Understanding Contingent Capital

CAS Spring Meeting 2013

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Manulife Financial

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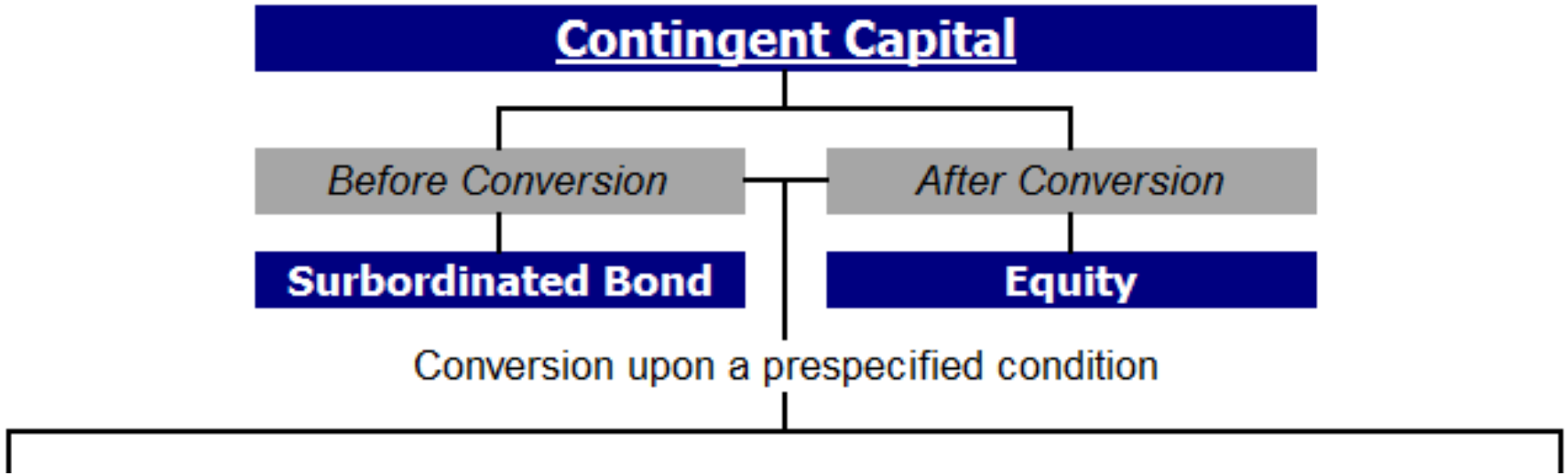
Contingent Capital



Stock price < $5

Capital adequacy ratio < 150%

Credit spread > 4.5%

CAT loss > $5M

Book value of equity per share < $10

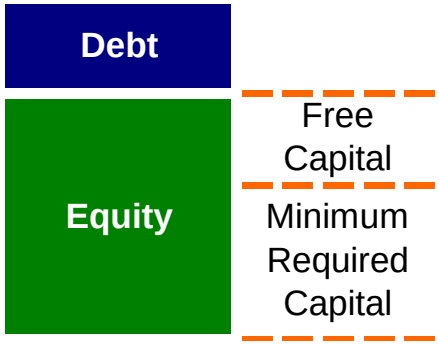
Industry loss > 50% of available capital

At the discretion of regulators

To provide automatic capitalization when the issuer is in trouble.

