Finance and Insurance: Converging or Diverging?

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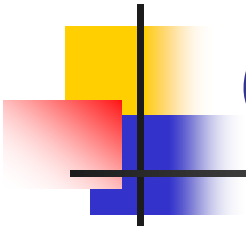
May 2002



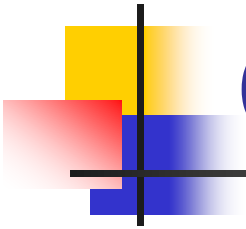
Overview

1. Underwriting

- What is underwriting?
- Examples of insurance structures
- Examples of securitization

2. **Finance and Insurance**

- Finance and Insurance compared
- Complete Markets
- Cat Bond Market Pricing



Overview

3. Insurance within Finance

- Business Demand for Insurance
- Insurer and non-Insurer Risk Management
- Insurance Company Structures
- State of Insurance Industry
- Investor Reaction to 9/11

4. Conclusions

Historical Perspective

- Reform of insurance and banking laws
- Integration of banking and insurance
  - Partnerships (P/C) and Mergers (Life) with banks
  - Banks as P/C intermediaries rather than risk bearers
- Industry over- ***and*** under-capitalized
  - Low ROE, very low leverage ratios
    - Conservative rating agency models
    - One-time capital gains
  - But, inability to cope with large cats
  - Industry using capital inefficiently?

Historical Perspective

- Wind-fall capital gains in late 1990s led to savage price war and poor underwriting results 97-2000
- Fragile industry shocked in 2001
  - 9/11 terrorist attacks
  - Enron
  - Re-emergence of asbestos
- Hard market, industry distressed
- Market not embracing securitization solutions

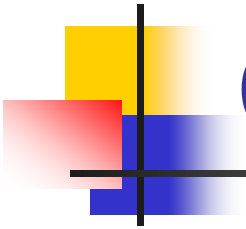
1. Underwriting

What is Underwriting?

- Assess and quantify risks
- Attract capital to support writings
  - Existence of capital demonstrates uw competence to buyer
- Provide infrastructure to issue policies, comply with regulation, adjust claims
- May sound easy, but consider starting from scratch!

Insurance Policies

- Property Casualty focus
  - Auto liability (AL) and physical damage (APD)
  - General liability (GL): Premises and Products
  - Workers Compensation (WC): Statutory cover, unlimited loss potential
  - Homeowners
  - Commercial property: Terrorism
  - Umbrella (over AL, GL)
  - Reinsurance



Catastrophes

- Independent risks underlies P/C insurance
- Catastrophe (Cat) Risk: catch-all phrase for failure of independence
  - Hurricane, earthquake
  - Tornado, winter storm
  - Terrorist attack
- Property cats monitored by PCS
  - Provide industry wide estimates of losses from cat events over $25M

Overview of Cat Reinsurance

- Common catastrophe reinsurance covers
  - Per occurrence excess of loss
    - $100M xs $150M per occurrence
  - Reinstatements
    - 1 at 100%, 3 "pro rata as to time and amount"
  - Aggregate excess of loss – less common
- Catastrophe Models
  - Per location computation of loss costs and distribution of occurrence and aggregate losses
    - Consider specific location characteristics
      - Soil type, distance to shore
      - Construction type, building characteristics and use
    - 1000's of simulated events applied to each location

Overview of Cat Re

- Pricing of Cat Contracts
  - Expected losses typically determined by models
    - Data quality a key concern
  - Premium markup 150% to 500% of expected loss
    - See Froot paper on www.guycarp.com
  - Loss ratio = 1 / Markup
  - Rate on line (ROL) = premium / line extended
  - For a 1:100 year event
    - Loss cost approx. 1% on-line
    - Rate or premium 1.5-5% on line
    - Loss ratio 20% to 66%

Overview of Cat Re

- Retro: reinsurance for reinsurers
  - Greater uncertainty about underlying risks
  - Poorer data quality for modeling
  - Do not want to provide capacity to competitors
- Capacity
  - Industry surplus approx. $290B
  - Large event: $100B
  - WTC approx $30-50B, Andrew approx $20B
- All risks coverage vs. named peril
  - Key difference in WTC!

Overview of Cat Re

US Region	100 Year Return	250 Year Return
Florida Wind	$30B	41
S California EQ	15	27
New Madrid EQ	4.5	14
US Multi-Peril	59	115

-Regional losses on occurrence basis; US total on aggregate basis
-Loss amounts are gross insured loss, net of insured deductibles
-Multi-peril loss includes EQ, fire-following, hurricane, tornado and hail
-AM Best focuses on 250 year returns for EQ and Florida wind, and 100 year returns for non-Florida wind

Source: RMS

Typical Reinsurance Structure

- Property
  - All individual risks "bought-down" to $10-20M per risk (location/event)
    - Facultative or Per Risk treaty
    - Typically not considered cat exposed (fire, explosion)
  - Treaty occurrence coverage up to 250-1000 year event in several layers (tranches)
  - Occurrence coverage harder to quantify
  - Market crises after Andrew led to interest in alternative structures and securitization

Securitization

- Bundling or repackaging of rights to future cash flows for sale in the capital markets
  - **Transformation** of uw cash flows into securities
  - **Transfer** of uw risk to the capital markets
- Advantages to insurers
  - More capacity
  - No counter-party risk
  - More favorable tax treatment (SPV offshore)
  - Consistent capacity through market cycle

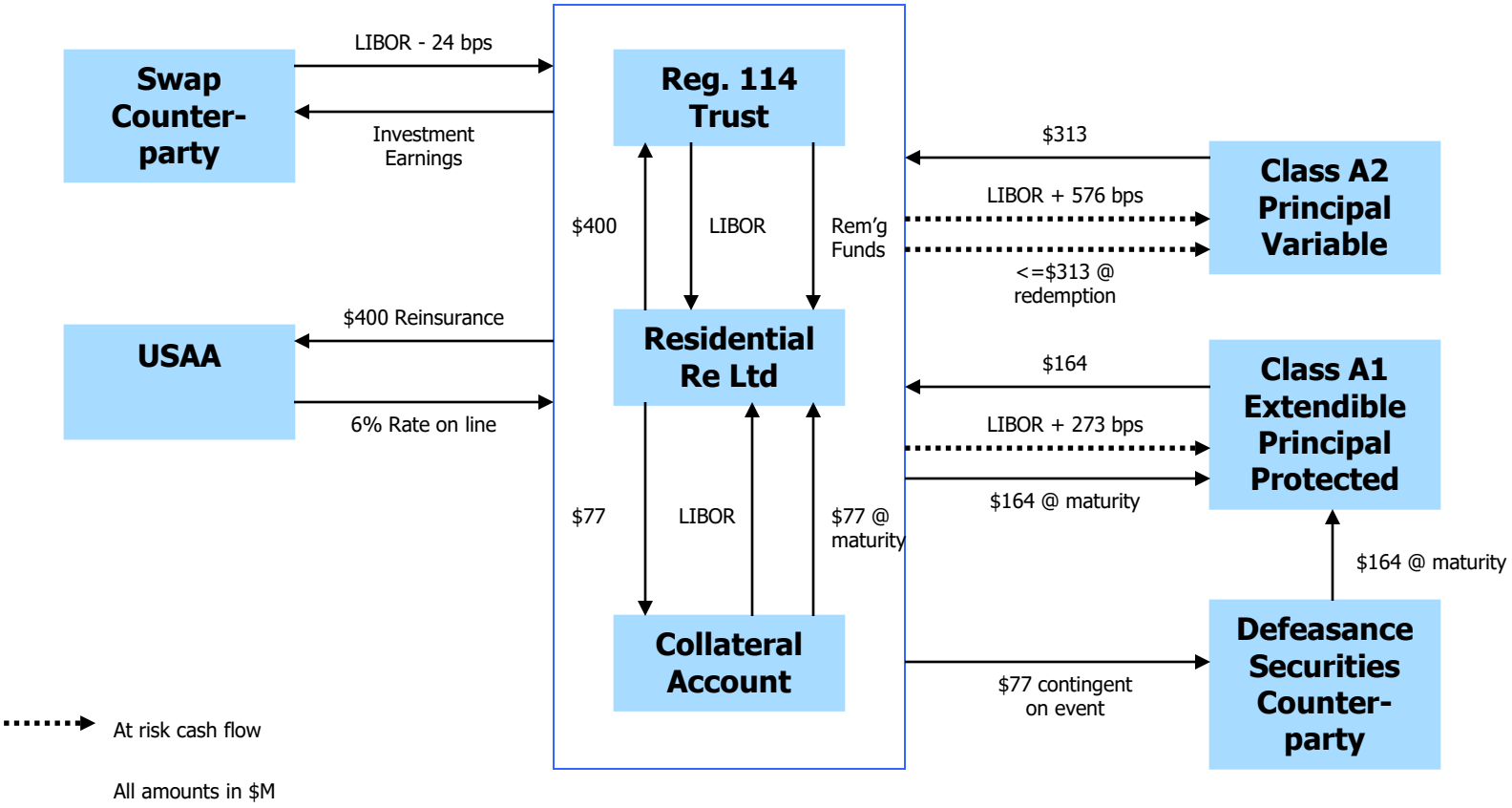
Securitization

- Characteristics of a successful deal
  - High retention, low probability of loss
    - Capacity rather than frequency risk
  - Underlying risk uncorrelated with financial markets
  - Understandable, quantifiable risk
    - Computerized cat models key to development
  - Short exposure period, quickly quantifiable losses
  - BB or better credit rating from Rating Agencies
  - Liquid market

