Should Life Insurers buy CoCo Bonds? - Regulatory Effects Implied by the Solvency II Standards

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Workshop on Banking and Insurance: Interconnectedness, Systemic Risk and Regulation
Contingent Convertibles

- Liikanen Report (2012) strongly recommends the **issuance of contingent convertible debt** as a mechanism to
  - reduce moral hazard created by governments’ bail outs
  - enhance financial stability

- Contingent Convertibles (“CoCos”) = debt that converts to equity as a bank approaches financial distress (“trigger”)

- CoCos can be used as regulatory capital under Additional Tier 1 and Tier 2 of Basel guidelines (BIS 2011)

- Suitable investors: well diversified financial institutions with long term maturities on their funding side and restrictive termination rights ⇒ **life insurance companies**, pension funds, specialized hedge funds (Krahnen 2013)
CoCo Bonds: Issuance

Figure: Contingent Capital Issuance volume by regulatory capital classification*

Banks and insurance companies that have issued CoCo bonds


*Sources: Bloomberg, Dealogic, BIS
Research Questions

In the case of fairly priced CoCo bonds

1. How does the design of CoCo bonds affect a bank’s risk situation?

2. How does the CoCo design affect an insurer’s risk situation and thus the Solvency II capital requirements?
   - higher $SCR$: additional costs of capital must be earned by higher nominal interest rate of CoCo bonds ⇒ fairly priced CoCo bond disadvantageous
   - lower $SCR$: fairly priced CoCo bond advantageous

3. Identification of CoCo design parameters that lead to higher or lower capital requirements
Pennacchi (2011) studies the valuation of CoCos within a structural model of contingent bank capital and shows how conversion decreases shareholder returns in higher risk banks.

Glasserman and Nouri (Management Science, 2012) analyze the case of contingent capital with a capital-ratio trigger and partial and on-going conversion.

Perotti and Martynova (2013) consider the effect of CoCo bonds on banks’ risk-taking incentives and show that CoCo bonds can induce less risky asset choices by the bank.

To our knowledge, this paper is the first to analyze the effects of a CoCo bond investment on the risk situation of insurers.
Procedure

- Develop a stylized model of a bank and an insurer
- Develop a Solvency II internal model
- Compare the insurer's capital requirements when holding non-convertible bank bonds with those when holding CoCo bonds
Model Framework

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

- **Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

![Diagram of financial connection between bank and insurance]

**Figure**: Financial connection between bank and insurance.
**Sequence of Events**

$ t = 0 $  
Bank decides on riskiness of its loan portfolio  
Insurer invests into stocks and bonds, and sets equity capital according to Solvency II

$ 0 < t < 1 $  
Intermediate return on loans realizes  
Conversion may occur  
Liquidity shock may occur

$ t = 1 $  
Asset returns realize

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**BaBo**  
Bank issues bond  
Insurer buys bond

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**CoCo**  
Bank issues CoCo  
Insurer buys CoCo  
Conversion to stocks if trigger is breached

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Interest payment, or partial or complete default

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Interest payment, no or partial interest payment, or partial or complete default

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**Figure:** Sequence of events in the model.
Model Framework

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

- **Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

\[
\begin{align*}
\text{Bank} & \\
\text{Loans} & \\
\text{Equity} & \\
\text{Deposits} & \\
\text{BaBo/CoCo} & \\
\end{align*}
\]

- initial value \( V_0 \), value at time \( t \): \( V_t = e^{t \cdot r_V} \cdot V_0 \)

- return \( r_V \) is normally distributed, \( r_V \sim \mathcal{N}(\mu_V, \sigma_V) \)
**Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

**Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

\[ E_0^B \geq k \cdot V_0 \text{ in } t = 0 \]
Model Framework

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

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- **Bank**
  - Loans
  - Deposits
  - Equity
  - BaBo/CoCo

- Stochastic liquidity shock on deposits between $t_0$ and $t_1$
- Probability of high liquidity shock increases with the bank’s default risk
- Liquidity shock leads to early asset liquidation at costs $\beta \geq 0$
**Model Framework**

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

- **Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

- Non-convertible or CoCo with face value $B^{FV}$ is issued

- Bank pays nominal interest rate $r_B$ for non-convertible bank bonds, $r_C$ for CoCos

- Nominal interest rates depend on the bank’s default risk and are set so that the initial market values are equal (Pennacchi 2011), $BB_0 = CC_0$
Model Framework

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

- **Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

  - initial value $ST_0$
  - rate of return $r_{ST}$ is normally distributed, $r_{ST} \sim \mathcal{N}(\mu_{ST}, \sigma_{ST})$
Model Framework

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)
- **Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

- initial value $GB_0$
- return $r_{GB}$ equals risk free rate
- no default risk
Model Framework