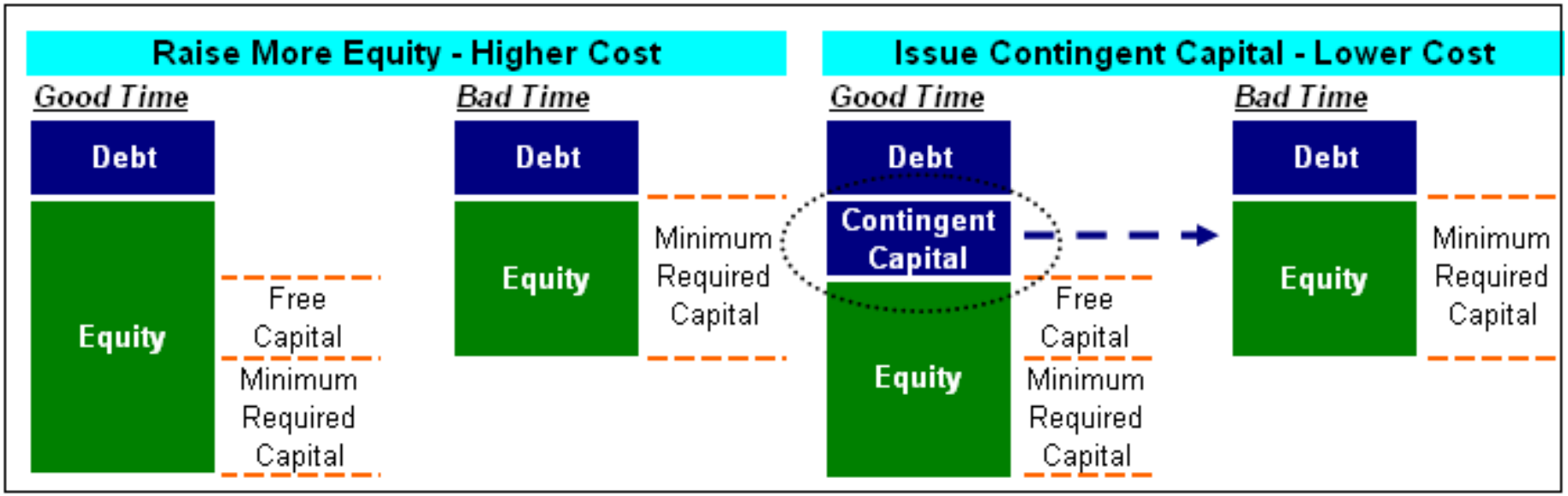
Contingent Capital

Good Time



Bad Time

Solution	*Issue*
Raise More Capital	High Cost
Derisk	Slow Process
Government Bailout	Social Criticism



Agenda

- **Research Background**
- **Contingent Capital Market**
- **Key Features and Potential Issues**
- **Pricing, Valuation, and Risk Assessment**
- **Case Study**
- **Recap**

I. Research Background

Background

The Committee on Valuation, Finance, and Investments (VFIC) of Casualty Actuarial Society issued an request for proposals on "Contingent Capital" in 2011.

Purpose (As stated in the RFP)

"To extend the theory and actuarial tools currently available to evaluate and structure alternative risk capital forms to traditional reinsurance and equity or hybrid capital. Contingent capital is another tool which actuaries should understand in managing risk and capital."