USAA Cat Bond

- First major securitization (June 1997)
  - Special Purpose Vehicle (SPV) Residential Re
  - Protection: $400M part of $500M xs $1B retention
    - USAA participates in all lower layers
    - Traditional reinsurance $400M part of $550M xs $450M
  - Two Tranches
    - A1 Principal protected $164M @ LIBOR + 273 bps (AAA)
    - A2 Principal at risks $313M @ LIBOR + 576 bps (BB)
    - Provides approx. $400M reinsurance protection
  - USAA writes personal lines for Armed Forces personnel and their families

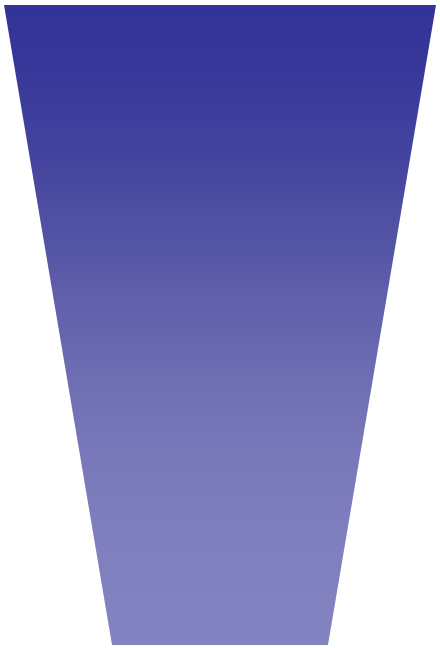
USAA Cat Bond



USAA Cat Bond

- Paying for the spread
  - Income: 6% ROL x $400M = $24M
  - Expense: $23.65M + friction
    - 24 bps on $477M = $1.15M
    - 576 bps on $313M = $18.0M
    - 273 bps on $164M = $4.5M
- Renewal History (unprotected tranche)
  - 1997, LIBOR + 576 bps, $400M total capacity
  - 1998, LIBOR + 400 bps, $400M total capacity
  - 1999, LIBOR + 366 bps, $200M total capacity
  - 2000, LIBOR + 416 bps, $200M total capacity
  - 2001, ??, $150M total capacity

Cat Bonds



Purchasers:

- Mutual funds
- Hedge funds
- Reinsurers
- Life Insurers
- Banks
- P/C Insurers

Cat Bonds

- SR Earthquake Fund, Ltd.
  - Swiss Re Securitized $112M of California Earthquake for 2 ¼ years
    - Related to reinsurance of CEA (Buffett connection)
    - Trigger based on PCS industry losses

Tranche	Rate	ROL	Trigger / Loss of Principal	Rating
A1	L + 255 bps	4.25%	18.5B 20%; 21B 40%; 24B 60%	BBB
A2	L + 280 bps	4.67%	18.5B 20%; 21B 40%; 24B 60%	BBB
B	L + 475 bps	4.75%	18.5B 33%; 21B 67%; 24B 100%	BB
C	L + 625 bps	6.25%	12.0B 100%	NR

Cat Bonds

- SCOR / Atlas Re, 3/16/2000
  - $200M cat bond, multi-year, expires 2003
    - $100M xs $200M per event and $200M in aggregate
  - Reference portfolio, ensures data quality
    - Allows better loss modeling
    - Indemnity Payment = Ref. P/f Losses x Adj. Factor
  - Retro protection for SCOR, a reinsurer
    - European wind, US EQ, Japanese EQ perils
  - Atlas Re based in Ireland
  - Class A, $70M BBB+ @ LIBOR + 270 bps
  - Class B, $30M BBB- @ LIBOR + 370 bps
  - Class C, $100M B @ LIBOR + 1400 bps

Cat Bond Summary (97-2000)

Deal	Date	Spread	Trigger	Peril
Res Re I	6/9/1997	576	Indemnity	Various US
SR Earthquake	7/16/1997	475	Index	Ca EQ
Parametric Re	11/19/1997	430	Parametric	J EQ
Trinity Re	2/19/1998	367	Indemnity	FL wind
HF Re	6/4/1998	375		
Res Re II	6/8/1998	400	Indemnity	
Pacific Re	6/15/1998	370		
Mosaic Re A	7/14/1998	440		
XL Mid Ocean A	8/12/1998	412	Retro	Swap/Reins
Trinity Re II	12/31/1998	417	5 month	Fl Wind
Mosaic Re II	2/25/1999	400	Retro	
Domestic Inc	3/25/1999	369		
Concentric Ltd	5/3/1999	310	Parametric	
Res Re III	5/25/1999	366	Indemnity	
Juno Re	6/18/1999	420	Indemnity	
Gold Eagle	11/16/1999	540	Model Based	
Namazu Re	11/23/1999	450	Model Based	
Seismic Ltd	3/1/2000	450	Index	
Atlas Re	3/16/2000	370	Ref. Portfolio	

Cat Bond Summary (00-01)

2000 Insurance Linked Securitization Deals

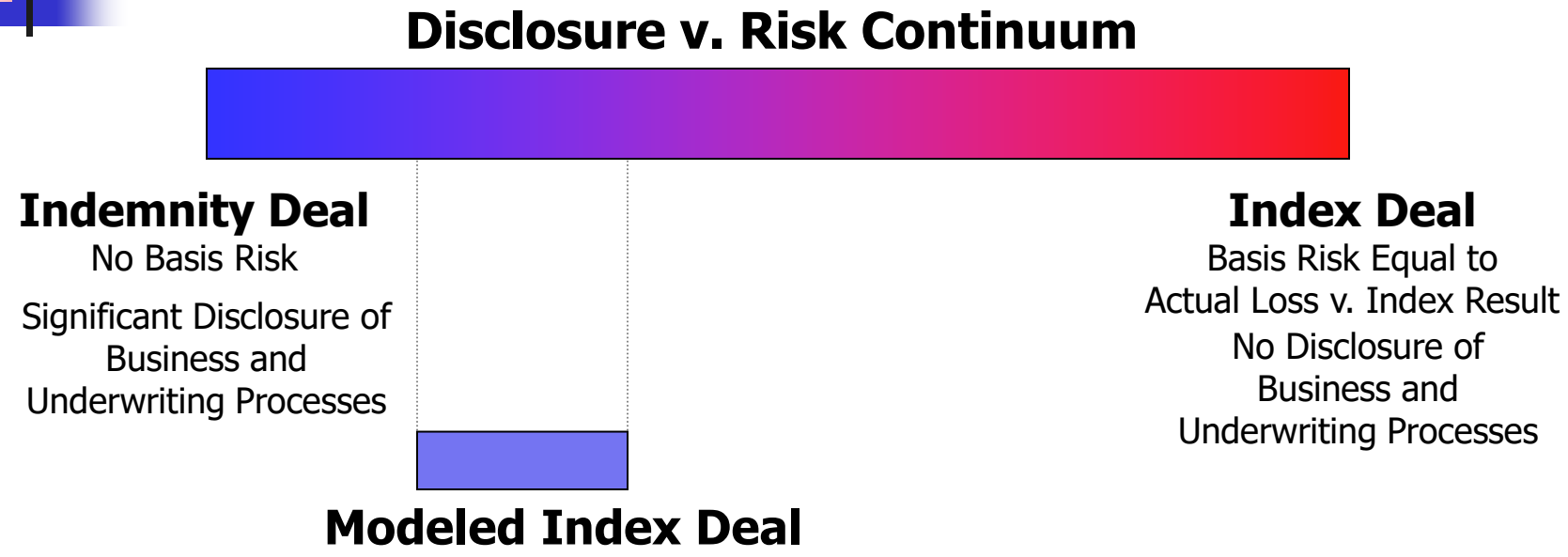
SPV	Cedent	Amount US$M	S&P	Moody's	Fitch	3/00-3/01 Issue Date	Maturity Term	Expos Term	Spread to LIBOR	Adjusted Annual Spread	Expected Loss	Prob of 1st Loss	Prob Exhaust	Exp Excess Return	CEL
Alpha Wind 2000 FRN	Arrow Re St Farm	52.2	BB+	--	--	1-May-00	12	12	456	462	0.63%	0.0099	0.0038	399	63.64%
Alpha Wind 2000 Pref Shrs	Arrow Re EW	37.5	BB-	--	--	1-May-00	12	12	700	710	1.46%	0.0208	0.0099	564	70.19%
Residential Re 2000 USAA	USAA	200	BB+	Ba2	--	1-May-00	12	12	410	416	0.54%	0.0095	0.0031	362	56.84%
NeHi	Vesta Fire Ins.	41.5	--	--	BB	1-Jul-00	36	36	410	416	0.70%	0.0087	0.0056	346	80.46%
Mediterranean Re Class A	AGF	41	BBB	Baa3	BBB	1-Nov-00	60	59	260	264	0.22%	0.0028	0.0017	242	78.57%
Mediterranean Re Class B	AGF	88	BB+	Ba3	BB+	1-Nov-00	60	59	585	593	1.16%	0.0147	0.0093	477	78.91%
PRIME Hurricane	Munich Re	159	BB+	Ba3	BB	1-Nov-00	38	37	650	659	1.27%	0.0146	0.0108	532	86.99%
PRIME EQEW	Munich Re	129	BB+	Ba3	BB	1-Nov-00	38	37	750	760	1.33%	0.0169	0.0107	627	78.70%
Western Capital	Swiss Re	97	BB+	Ba2	--	1-Feb-02	24	23	510	517	0.55%	0.0082	0.0034	462	67.07%
Halyard Re	Sorema	17	--	--	BB-	1-Mar-01	12	12	550	558	0.22%	0.0084	0.0004	538	26.19%
Gold Eagle 2001	American Re	116.4	BB+	Ba2	--	1-Mar-01	12	12	550	558	0.75%	0.0118		483	63.56%
SR Wind Class A-1	Swiss Re Swiss Re	58.2	BB+	--	--	1-May-01	48	48	575	583	0.68%	0.0107	0.0044	515	63.55%
SR Wind Class A-2	Swiss Re Lehman I	58.2	BB+	--	--	1-May-01	48	48	525	532	0.76%	0.0113	0.0053	456	67.26%
NeHi	Vesta Fire Ins.	8.5	--	--	--	1-Jul-00	36	36	450	456	0.93%	0.0100	0.0087	363	93.00%
PRIME Hurricane	Munich Re	6	--	--	--	1-Nov-00	38	37							
PRIME EQEW	Munich Re	6	--	--	--	1-Nov-00	38	37							
Western Capital	Swiss Re	3	--	--	--	1-Feb-01	24	23			0.82%	0.0082			100.00%
Gold Eagle 2001	American Re	3.6	--	--	--	1-Mar-01	12	12	700	710	1.18%	0.0118	0.0118	592	100.00%
SR Wind Class B-1	Swiss Re Swiss Re	1.8	BB	--	--	1-May-01	48	48	700	710	1.07%	0.0107	0.0107	603	100.00%
SR Wind Class B-2	Swiss Re Lehman I	1.8	BB	--	--	1-May-01	48	48	650	659	1.13%	0.0113	0.0113	546	100.00%
CEA		100					24								
SAAB AB	SAAB AB	1170				1-Dec-00	180	180		367					
WestLB		44				1-May-00									
Tokio marine/St Farm Swap		200				1-Mar-00	60	60				Equal Prob			
Rolls Royce															