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

- **Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

- initial value $BB_0 = CC_0$
- nominal return $r_B$ or $r_C$
- either bond will be held to maturity (includes bank shares after possible conversion)
Model Framework

- **Bank**: provides (corporate) loans financed by equity capital, deposits and bank debt (bank bonds/CoCo bonds)

- **Life insurer**: stylized life insurer with an outstanding stock of life insurance contracts; invests in three asset classes

- initial book value $L_0$
- growth rate $r_G$, average time to maturity $T_L$
- market-consistent valuation of liabilities on the solvency balance sheet (EIOPA 2013)
Solvency II Internal Model

- Solvency Capital Requirement (\(SCR\)) is based on a Value-at-Risk calibrated to a 99.5% confidence level over a 1-year time horizon

**Parsimonious asset-liability approach**

- Two steps to calculate \(SCR\) (Habart-Corlosquet et al. 2013)
  
  (i) Project insurer’s asset and liabilities over a one-year horizon to evaluate the net asset value at time \(t = 1\)

  - To forecast the market value of the bank/CoCo bond, the insurer takes into account the bank’s development

  (ii) Discount the value of the 99.5% quantile to \(t = 0\) to quantify the amount of capital which invested at \(t = 0\) will enable the insurer to avoid insolvency in 99.5% of cases

- Due to complexity of interconnectedness: no closed-form solution possible
Calibration

Varying model factors

- Bond design
  - Trigger value: \( k \)
  - Conversion ratio: at, below or above par value

- Bank
  - Bank risk: \( \sigma_V \)
    - Determines the volatility of the converted bank shares
Baseline Results

- Bond size: 5% of total bank assets
- Trigger value: $k = 5\%$
- Conversion at par

**Figure:** Bank’s default probability and insurer’s capital requirements. The solid line represents the non-convertible bank bond, the dashed line the CoCo bond.

* Based on Deutsche Bank’s Additional Tier 1 hybrid debt instruments in 2012.
** Under Basel III, the minimum trigger level required for a CoCo to qualify as Additional Tier 1 capital is 5.125%.
Baseline Results

Bank

- Default probabilities increase with $\sigma_V$
- Probability of default for bank that issues non-convertible bond higher than for bank that issues CoCo

Insurer

- Capital requirements increase with $\sigma_V$
- For lower $\sigma_V$, $SCR$ for CoCo holder equals the $SCR$ for non-convertible bond investor
  $\Rightarrow$ low conversion risk due to low bank risk
- For higher $\sigma_V$, $SCR$ for CoCo holder exceeds the $SCR$ for non-convertible bond investor
**Varying Trigger**

- Trigger value: \( k = 2.5\% \iff k = 5\% \implies k = 7.5\% \)

![Graphs](image.png)

- **(a)** Bank's default probability
- **(b)** Insurer's capital requirements

**Figure**: Bank's default probability and insurer's capital requirements. The solid line represents the non-convertible bank bond, the dashed line the CoCo bond.
Varying Trigger

**Bank**
- Probability of default for CoCo issuing bank decreases with increasing trigger value
- Probability of default for CoCo issuing bank increases with decreasing trigger value

**Insurer**
- Increased trigger value leads to higher capital requirements for the CoCo holder
  ⇒ higher conversion risk
- Lower trigger leads to smaller capital requirements for the CoCo holder
  ▶ for moderate $\sigma_V$, internal model considers CoCo to be less risky than non-convertible bond
  ⇒ lower conversion risk
Varying Conversion ratio

Conversion: below par \iff at par \implies above par

Figure: Bank's default probability and insurer's capital requirements. The solid line represents the non-convertible bank bond, the dashed line the CoCo bond.
Varying Conversion Ratio

**Bank**
- Probability of default for CoCo issuing bank decreases (increases) with increasing (decreasing) conversion ratio
  ⇒ Effect of lower (higher) coupon

**Insurer**
- Conversion above par leads to increased stock exposure after conversion and thus to increased risk capital for CoCo holders
  ⇒ Value-at-Risk measure picks up stock volatility
- Conversion below par leads to lower stock exposure after conversion and thus to reduced risk capital for CoCo holders
The higher the reduction in the bank’s probability of default, the higher the capital requirements for the insurer under Solvency II

- high trigger
- high bank risk
- conversion above par

⇒ fairly priced CoCo bond disadvantageous

CoCo bond reduces the bank’s default probability and leads to similar or even lower capital requirements for the insurer compared to a non-convertible bond if

- low trigger
- moderate bank risk
- conversion below par

⇒ fairly priced CoCo bond advantageous
Discussion

Results must be seen in the context of the

- Simplified asset structure of the insurer, liability structure of the bank
- Exogenous risk-free interest rate
- Insurer not being subject to policyholders’ reaction
- Application of the Value-at-Risk measure under Solvency II
- (In)Adequacy of the Solvency II standard model