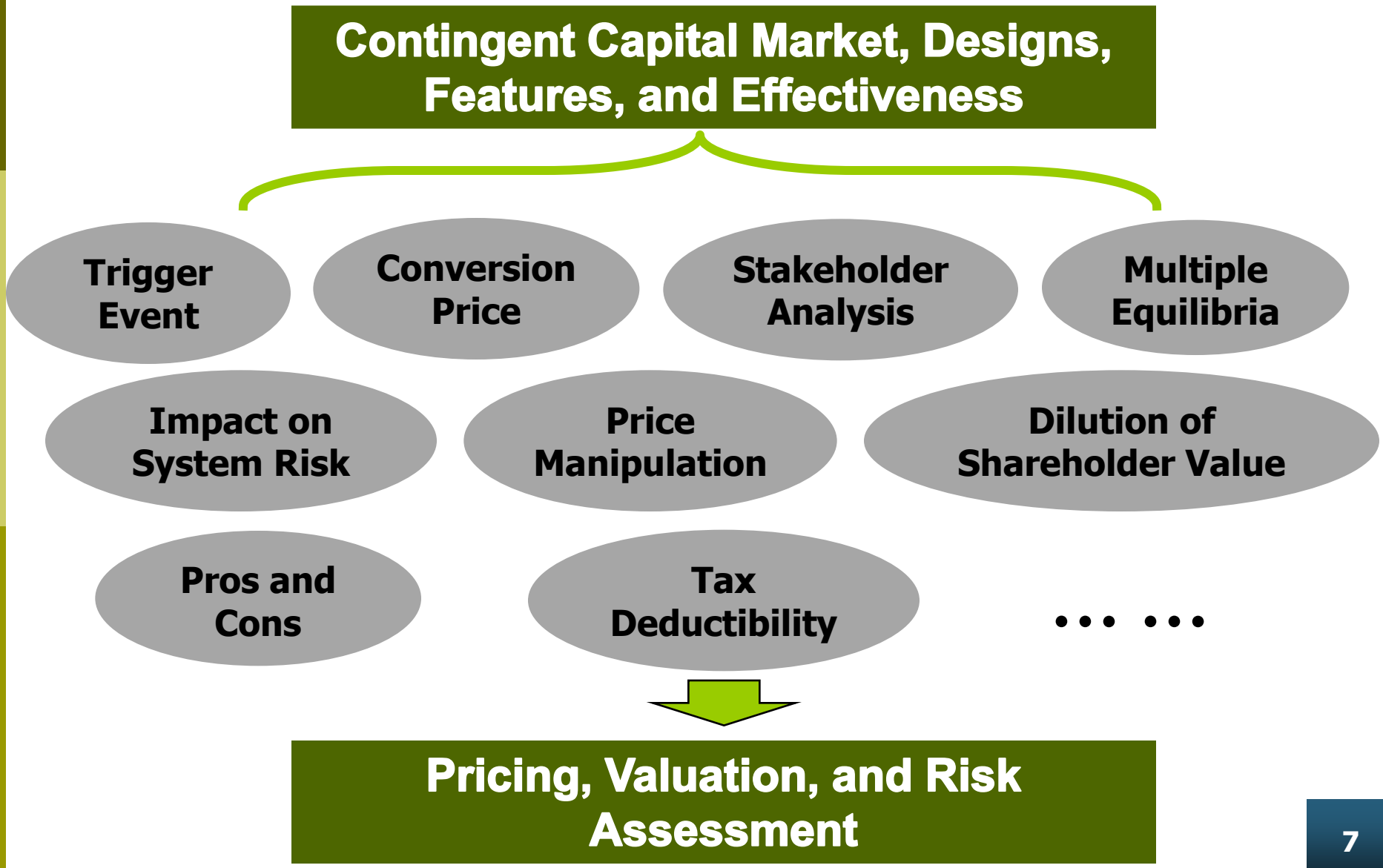
Project Team

Chris Gross	**Edward Yao**	**Kailan Shang (Author)**
Philip Kane	**Rasa McKean (Chair)**	**David Core (Coordinator)**

The report and the accompanying EXCEL file can be accessed from CAS website.

http://www.casact.org/research/Understanding_Contingent_Capital_Complete.pdf
http://www.casact.org/research/contingent_capital_qa_tool.xlsm

What has been done?



II. Contingent Capital Market

Sample Deals

Name	Enhanced Capital Note	Senior Contingent Note	Convertible Subordinated Notes
Issue Date	Nov. 2009	March 2011	July 2011
Issuer	Lloyds	Rabobank	Allianz
Investor	Existing Investors (Exchange Offer)	Primary Market	Nippon Life
Size	£8.5 Billion	€1.25 Billion	€0.5 Billion
Trigger Event	Core Tier 1 Capital Ratio < 5%	Capital Ratio < 7%	N/A
Term	10-22 Years	10 Years	10 Years
Conversion	Convert to Equity	75% Face Amount Written Down	Convert to Equity
Seniority	Subordinated	Senior	Subordinated

Do We Need Contingent Capital?

Limit the increase in WACC due to higher capital requirement compared to issuing stocks	***Fixed recapitalization cost at conversion, a cheaper way to raise capital in bad time***
Reduce the probability of bankruptcy and government bailout	***Tax deductibility before the conversion***

Design

Trigger Event

Institution Level	**Industry Level**
Going Concern	**Gone Concern**
Rule based	**Discretionary**
Book Value	**Market Value**
Equity/Capital	**Credit Spread**

Conversion Price

Fixed

Floating

- Par Conversion
- With a Floor

Way of absorbing the loss

Convert to Equity	**Liability write down**

Sample Proposals

Squam Lake Working Group (2009)	Dual Trigger Event 1. An industry level event such as a declaration by regulators that the financial system is suffering from a systemic crisis. 2. An institution based event such as a violation of covenants in the hybrid-security contract. (Bank's Tier 1 Capital/risk adjusted assets)
McDonald (2011)	Dual Trigger Event 1. Firm's stock price. 2. The value of a financial institutions index.
Kashyap et al (2008)	An insurance contract that the trigger of payoff is based on the capital loss of the total banking industry
Bolton and Samama (2011)	Capital access bond (CAB) Trigger Event is not specified but at the direction of the issuer. The issuer has the unconstrained right to exercise the option to repay the bond in stock at any given time during the life of the bond. It has two embedded options: a call option on the bond and a put option on the shares.
Calomiris and Herring (2011)	Trigger Event: A quasi market value based equity ratio designed to smooth the impact of the fluctuations in share prices. It is calculated as the 90-day moving average of MV of equity/(MV of equity + Face Amount of debt)