**Deals announted 3/00 to 3/01. All deals converted to 365-day year (LIBOR convention is 360 day, but cat bonds are 365 day years).
Source: http://www.lanefinancialllc.com/pub/sec1/Analyzing_the_Pricing_of_the_2001_Risk-Linked_Securities_Transactions.pdf

Securitization Prospects: Triggers

Trigger	Pros/Cons	Example
Indemnity	No basis risk Need good under-standing of risk	USAA / Res. Re Trinity Re Juno Re
Model	Minimize Basis Risk Data quality risk borne by insured Fast payout after event	Namazu Re Gold Eagle
Index	Simplifies uw'ing Less disclosure Basis Risk Good for retro	ILWs SR Earthquake
Parametric	Very simple uw'ing No disclosure High basis risk	Tokyo Disney Parametric Re

Securitization Prospects: Triggers



- Cedent describes notional portfolio to modeling firm
- Cedent does not disclose its underwriting practices et cetera
- Cedent may update the notional portfolio every six months, if necessary
- Recovery based upon the notional portfolio using actual event characteristics
- Loss payments are made immediately after the modeled loss is run

Source: AON Capital Markets

Securitization Prospects

- Exchange Traded Instruments
  - CBOT Cat Index
    - Property Claim Services (PCS) loss index
    - 1 point in index corresponds to $100M industry losses
    - European options, settled in cash
    - National and various regional zones
    - Typically sold as spreads
      - Layer of reinsurance
  - Bermuda Commodity Exchange (BCE)
    - Similar to CBOT but based on Guy Carpenter loss-to-value index
    - Index available at zip code level
      - Allows more accurate hedging, lower residual basis risk
    - Can cover largest loss, second largest loss, aggregate losses
    - Binary options (pay all or nothing), six month term
  - Unsuccessful
    - Accounting; out of the ordinary

Securitization Prospects

- Securitization of other lines?
  - Balance desirability to investor with undesirability for insurer
    - Does not make sense for insurer to securitize low volatility, predictable lines
  - Many products (perceived as) too heterogeneous
    - MBS secondary market led to standardization
    - Would standardization be a bad thing for insurance?
  - Credit risk (Gerling/SECTRS) and lease residual value (Toyota/Gramercy Place) have been Securitized

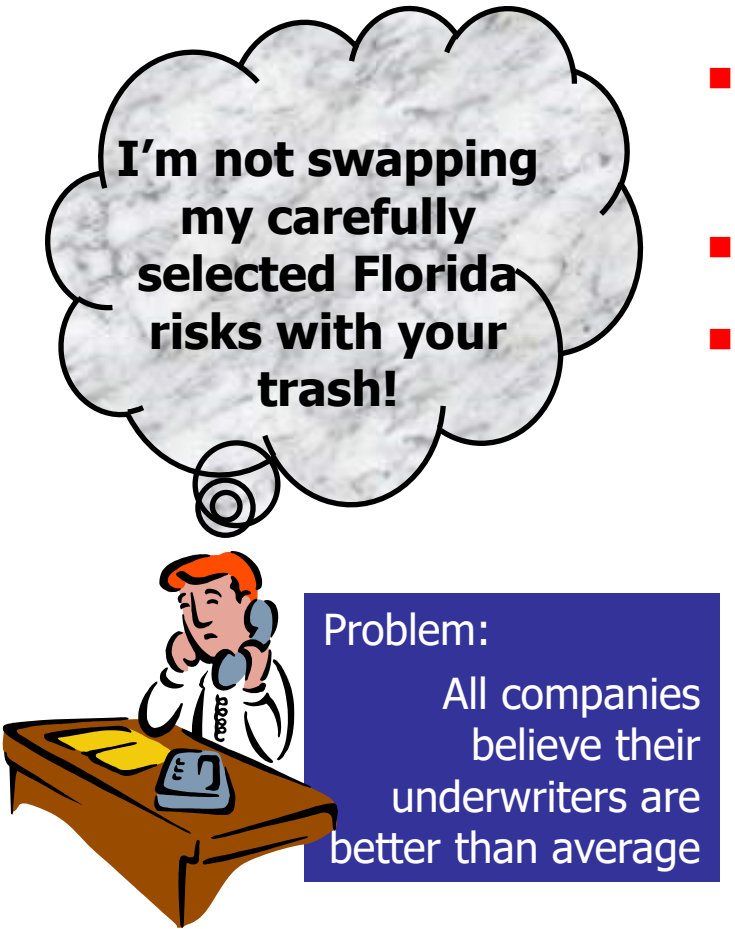
Securitization Prospects

- Contingent Capital
  - Put option arranged prior to event
    - Option on debt or (convertible) preferred shares
  - Provides immediate extra capitalization after large event
    - Gives greater operational flexibility in challenged market place
    - Allows company to capitalize on opportunities
  - Balance sheet protection rather than income statement protection
  - Not limited to insurance companies

Securitization Prospects

- Contingent Capital
  - AON CatEPut®
    - RLI $50M convertible preferred shares through Centre Re (Ca EQ exposure)
    - Horace Mann, $100M multi year deal (cw cat)
    - LaSalle Re $55M with Swiss Re
      - Triggered by 9/11 property losses
      - $55M equity in convertible shares put to Swiss Re
      - LaSalle Re Gross property losses > $140M
      - Requirements on net worth post-event
      - LaSalle Re now owned by Trenwick Group

Securitization Prospects



Problem:

All companies believe their underwriters are better than average

- Risk Swaps
  - CATEX internet based market for swapping risks
  - E.g. Florida wind and California quake
  - Reduces risk for minimal cost
    - No ceded premium
    - Expected loss and probability distributions swapped roughly comparable
    - No event, no cash flow
    - Opposite of mean preserving spread

Securitization Prospects

- Risk Swaps
  - State Farm / Tokio Marine & Fire
    - $200M Limit
    - Earthquake exposure: Japanese and US New Madrid quake
    - Coverage triggered by magnitude of event, not loss
    - State Farm receives
      - 17.5% of limit for 6.6R quake
      - 100% of limit for 7.1R+ quake
    - Diversifies risk and reduces net exposure
    - No premium outgo, no brokerage
  - Many other opportunities exist, even within US

2. Finance and Insurance

Finance and Insurance

Paradigm	Capital Markets	Insurance Markets
Risk and Return	Systematic risk	Price non-systematic risk
Diversification ↕ Hedging	CAPM, APT, CIR, Partial & General Equilibrium Models	Risk Bearing through pooling
	Options pricing, Comparables, No-arbitrage	Traditionally impossible, Reinsurance!
Efficient Markets	Long/short positions, liquid, transparent markets, standardization	Insurable interest, unique products

Finance and Insurance

When it comes to the valuation of Insurance liabilities, the driving intuition behind the two most common valuations approaches – arbitrage and comparables – fails us. This is because, for the vast majority of insurance liabilities, there are neither liquid markets where prices can be disciplined by the forces of arbitrage and continuous trading, nor are there close comparables in the market.

We are left in a predicament, but not an impasse. If we can refocus our attention from "market value" to "present value," progress can be made. In doing so we need not descend the slippery slopes that surround the quagmire of equity valuation. The pseudo-scientific methods typically used there impart only a thin veneer of respectability.

David F. Babbel
Discussion of "Two Paradigms for the Market Value of Liabilities"
by Robert Reitano
NAAJ 1(4), 1997

Finance and Insurance

- Complete Markets and Insurance
  - **Complete Market**: every pattern of cash flows can be replicated by some portfolio of securities that are traded in the market
  - Insurance products are not redundant: they add to the set of available securities
  - Cannot use arbitrage-free pricing techniques to determine price of non-redundant securities
    - Cannot construct replicating / hedging portfolio
  - Incompleteness is a selling point
    - Obvious benefit to insured
    - Creates assets uncorrelated to the market for investor

Finance and Insurance

- Complete Markets and Insurance

  Financial option pricing methodologies since Black and Scholes (1973) define option prices as the hedging cost to set up a riskless hedge portfolio. Financial options are treated as redundant contracts, since they can be replicated by trading the underlying assets. The so-called "relative valuation" method prices financial options in the world of the risk-neutral measure. On the actuarial side, there is no liquid secondary market for insurance contracts; thus, insurance and reinsurance contracts are viewed as non-redundant, primary contracts to complete the market. Actuarial risk models that price insurance liability contracts are not based on an assumption of hedging, instead considering the present value of future losses (loss theory) and the cost of allocated capital. The pricing is done in the world of the objective measure.

