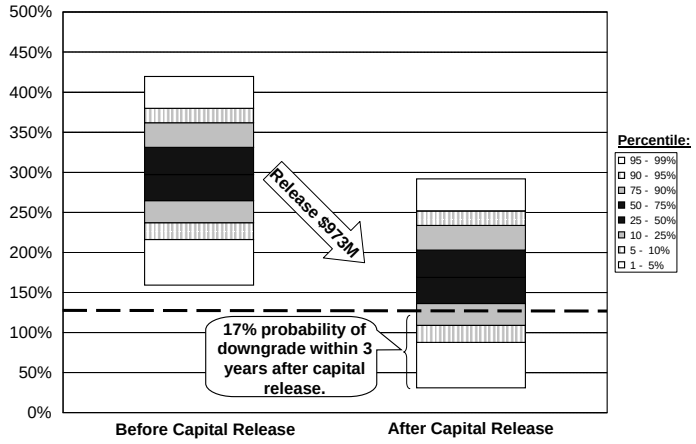
Process to Calculate Required Capital Using the "Financial Rating Risk Replication"

- Calculate distribution of the selected financial variable / time horizon combination
  - *S&P CAR at year 3*
- Select risk threshold
  - *"One-notch" downgrade from A to BBB = 125% S&P CAR*
- Calculate historical probability of transitioning from A to BBB over selected time horizon
  - *17%*
- Add or subtract current capital and iteratively re-run the model until the "global" transition probability (17%) equals the probability that the selected distribution will fall below the risk threshold (125% S&P CAR) is 17%

Required Capital Calculation Illustrated: "Financial Rating Risk Replication" Technique

- Calculate distribution
- Select risk threshold
- Calculate transition probability
- Adjust capital and iterate

Distribution of S&P Capital Adequacy Ratio – Year 3



The Multi-Stakeholder Approach to Capital Adequacy Illustrated

- Required capital calculations
  - Risk diversifies / aggregates differently at different points on the distribution and over different time horizons
  - Short-term needs dominate, long-term needs should be incorporated into planning

Current Capital Available to Release:

	Time Horizon			
Financial Variable (Risk Threshold)	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Economic Capital (Solvency)	1,845			
RBC Ratio (Default)	1,393	585	(35)	(354)
S&P CAR (Downgrade)	794	895	973	956

- Select stakeholder objective weights
  - Ability to react to changing environment – *raise capital / mitigate risk*
  - Uncertainty of future projections
- Select capital target

Benefits of Proposed Approach

- Incorporates unique views of all stakeholders
  - Different financial objectives
- Multi-year view
  - Going-concern
  - Risk diversification / aggregation
- Multiple risk thresholds can be evaluated
  - Beyond solvency analysis
- Risk thresholds calibrated to observable information
- Produces multiple estimates of capital adequacy
  - Sensitivity testing
- DFA models provide a consistent evaluation platform
- Aligned with real-world decision making processes

Areas for Future Research

- Management intervention
- Multi-year transition matrix information
- Rating standards shifts