Regulators

Financial Stability Board	In Oct. 2010, contingent capital was mentioned to be used to meet the stringent capital requirement at the point of non-viability. The report was endorsed by the G20.
Basel Committee on Banking Supervision	Contingent capital may be used to meet additional loss absorbency requirement for global systematically important banks effective from 2019.
EU: capital requirements directive	Contingent capital may be regarded as equity capital or even non-core tier 1 instruments if certain requirements are met.
US: Federal Reserve	As one of the provisions in the Dodd-Frank Wall Street Reform and Consumer Protection Act, Fed is exploring the minimum amount of contingent capital and a system wide trigger.
Canada: OSFI	All the non-common Tier 1 and Tier 2 capital must satisfy the requirement for non-viability contingent capital (NVCC). The trigger event of NVCC is dependent on the regulators' announcement with clearly defined criteria.
Solvency II	Contingent capital with appropriate feature can be classified as ancillary own fund to meet the solvency capital requirement subject to supervisory approval.
NAIC	Securities Valuation Office (SVO) reported on contingent capital in Aug. 2010. As there is no agreement on the design of the trigger event, the task force did not draw any conclusion.

Rating Agencies

Rating Agency	S&P	Moody's
Requirement for Rating	"contain triggers that convert them into equity or some other tier-1 instrument."	"securities that feature triggers for conversion that are credit-linked, objective and measurable and where the impact of conversion can be estimated."
Rating Consideration	Normally lower than the investment grade and lower than similar bonds without the conversion option	"the type and transparency of the trigger, how it is calculated, and over what time horizon."
Equity Instrument (For the issuer)	Timely Conversion "Happen early enough in the issuer's credit deterioration"	Need to be fail-safe

Doubts

The conversion may not be timely (a trigger event based on the capital ratio)	***Will its market big enough?***
Uncertain impact on systemic risk	***Not a solution for liquidity risk***
Various rules in different jurisdictions	***Reduced disciplining power of debt holders***

III. Key Features and Potential Issues

Impact on Systemic Risk

- Lower systemic risk and default probability compared to traditional debt instruments.
- A dilution of shareholder's value help reduce the incentive for taking risk.
- Not the entire solution for the too-big-to-fail issue.
- Liquidity risk is not taken care of.
- Uncertainty around conversion.

Price Manipulation

A death spiral near conversion

CoCo bond holders

Short sell the stock

Shareholders

Sell the stock

Solutions

- **Fixed Conversion Price**
- **Conversion Price = Average price in the past N days**
- **Forbid short selling**
- **A gradual conversion schedule**

Dilution of Shareholder Value

- Floating conversion price causes more material dilution compared to fixed or floored conversion price.
- The threat of dilution is critical for a more stringent control on risk taking activities.
- However, a floating conversion price may cause price manipulation and have a downward pressure on stock price near conversion.

Capital Admittance

Regulatory Framework	Qualification	Classification
EU: Capital Requirements Directive (CRD II)	Absorbing losses on a going-concern basis and that must be converted to core tier 1 capital	Tier 2 capital, capped at 50% of Core Tier 1 Capital.
EU: CRD IV Consulting Paper	EU is considering having a mandatory principal write-down or conversion feature for all non-core tier 1 instruments	Potentially non-core Tier 1 Capital
Basel Committee on Banking Supervision	i. contingent capital will have to be converted to Common Equity Tier 1 when it falls below X% of risk adjusted assets. ii. X%≥7% iii. Immediate conversion	To meet loss absorbency requirements for global systematically important banks (GSIB)
Solvency II	The amount of admittance is subject to supervisory approval	To meet the Solvency Capital Requirement, not the Minimum Capital Requirement
Canada: OSFI	Meet the requirements for non-viability contingent capital	Non-common Tier 1 or Tier 2 Capital
US	unclear	unclear

Tax Deductibility

- Favorite tax treatment is crucial for the success of contingent capital.
- Existing deals were granted tax deductibility: Lloyd's and Rabobank.
- The embedded conversion option might be separately accounted and treated differently.