Portfolio-Based Pricing of Residual Basis Risk with Application to the S&P 500 Put Options
Sergei Esipov and Dajiang Guo
2000 Discussion Paper Program
Casualty Actuarial Society

Finance and Insurance

- Complete Markets and Insurance
  - Econophysics
    - New slant on applying statistics to economics time series
    - Recognize short-comings of Gaussian based models
    - Price options by minimizing non-zero residual basis risk
      - Consider variation in total wealth from writing option
      - Consider impact of "thick-tails"
      - Alternatives to variance based risk measures
      - Alternatives to multivariate normal distribution for correlation
    - Theory of approach more clearly applicable to insurance
      - Fruitful area for future research

Finance and Insurance

In our opinion, mathematical finance in the past decades has over focused on the concept of arbitrage free pricing, which relies on very specific models where risk can be eliminated completely. This leads to a remarkably elegant and consistent formalism, where derivative pricing amounts to determining the risk-neutral probability measure, which in general does not coincide with the historical measure. In doing so, however, many important and subtle features are swept under the rug, in particular the amplitude of the residual risk. Furthermore, the fact that the risk-neutral and historical probabilities need not be the same is often an excuse for not worrying when the parameters of a specific model deduced from derivative markets are very different from historical ones. … In our mind, this rather reflects that an important effect has been left out of the models, which in the case of interest rates is a **risk premium effect**.

Back to Basics: historical option pricing revisited
J-P Bouchaud and M Potters
1998
xxx.lanl.govcond-mat/9808206
Emphasis added

Finance and Insurance:
Comparison of Pricing Methods

Hedge
Black-Scholes idealization
Adjust probabilities

Real world financial option

Dual-trigger financial/ insurance instrument

Diversify
Stock
Bond
Insurance
Cat Bond

Finance and Insurance

- Comparison of Pricing Methods
  - Insurance shares concepts and structures with finance
    - Swaps and Options ←→ Excess of Loss Insurance
  - Actuarial Pricing
    - No consensus on risk and profit loads
    - Searching for general equilibrium theory
    - Risk-Adjusted interest rates
      - Related to CAPM / APT arguments
      - Correlations with existing book of business
    - Wang and adjusted probabilities
      - Related to risk neutral, no-arbitrage theories
      - Additive in layers
    - Numerous risk-load approaches used in industry
    - Insurers (must) price non-systematic risk
      - Costly for insurers to raise capital
      - Benefit to non-insurers from laying off risk

Market Pricing for Cat Bonds

- Pricing Cat Bonds
  - Relationship to corporate bond pricing and to insurance pricing
  - Consistency with financial theories
- Issue of skewness in asset returns
  - Greed: Positive skewness is perceived as good
  - Fear: Negative skewness is perceived as bad
- Insurance returns are negatively skewed
  - You do well, you do OK
  - You do badly, you get killed
- Most asset returns are symmetric or positively skewed

Market Pricing for Cat Bonds

	Ba Bonds[1]	Typical Cat Bond
Spread over 1-year Treasuries	1.6%[1]	2.5-5.8%
1 year default prob	1.4%[2]	0.5-2.0%
10 year default prob	20.9%[2]	8.0-20.0%
Expected Recovery Rate	47.5%[2]	32.0%
Risk / Reward Multiple[3]	1.14	2.9-7.2

[1] Bloomberg BB Composite of Moody's Ba2 and S&P BB; one year data
[2] Moody's 1938-1996 default rates
[3] Excess return above risk free rates as multiple of prob of 1 year default

Source: CNA Re Securitization 2000

Market Pricing for Cat Bonds

- Lane introduced concepts of probability of 1st $ loss (PFL) and conditional expected loss (CEL)
  - Expected Excess Return = EER
  - EER = Spread over LIBOR – (PFL x CEL)
  - See slide 23 for PFL, EER and CEL
- Lane's model

$$\text{EER} = \gamma(\text{PFL})^{\alpha}(\text{CEL})^{\beta}$$

Market Pricing for Cat Bonds

- Lane model pragmatic and provides good fit
- Mainstream finance would suggest either CAPM or adjusted probability approach

Technical Aside

- Layer Pricing and Adjusted Probabilities
- For loss distribution X, F(x) = Pr(X<x)
- G(x)=1−F(x)=Pr(X>x)=survival function
- Insurance sold in layers

$$L(X,a,b)=\begin{cases} 0 & if \quad X<a \\ X-a & if \quad a\le X\le a+b \\ b & if \quad X>a+b \end{cases}$$

Technical Aside

- Expected value of layer

$$EL(X,a,b) = \int_{a}^{a+b} G(x)dx$$

- Price of short layer (small b)

$$EL(X,a,b) \approx G(a)b$$

- Relate to market pricing for layers to get adjusted distribution G*
  - Similar to risk-neutral valuation method used in option pricing

Market Pricing for Cat Bonds

- Wang Two-Factor Model, uses adjusted-probability paradigm
- A relation between physical probability distribution F and risk-neutral probability distribution F*

$$F^*(y) = Q\left(\Phi^{-1}(F(y)) + \lambda\right)$$

- Q a student-t distribution

Market Pricing for Cat Bonds

- Wang's approach captures several different risk characteristics
  - Lambda variable equivalent to a Sharpe ratio
  - Use of normal in place of student-t for Q
    - Translates normal to normal and lognormal to lognormal
    - Reproduces CAPM and Black-Scholes
  - Use of student-t distribution for Q captures parameter uncertainty in pricing
    - Works symmetrically for assets and liabilities
    - Correctly captures market reaction to skewness in returns

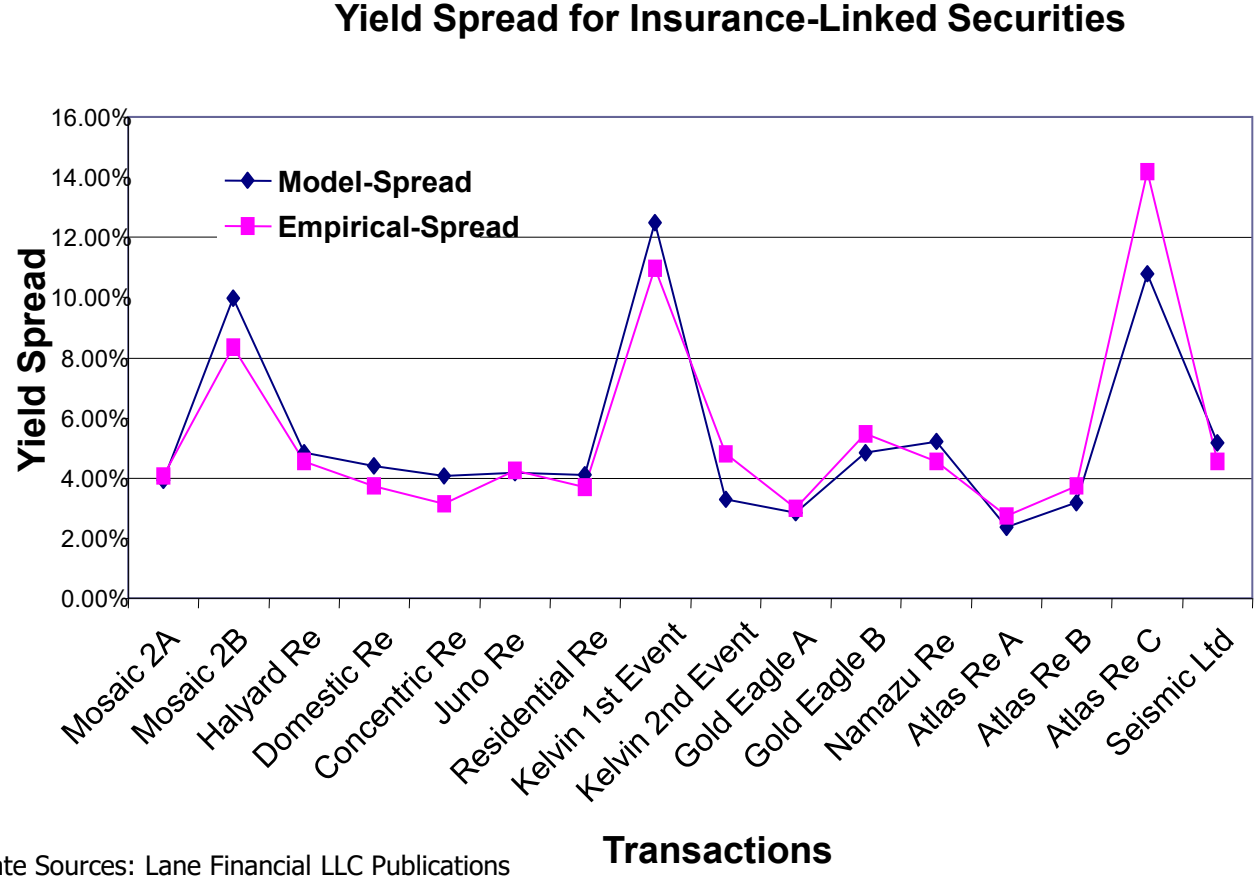
Market Pricing for Cat Bonds

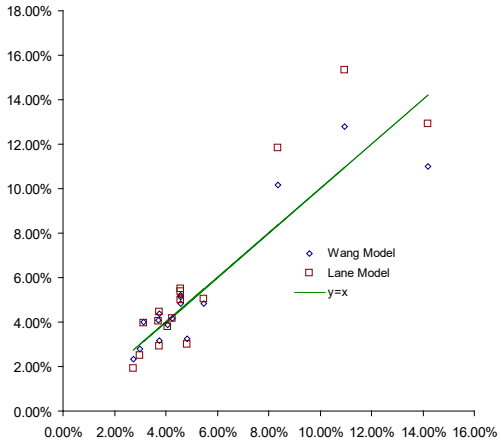
- 16 CAT-bond transactions in 1999
  - Fitted well to 2-factor model
  - Over/under-priced bonds are identified, consistent with Lane study
- 12 CAT bond transactions in 2000
  - Used parameters estimated from 1999 data to price 2000 transactions
  - Remains best-fit: good consistency over time