Other Issues

- Need to allow replacement of management and the Board after a large-scale conversion.
- After conversion, new and timely issuance of contingent capital is necessary to regain the protection.
- Transparency is crucial for marketing contingent capital.

IV. Pricing, Valuation, and Risk Assessment

Pricing/Valuation Models

Type	Structural Model	Reduced-form Model
Origin	Based on Merton (1974) and Black Scholes (1973).	Based on Duffie and Singleton (1999) model.
Prob. of Default	Shareholder's value is a call option on the firm's value with an exercise price equal to the value of the debt.	The default probability is modeled directly by a hazard rate influenced by exogenous market factors closely correlated with the firm value.
Prob. Of Conversion	Adjust the exercise price	Adjust the hazard rate
Account for stakeholder behavior (Examples)	Include discontinuous jumps in the asset value.	1. Model the hazard rate or loss ratio as a function of the stock price. 2. Include discontinuous jumps in the stock price.

A Reduced-form Model

Duffie and Singleton (1999) Approach with Equity Price State Variable

Default-adjusted Discount Rate: $R(t) = r(t) + Lh(S,t)$

Stock Price: $S_t = S_0 \exp\left(r(t)dt + \sigma_s dW + \sum_{i=1}^{N_i} Y_i \right)$

Value of Convertible Security: $V_t = \mathrm{E}_t^Q \left[e^{-\int_t^T R(u)du} X + \int_t^T e^{-\int_t^T R(u)du} dC_s \right]$

Conversion Hazard Rate: $h(S,t) = \theta + \frac{\rho}{S_t}$

Loss Ratio at Conversion: $L = (1 - K / CP)$

Notations

***X*: Redemption Value** **C_t: Coupon Payment Process**

***CP*: Conversion Price** **K: Expected Stock Price at Conversion**

$\sum_{i=1}^{N_i} Y_i$ **Jump Component that follows Compound Poisson Process with negative shock size**

A Structural Model

Garcia and Pede (2011) analytical first passage time approach with discontinuous jumps

$$V_t = S_t + \hat{H}(t)$$

Firm Value Process: $V_t = V_0 \exp\left(rdt + \sigma(t) W_t^Q\right)$

Barrier: $\hat{H}(t) = He^{rt - B\int_0^t \sigma^2(s)}$

Stock Price: $S_t = P_t \mathrm{E}_t\left[\frac{\left(V_T - \hat{H}(T)\right)^+ 1_{\{\tau > T\}}}{P_T}\right]$

RBC Ratio: $RBC_t = g\left(V_t / \hat{H}_t\right) + \varepsilon_t$

Challenges

- The lack of a framework that explicitly quantify the impact of the stakeholders' behavior such as price manipulation.
- The conversion event deals with the tail risk where market data may be too sparse for a credible calibration.
- It is possible that default can happen before the conversion option is exercised.
- The impact of the issuer's debt structure on the price of contingent capital needs to be incorporated in the pricing model at a more granular level considering different seniorities of the debt.
- New issuance of contingent capital may have an impact on the equity value due to the potential value transfer between shareholder and debt holder and the change in risk taking capability.

Illiquidity and Non-hedgeability

Liquidity Premium

- Current contingent capital market is not liquid.
- It may be estimated using corporate bond market data.
- Liquidity premium is a key factor when setting the price. It is added to the risk free curve for discounting.

Cost of Nonhedgeable Risks

- Many factors cannot be fully hedged, such as the change in capital rules, business strategy, economic cycle, and business environment.
- The cost of taking those risks can be estimated using the cost of capital approach, as in the MCEV calculation.

$$\sum_{t=0}^{T-1} REC_t \times CoC \times \nu_{t+1} \times p_t$$

REC: Required Economic Capital for Non Hedgeable Risks

CoC: Cost of Capital $\quad \nu_t$: Discount Factor at time t

p_t: Survival Probability

Risk Analysis

Greeks (Sensitivity)

- Delta (Δ) = $\delta V/\delta S$: the change in the value of contingent capital due to the change in equity price.
- Gamma (Γ) = $\delta^2 V/\delta S^2$: the convexity of the value with respect to the equity price.
- Vega (ν) = $\delta V/\delta \sigma$: the change in the value of contingent capital due to the change in equity volatility.
- Rho (ρ) = $\delta V/\delta r$: the change in the value of contingent capital due to the change in interest rate.

Hedging

- High basis risk when hedging contingent capital
- Delta hedging may push down the stock price further

Earnings Volatility and Capital Adequacy

- Issuer: Reduced earnings volatility and enhanced capital position upon conversion.
- Investor: Higher volatility compared to holding plain vanilla bonds.

V. Case Study

CoCo Bond – Terms and Assumptions

A simple CoCo bond example

Issuer	ABC Insurance Company	Credit Default Swap Curve for subordinated bond	Term / Rate (bps)
Face Amount	$10,000,000		1 / 124.9
Trigger Event	NAIC RBC Ratio <=150%		2 / 198.9
Conversion Price (CP)	$40 per share		3 / 262.5
Term of Contract (T)	10 years		4 / 300.6
Current Stock Price (S_0)	$45 per share		5 / 311.8
			7 / 313.9
Current RBC Ratio (RBC_0)	300%		10 / 305.0
Credit Rating	S&P BBB+	Economic Assumption	
BBB+ rated junior subordinated bond yield	7.2%	Risk Free Rate (r)*	3.0%
Dividend Yield (d)	0%	Equity Volatility (s)	45%
		Recovery Rate for Junior Subordinated Bonds	40%

CoCo Bond – Pricing

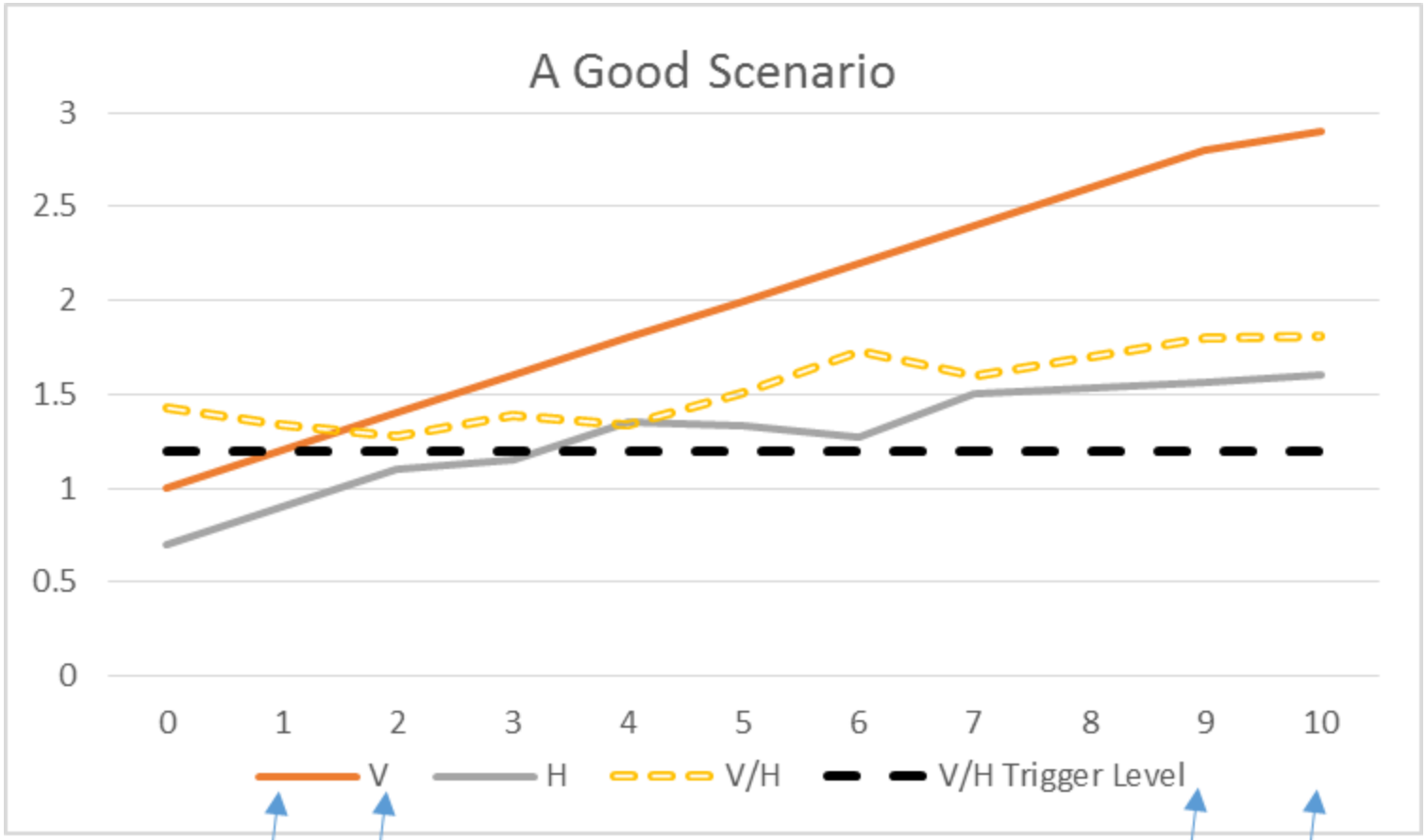
Use Garcia and Pede (2011) analytical first passage time approach