1999 Cat Bond Transaction	Empirical Spread	Wang Model	Lane Model
Mosaic 2A	4.06%	3.88%	3.80%
Mosaic 2B	8.36%	10.15%	11.83%
Halyard Re	4.56%	4.82%	5.01%
Domestic Re	3.74%	4.36%	4.45%
Concentric Re	3.14%	4.01%	3.97%
Juno Re	4.26%	4.15%	4.16%
Residential Re	3.71%	4.08%	4.03%
Kelvin 1st Event	10.97%	12.80%	15.34%
Kelvin 2nd Event	4.82%	3.25%	3.02%
Gold Eagle A	2.99%	2.81%	2.51%
Gold Eagle B	5.48%	4.82%	5.03%
Namazu Re	4.56%	5.20%	5.52%
Atlas Re A	2.74%	2.35%	1.92%
Atlas Re B	3.75%	3.15%	2.90%
Atlas Re C	14.19%	11.01%	12.90%
Seismic Ltd	4.56%	5.13%	5.38%
Sum Squared Error		0.22%	0.41%

Market Pricing for Cat Bonds

Wang 2-factor model to fit 1999 cat bond data

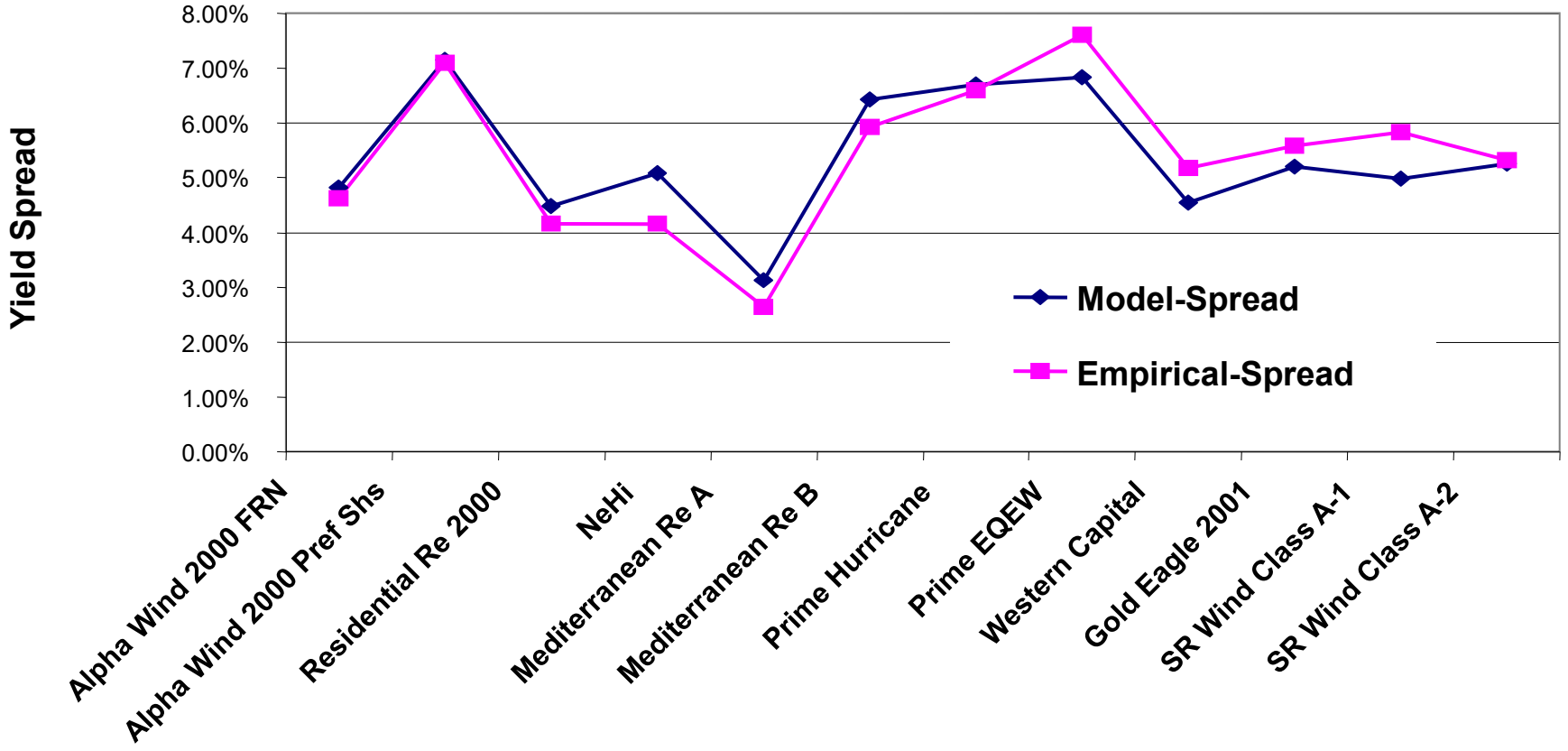




Date Sources: Lane Financial LLC Publications
Chart: Courtesy Shaun Wang

Market Pricing for Cat Bonds

2000 Cat Bond spreads predicted by 1999 parameters



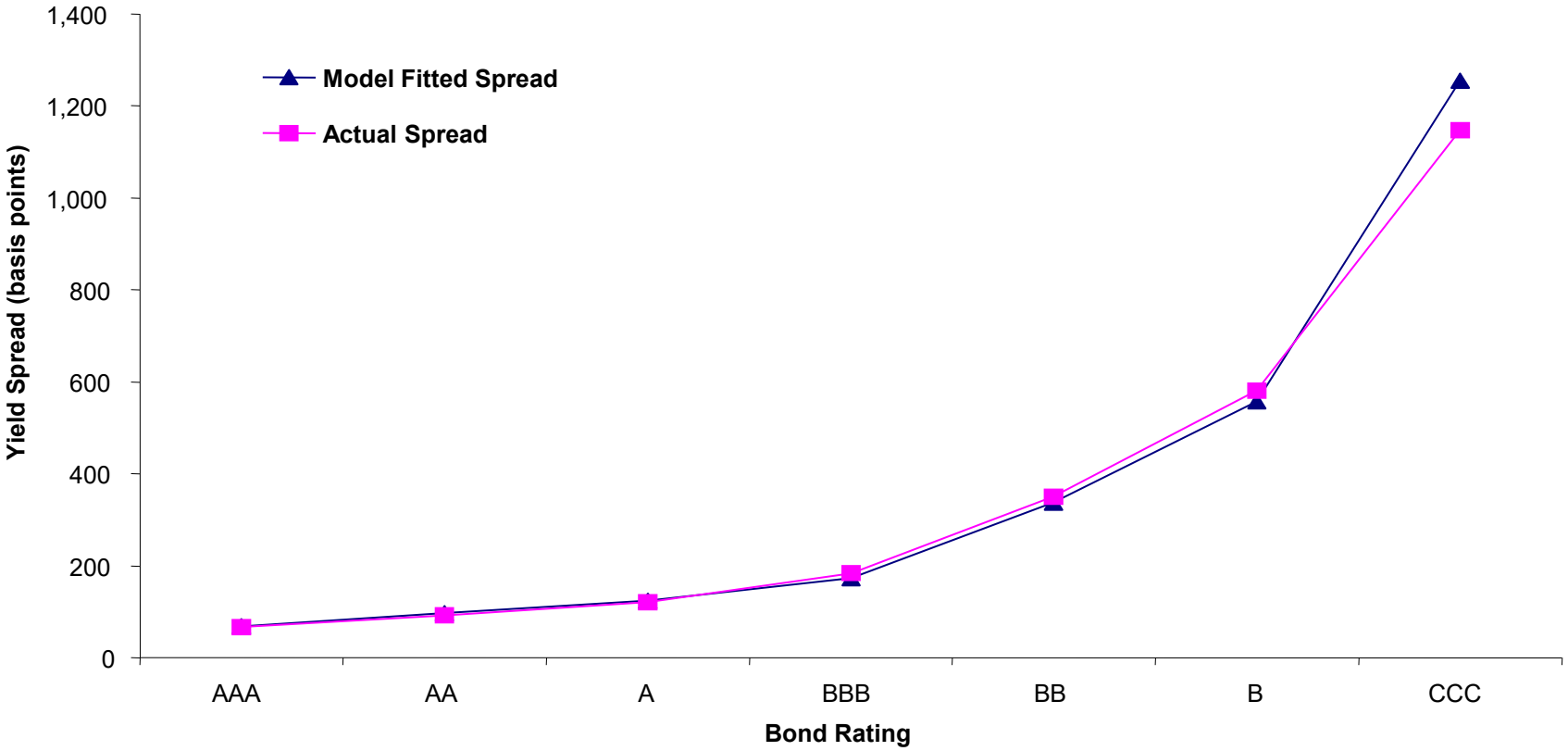
Date Sources: Lane Financial LLC Publications
Chart: Courtesy Shaun Wang

Market Pricing for Bonds

- Apply same model to corporate bonds
  - Fit yield spreads using historical default probability and yield spread by bond rating
  - Wang 2-factor model fits data well
  - The λ parameter is similar to cat-bond, but Q-degree of freedom less severe
    - Market perceives greater parameter uncertainty in cat-bonds
      - Reasonable, given huge volume of data on corporate bonds
      - Correlations exist between corporate bonds and between cat bonds

Market Pricing for Bonds

Wang 2-factor model fit to corporate bond spreads by bond rating



3. Insurance within Finance

Business Demand for Insurance

- Insurance below economic cost is always a good investment
- Information asymmetries can hinder development of insurance markets
  - Business purchasers have informational advantage or can influence market
    - Weather derivatives and energy companies
    - Lease residual value and original manufacturers
    - Names and Lloyds in 1980s

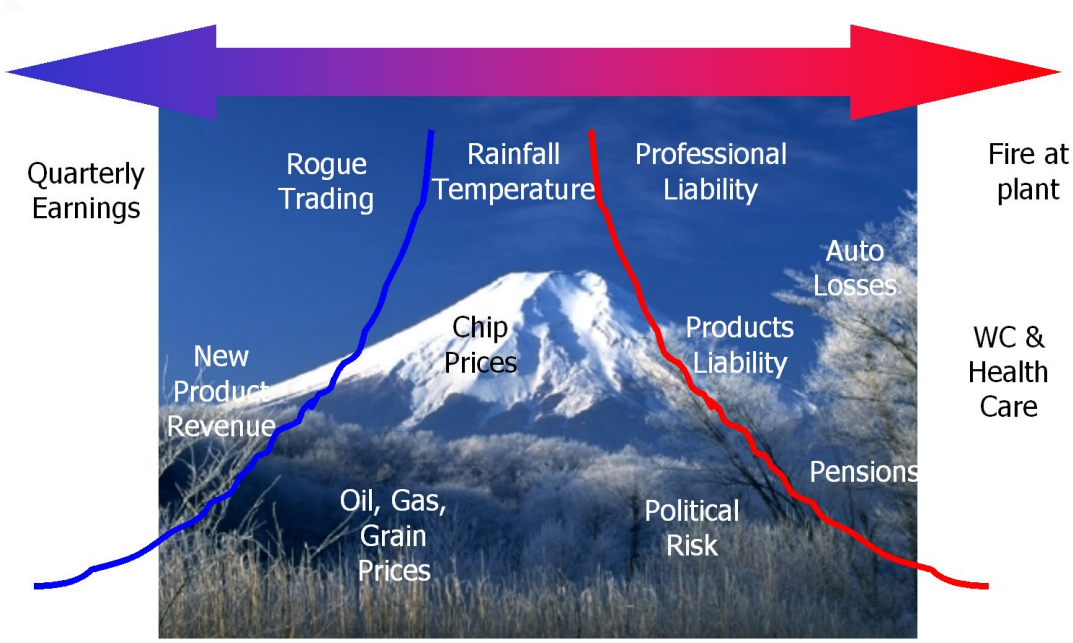
Business Demand for Insurance

- Miller-Modigliani
  - Tax
  - Contracting costs
  - Impact of financing policy on firm's investment decisions (!)
- Mayers and Smith
  - Comparative advantage in risk bearing
  - Transaction costs of bankruptcy
  - Real service efficiencies (claims expertise)
  - Monitoring and bonding management decisions
  - Tax

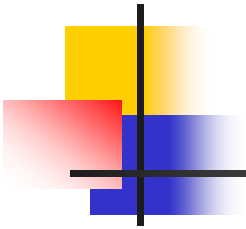
Business Demand for Insurance

- Froot, Scharfstein, Stein
  - Key to creating corporate value is making good investments
  - Need to generate enough cash internally to fund investments
    - Companies tend to cut investments rather than use external capital when they do not raise enough internally
    - Informational opacity of insurer operations makes raising capital expensive
  - Managing cash flow becomes key
- Other
  - "Be there" when the "market turns"
  - Protecting franchise
    - PV(income from future business)

Business Demand for Insurance



- Evolution through soft-market
  - Quarterly earnings – Reliance, insolvent
  - Weather, rainfall – continuing small market
  - Commodity prices
  - Multi-year, multi-line aggregates – still not common



ERM

- Enterprise Risk Management
- Holistic assessment and management of all risks facing enterprise
- Insurer ERM interesting microcosm of non-insurer ERM
  - How do insurers manage the risks no-one else wants?
- Small risks – handle cheaply
- Large risks – mitigate effectively and maximize security

ERM: Non-Insurers

- What are the large events that could impact the company?
  - "Keep you up at night" events
  - Large exposures often first party rather than third party
    - Damage to property
    - Rogue trading
- ERM framework essential for understanding and managing risk
  - You cannot manage what you cannot measure
- Risk to shareholders is from entire enterprise
  - Investors certainly indifferent to arbitrary compartmentalization of risk

ERM: Non-Insurers

- Operational flexibility
  - Pricing
  - Relative competitive advantage
  - Focus on core-competencies
- Lower cost of capital
  - Credit enhancement
  - Greater leverage
- Internal capital budgeting and project planning
- Higher stock market valuation multiples
  - Deliver consistent earnings
- Protect franchise value
  - Capitalize on market opportunities
- Tax benefits
- Bonus protection and job security
  - Would you work for an uninsured entity?

Who is the CRO?

- Treasury / CFO
  - Manage financial risks
  - May have more corporate-wide view

- Risk Manager
  - Manages traditional insurance coverages
  - Less comfortable with financial risks

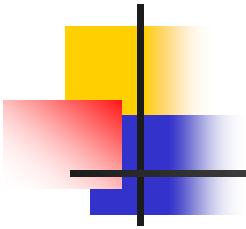
Turf-war mentality and inter-departmental nature of problem seen as major stumbling block for ERM. Cited as major obstacle in Honeywell/AIG integrated deal.

Earnings Management

- Consistent earnings is one stated goal of ERM
- Is goal consistent with financial theory?
  - CAPM ignores non-systematic risk
  - Myers-Skinner (1998) shows companies on earnings "winning streak" have incentive to continue streak
    - Higher valuation multiples
    - Bigger drop when growth falters
  - Do not comment on why valuations high
- Types of earnings management
  - Demonstrate actual earnings more effectively
  - Match one-time expense and gains
  - Misleading investors on source or level of income

Earnings Management

- Consistent earnings: good or bad?
  - Until Enron, Global Crossing, consistent earnings were considered good: GE, AIG
- Advantages of consistent earnings
  - Consistent earnings results in virtuous circle of higher credit rating, lower cost to borrow, larger scale (GE Capital)
- Disadvantages
  - Hides true risk in business, lowering required return
  - Confuses and misleads investors and analysts



ERM: Insurers

- ERM most common amongst financial companies
- Insurer ERM *similar* to non-insurer ERM
- ERM clearly essential to insurer:
  - Maintaining strong balance sheet mission-critical
  - Volatile portfolios
- Insurer-reinsurer relations good laboratory for studying enterprise-insurer relations

ERM: Insurers

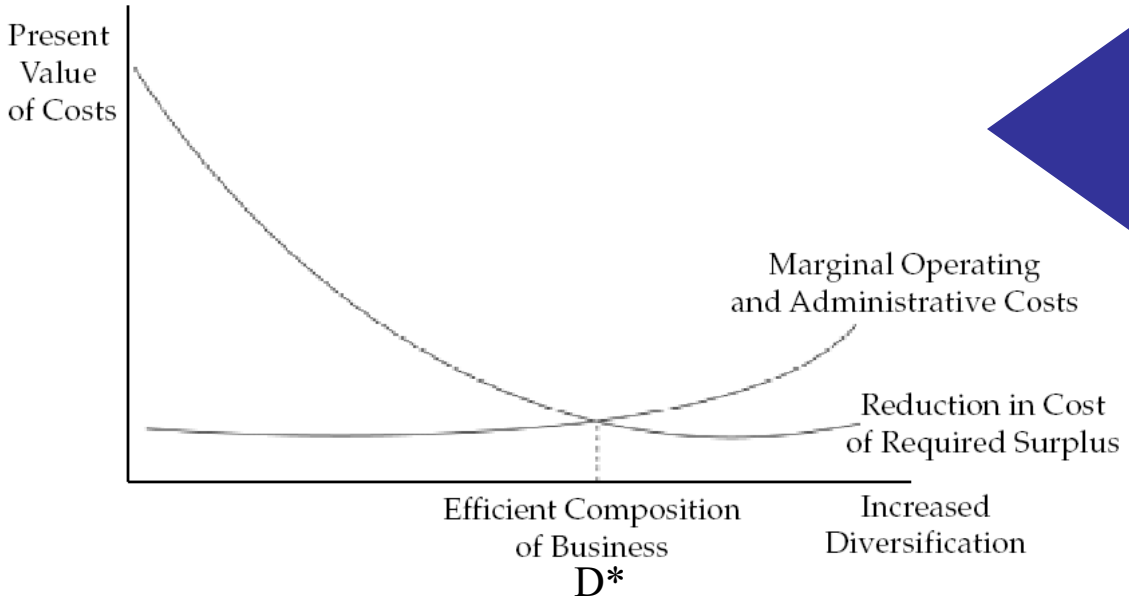
- Costs of financial distress
  - Rating essential
    - Higher price for more secure product
    - Cost of credit
  - Capital: expensive to replace
    - Asymmetric information in new equity issues
    - Insurer reluctance to release proprietary information
    - Easy to change risk portfolio
    - High costs and taxation discourage dividends
    - Regulation
- Costs of volatility of results
  - Concave tax schedules
  - Hard for analysts to track true performance
  - Prevents company from investing in profitable business opportunities
  - Capital: an expensive way to manage risk
    - Double taxation of investment earnings
    - Lower ROE
    - Perils of corporate bloat, owner-manager agency problem