1. Yield >7.2%
2. NAIC RBC Ratio = 150% => V_t/H_t <120% and Stock Price = $15
   A brave assumption that may be estimated based on the historical data of RBC ratio and stock price, the expectation of capital rule change, and the risk budgeting plan.

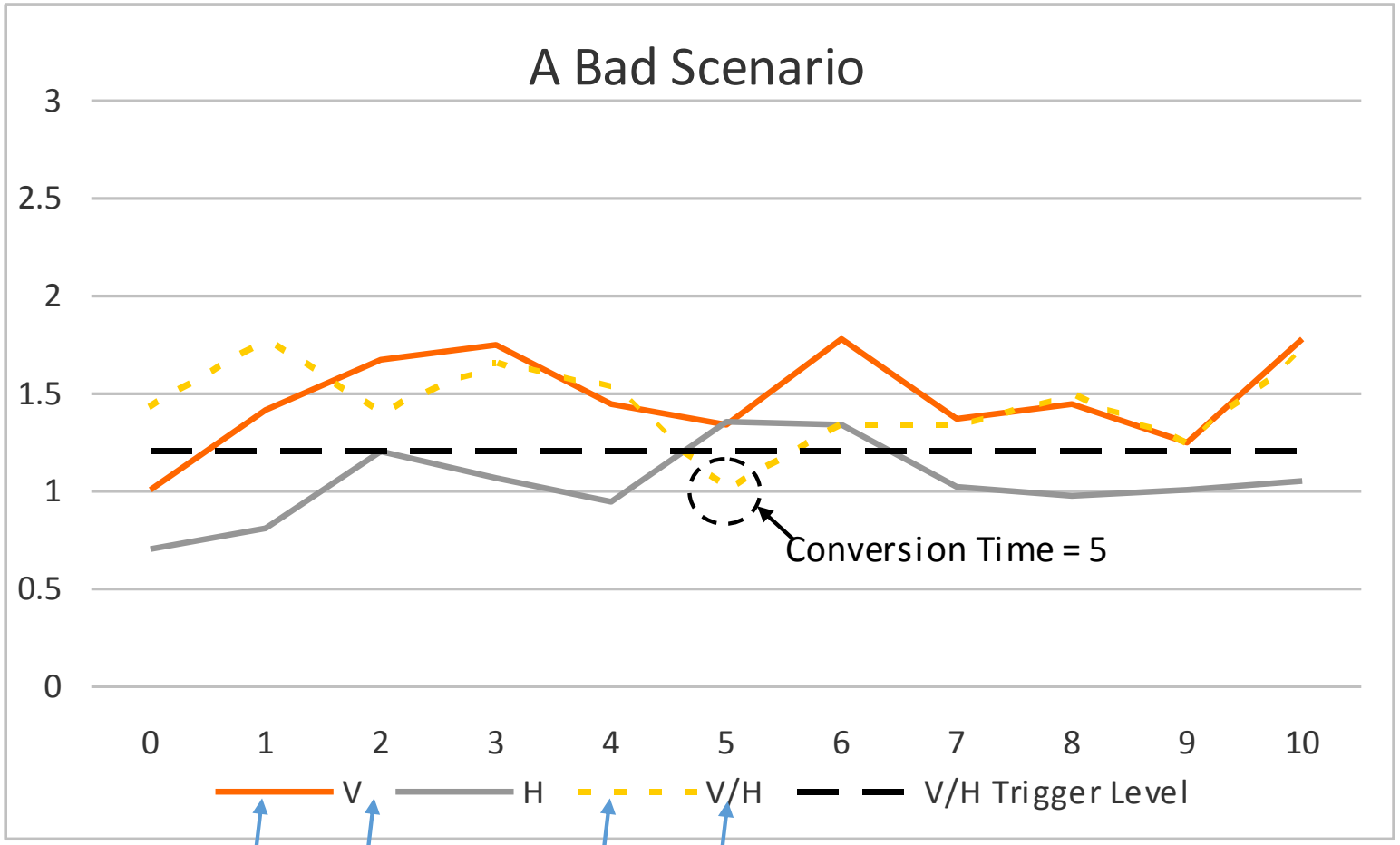
i. Simulate the firm value and barrier.
ii. Conversion time τ_c is simulated based on the value of V_t/H_t compared to a threshold translated from the RBC trigger level.
iii. If there is no conversion before bond maturity, the value is the value of the plain vanilla bond using risk free discount rate. If there is a conversion, it is calculated as the value of paid coupons and the value after conversion.
iv. Take the average of the bond value across all scenarios.