ERM: Insurers

- Asset Risks
  - Credit, market, interest rate, counter-party, inflation
- Liability / Actuarial Risks
  - Cat, non-cat, reserve development, APMT, ALAE, legal, coverage reinterpretations
- Operating / Management Risks
  - Compliance, systems, business environment, regulation
- Event Risk
  - Front page risk

ERM: Insurers

- Managing asset risk
  - Impossible on risk-adjusted basis?
  - Insurers hold conservative investment portfolios
- Managing total risk of liabilities



D* optimal diversification, balancing cost of doing business & leveraging uw expertise

Graph from Myers-Read, 2001

Insurance Company Structure

- Different organizational forms in insurance industry correspond to different ERM and agency problem and concerns
- Instructive to review these for different structures
  - Stock
  - Mutual
  - Securitized
- Cummins and Nini (2000)

Insurance Company Structure

- Owners, policyholders and managers have different goals and objectives
- Owners and Managers:
  - Managers do not fully share in residual claim held by owners
  - Have incentive to behave opportunistically
- Owners and Policyholders:
  - Owners have incentive to change risk structure of company to increase value of equity

Insurance Company Structure

- Owner-Manager conflict
  - Increased leverage reduces conflict
    - Increases probability of insolvency
      - Costly for managers
    - Decreases free cash flow
      - Harder to purchase perquisites
    - For fixed management share of company, increases proportionate ownership

Insurance Company Structure

- Owner-Policyholder conflict
  - Decreased leverage reduces conflict
    - Risky investments more valuable to owners
    - Lower leverage reduces attractiveness to owners
- Optimal capital structure a trade-off between benefits of increased leverage (minimize owner-manager conflict) and decreased leverage (owner-policyholder)

Insurance Company Structure

- Hard to quantify risk
- Uw discretion vital
- Difficult for owners to track and control uw actions
- Sophisticated and knowledgeable policyholders

Helps minimize owner-manager conflicts

Stock Insurance Companies

Owners and manager interests more effectively aligned

- Easy to quantify risk
- Little/no need for uw discretion
- Easy for owners to track and control uw actions
- Important because mechanisms available for owners to control managers more limited

Solves owner-policyholder conflicts

Mutual Insurance Companies

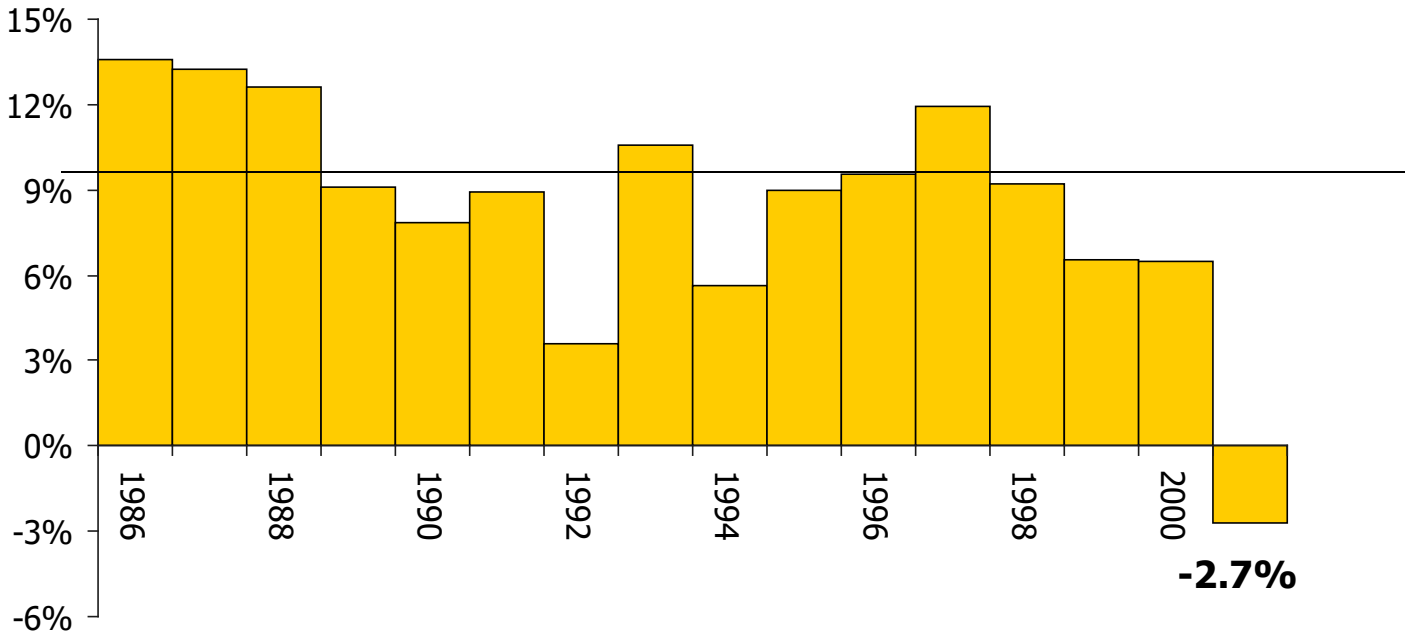
Merge owners and policyholders
Good for less sophisticated pol'holders

Insurance Company Structure

- Mutual companies more common in personal lines, WC
- Stock companies more common in commercial and specialty lines
- Where does securitized solution fit?
  - "UW and done" approach divorces uw decision from results
  - Does not appear to solve owner-manager conflict or owner-policyholder conflict
- Cat bonds involve very little or no underwriting judgment
  - Minimize potential owner-manager conflict
  - Similar to mutual fund structure

State of Insurance Industry

Property Casualty Statutory Return on Surplus
1986-00 Average: 9.2%

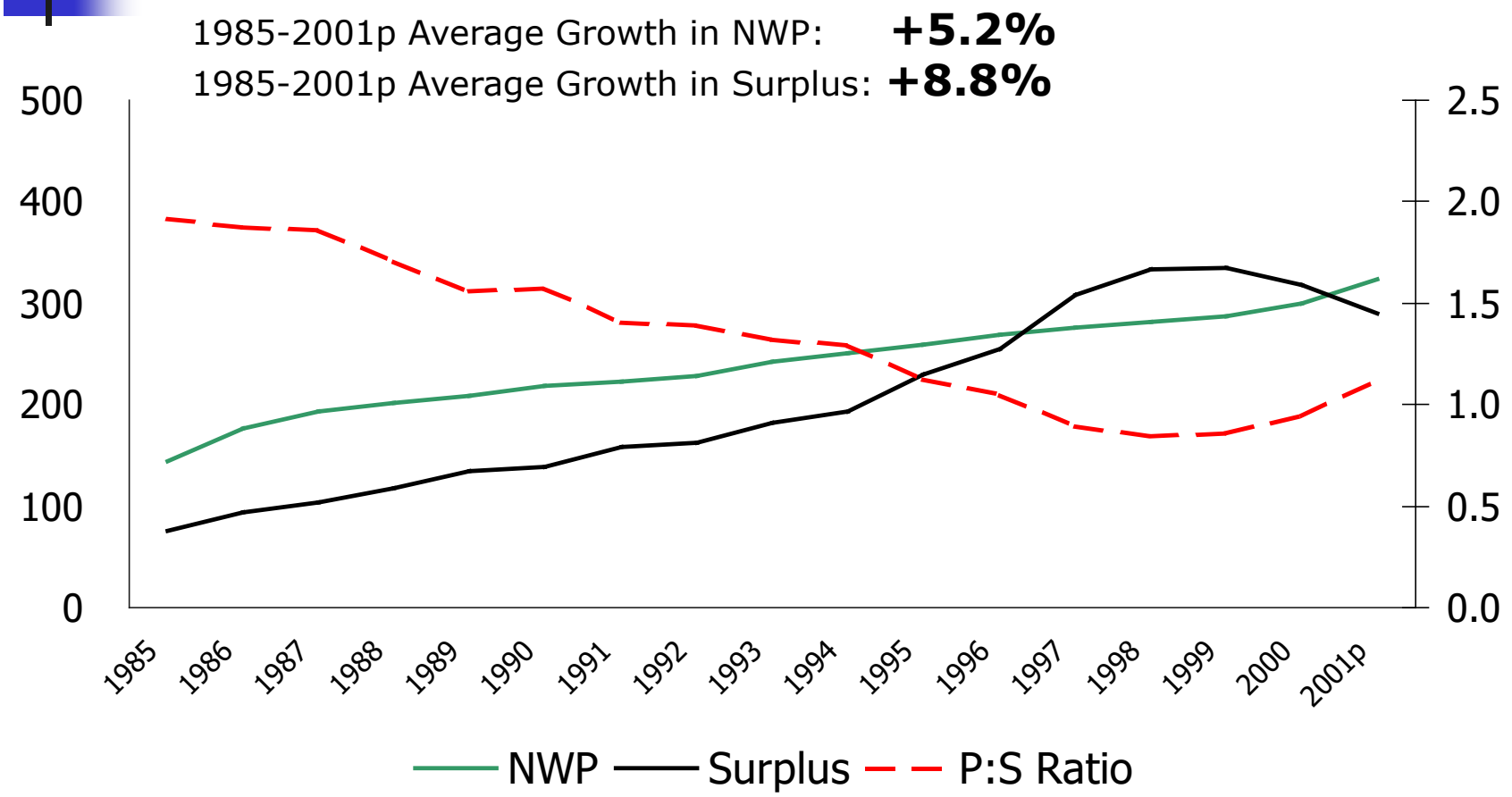


After-tax SAP ROS including capital gains
AM Best + Preliminary estimate for 2001 from IS
Slide from NCCI AIS Presentation, 2002

State of Insurance Industry

- Throughout early to mid-1990s leverage ratios declined and returns moderate to good
- Leverage driven down by one-time capital gains
- Lower leverage ratios not economically justified
- Companies reluctant to dividend gains to investors per standard ERM rationale
- Over-capacity and competition for market share led to effective policy-holder dividend through inadequate pricing
  - Cummins and Nini, 2000

State of Insurance Industry



Preliminary 2001 estimates from ISO News Release, April 15, 2002
Source: AM Best Aggregates & Averages
Slide from NCCI AIS, 2002

State of Insurance Industry

- US P/C Industry combined surplus:
  - 12/31/99: $334.3B
  - 2000: $317.4B (-5%)
  - 2001: $279.0B* (-12%)
  - 2002: $271.5B* (-3%)

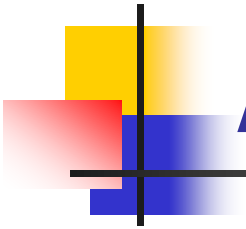
    * AM Best Estimate
- Previous declines since 1970
  - 1983/4: $56B to $53B (-6%)
  - 1972/4: $21.4B to $14.8B (-30%)

State of Insurance Industry

- Contraction of commercial lines capacity
  - A&E, prior year development, WTC
- Operating income crucial
  - Depleted capital base
  - Rating agencies emphasize earnings
  - Apparent investor indifference to existing companies vs Bermuda start-ups
  - Low interest rates

State of Insurance Industry

- Low Interest Rates emphasize importance of underwriting result
  - After 1983/4 decline in surplus, net investment income 28% of prior year surplus
  - 2002 net investment income estimated to be 11.5% of prior year surplus, 16.5 ppts lower
- Industry needs combined ratios in high-90%'s for reasonable ROE
  - Last achieved in 1970's

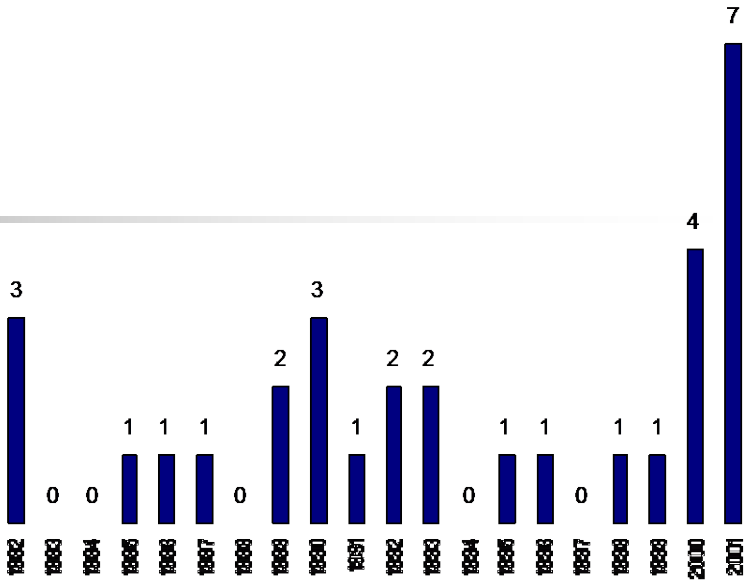


Aside: Asbestos

- Current estimate: 100 million people occupationally exposed to asbestos
  - Huge increase over 27.5M from 1982 study
- 200,000 asbestos BI claims pending in courts
- 60,000 new claims filed in 2000
  - Average only 20,000 per year from early 1990's
  - 2,000 mesothelioma cases per year
  - 2,000-3,000 cancer cases
  - 54,000 claims for nonmailgnant injuries

Aside: Asbestos

- Producer Bankruptcies
  - Claim deadline to get on creditor list
- Claims against peripheral defendants
  - 300 main defendants in 1980's
  - Now over 2,000 named defendants
  - Move from products liability to premises policies



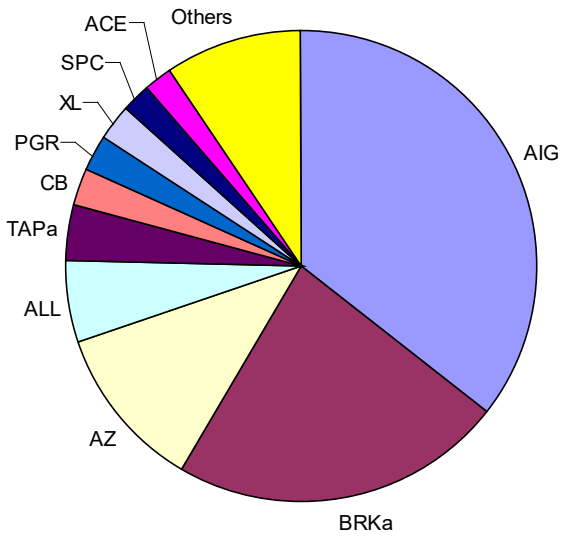
- Claims filed now in anticipation of legal reforms or statute of limitations
- Plaintiffs attorneys group claims:
  - Multiple defendants (installers, electricians)
  - Range of injuries
  - Increases costs for adjudicating claims
  - Jurisdiction shopping (Mississippi)

Aside: Asbestos

- AAA study estimates ultimate cost to be $200-275 billion
  - $60-70 billion borne by US P/C industry
  - At year end 2000:
    - $22 billion paid
    - $10 billion reserves
    - $30-40 billion shortfall
  - Look for 1.5-2.0 point drag on industry combined ratio
- Environmental costs stabilized

State of Industry: Concentration

- Winner-takes-all
  - AIG (Hank Greenberg) $177B
  - Berkshire (Warren Buffett): $114B
  - State Farm $38B SAP
  - Allstate $28B
  - AZ = Allianz AG, huge German insurer



Market Cap of 31 leading P/C & general insurance groups, totaling $500B
Detail shown for top 10

Market values shown unless otherwise indicated

9/11: Capital Market Reaction

- Securitization advocates had great expectations
- Market disappointed
- Reaction swift and consistent

Group	Capital Raised	9/11 Loss	Net New Capital	Pct Total
Bermuda Startups	6.3B	0.0	6.3	58%
Existing Bermuda Cos.	3.5	1.8	1.7	16%
North American Cos.	2.3	1.1	1.2	11%
Lloyds/London	1.0	0.1	0.9	8%
Other	2.4	1.7	0.7	6%
Total	**15.5**	**4.7**	**10.8**	**100%**

All amounts in $B
Source: IBNR Weekly 1/6/2002

9/11: Capital Market Reaction

- Investors utilizing Bermuda companies and start-ups, rather than existing US-based P/C companies
  - No A & E hang-over
  - No reserve development on prior years
  - Tax and accounting benefits
  - New shells a "clean play" for investors to "flip"
  - 75% of net capital went to Bermuda

9/11: Capital Market Reaction

- Securitized solution not suited to opportunistic writings and exercise of underwriting judgment
  - Even stock startups have difficulty "putting capital to work"
  - Underwriting and technical talent greater constraint than capital
- Stability and availability arguments for securitization paradoxically not holding
  - General commercial line crunch led to greatly increased capacity
  - Mitigated capacity shortage for property cat

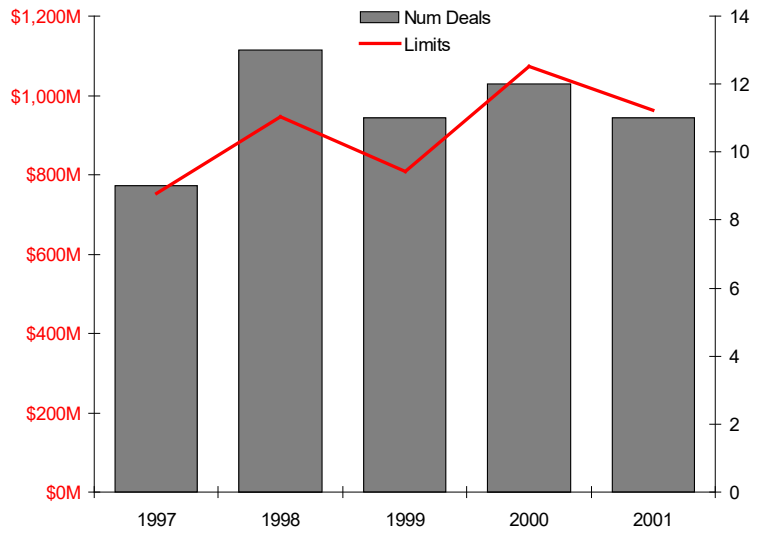
4. Conclusions

Conclusions

- Underwriting is key
  - Must be a close relationship between underwriter and capital
    - Must control owner/manager agency problem
  - Solution supports stock insurance structure when underwriter discretion and freedom of action required
- Securitization does not address agency problem

Conclusions

- Securitization not taking off
  - Great opportunity post-9/11
  - Investments almost entirely in (new) stock insurance companies
- Convergence with financial institutions – stepping backwards?
  - Travelers and Citigroup
  - GE and ERC – sell-off rumors



Conclusions

- Insurance companies still best suited to bearing hard-to-quantify risk
  - Special Risk Insurance and Reinsurance, Luxembourg SA (SRIR)
    - Joint venture of Allianz, Hannover Re, Swiss Re, XL Capital, Zurich Financial Services, SCOR
    - $440M insurance capacity against terrorism
    - Stock companies have ability to allow uw'ing flexibility and "bet taking"
    - Hard for dis-integrated securitized product

References and Links

- Links and references are available on my web site, along with a copy of this presentation:

http://www.mynl.com/pptp/bolnick2002.shtml

- Please email any comments on this presentation to me at steve@mynl.com