=> Annual Yield = 8.7%

CoCo Bond – Pricing – Scenario 1



CoCo Bond – Pricing – Scenario 2



Cash Flows: 100c | 100c | ▪▪▪ | 100c | 100c+100×*Stock Price at Conversion/ Conversion Price*

CoCo Bond – Pricing – Variation (1)

RBC Ratio Reporting Frequency

Frequency	Annual	Semi-annual	Quarterly
Value	1.00	0.98	0.96

Investor Behavior (Death Spiral Near Conversion)

Scenario	Baseline	Short Selling near Conversion*
Value	1.00	0.85

*Once V/H is below 125%, double the volatility parameter and only allow downward movement

Future Capital Rule Change (More Stringent Requirement)

Firm Value $V_t = V_0 \exp\left(rdt + \sigma(t) W_t^Q + \sum_{i=1}^{N_i} Y_i \right)$

Barrier $\hat{H}(t) = He^{rt - B\int_0^t \sigma^2(s) + \sum_{i=1}^{N_i} Z_i}$

N: # of jumps and it follows a Poisson process

Y: The shock size due to management actions. In this example, it is assumed to be positive but less than Z.

Z: The shock size due to capital rule changes. In this example, it is assumed to be positive to account for more stringent capital requirement.

CoCo Bond – Pricing – Variation (2)

Future Capital Rule Change (Continued)

Scenario	Baseline	Compound Poisson Process with Fixed Shock Size*
Value	1.00	0.85

Account for the Risk of Future Capital Rule Change

Cost of Residual Nonhedgeable Risks (CRNHR)= $\sum_{t=0}^{T-1} REC_t \times CoC \times \nu_{t+1} \times p_t$

REC_0 = shocked CoCo bond value under stress scenario - baseline CoCo bond value

REC_t = as $\alpha \times$Risk Driver$_t$

$\alpha = REC_0$/Risk Driver$_0$

Under the stressed scenario, the model value of CoCo bond becomes 0.657. Risk driver is set to be the price of plain vanilla bond without the conversion option and assuming no default risk.

	Baseline	CRNHR	Adjusted Price
Value	1.00	0.09	0.91

Demo of the EXCEL Tool

The EXCEL tool can be downloaded at
http://www.casact.org/research/contingent_capital_qa_tool.xlsm

Documentation of the tool:
1)Appendix A. Quick Guide for CONTINGENT CAPITAL QA TOOL in the report.
2)Tab "ReadMe" in the EXCEL file.

VI. Recap

Conclusion

Contingent capital is a promising candidate in improving the financial stability.

1. It may improve the risk tolerance of the financial industry.
2. It may reduce the cost of the financial crisis paid by the taxpayers.
3. It has a lower cost of capital before conversion than raising additional equity.
4. It is welcomed by regulators.

However, there is still a long way to go.

1. It is difficult to choose an appropriate design.
2. There is great uncertainty about the behavior of the issuers, the investors and other stakeholders.
3. There are some technical challenges for pricing, valuation, and risk assessment.

Thank you!