Convertible Bonds and Bank Risk-taking

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Motivation

- In the credit boom, high leverage drove excess risk shifting.
- At some leverage threshold, risk incentives build up non linearly.
- Basel III calls for more bank capital in order to
  - force more risk absorption (bail in at default)
  - reduce risk shifting (early conversion as going concern)
- Contingent capital has been proposed as an alternative to equity. CoCo (convertible bonds) is a debt instrument which automatically converts into equity if the bank is doing poorly.
- While not adopted under Basel III, CoCos are admitted as a component of additional capital buffers (EBA, Switzerland).

Contribution

- Optimal design for convertible bonds to prevent endogenous risk shifting.
- **Main results**:
  - An appropriate trigger reduces risk shifting by converting in high leverage states, when incentives deteriorate.
  - There is an optimal amount of contingent capital, beyond which incentives deteriorate.
  - A larger amount of contingent capital is required to substitute pure equity. The ratio depends critically on trigger efficiency.
  - CoCos may be safer and thus cheaper than a conventional bond.
  - A market trigger produces more frequent conversion (type I error), a regulatory trigger is subject to forbearance and thus is less efficient in reducing risk taking (type II error).

Plan of the Presentation

1. Motivation
2. Model set up
   - Optimal CoCo design
3. Extensions
   - CoCo versus Conventional Bonds
   - CoCo versus Equity
   - Market versus Regulatory Trigger
4. Conclusion

Model

- Three dates: $t = 0, 1, 2$
- Everybody is risk-neutral, no discounting
- Active agents: the banker
- Passive agents: shareholders, depositors

Investment Technology

- The value of assets at $t = 0$ is $V_0 = 1$
- At $t = 1$, exogenous shock $\zeta \sim U[-\delta, \delta]$ changes interim assets value to $V_1 = 1 + \zeta$, denoted by v
- Realization of v is initially observed only by the banker
- The banker owns all bank shares and chooses its lending strategy
- The asset value v may be revealed with probability φ.

Investment Technology

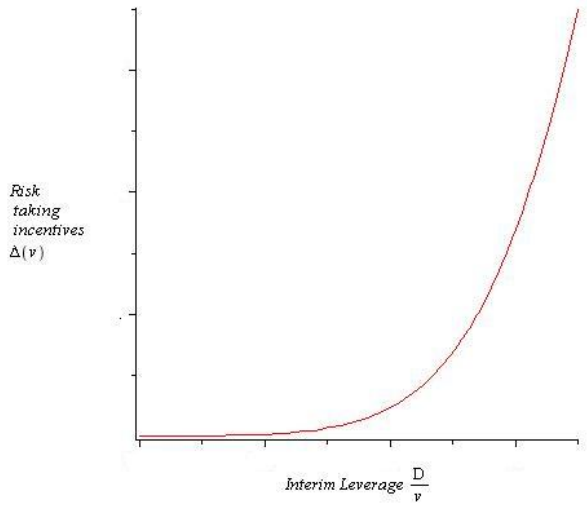
- Depending on the risk choice at 1, the asset value at $t = 2$ is:
  - **safe** asset choice has a gross return 1
    in this case the bank never defaults for $\forall V_1 : V_1 - D \geq 0$
  - **risky** asset has a payoff $v + \varepsilon$, where ε follows $F(\varepsilon)$ with pdf $f(\varepsilon)$, mean $-z$ and standard deviation σ.
  - Thus the risky choice has negative NPV.

Agents:

- The banker chooses whether to control assets risk:

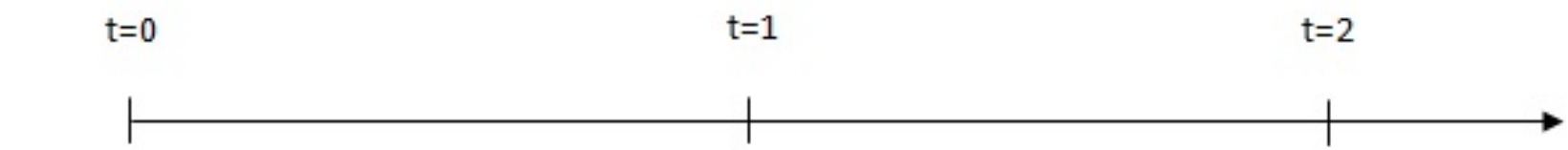
$$\max_e e \cdot \underbrace{(v - D)}_{\text{Safe return}} + (1 - e) \cdot \underbrace{Prob(V_2 > D) \cdot E(V_2 - D | V_2 > D)}_{\text{Banker's return from risky asset}}$$

$$\text{s.t. } e = \{0, 1\}$$



- intuitively, risk incentives are suboptimal under high leverage, as the banker benefits from risk-shifting

Game structure



- Shareholder invests 1-D raising D in deposits and CoCos

- Banker receives a precise signal about interim asset value.
- Banker chooses risk.
- Information is revealed with probability φ.
- Conversion may occur.

- Value of assets is realized.
- Payoffs are distributed.

Conversion terms

- An amount C of Coco bonds substitute an equal amount of deposits D
- CoCos are converted into equity at a fixed conversion ratio when the asset value falls below the trigger asset value v_T
- CoCo holders break even if $v_T = v$, else they do not get full face value.
- Shareholders are fully wiped out only when equity value is zero after conversion.

Model: Optimal trigger

Lemma

CoCos improves risk choice for banks with $v_C^* \leq v \leq v^*$. Banks with extremely high leverage $v < v_C^*$ do not change their risk choice. Banks with $v > v^*$ are not affected.

- The optimal trigger asset value v_T equal to v^*.

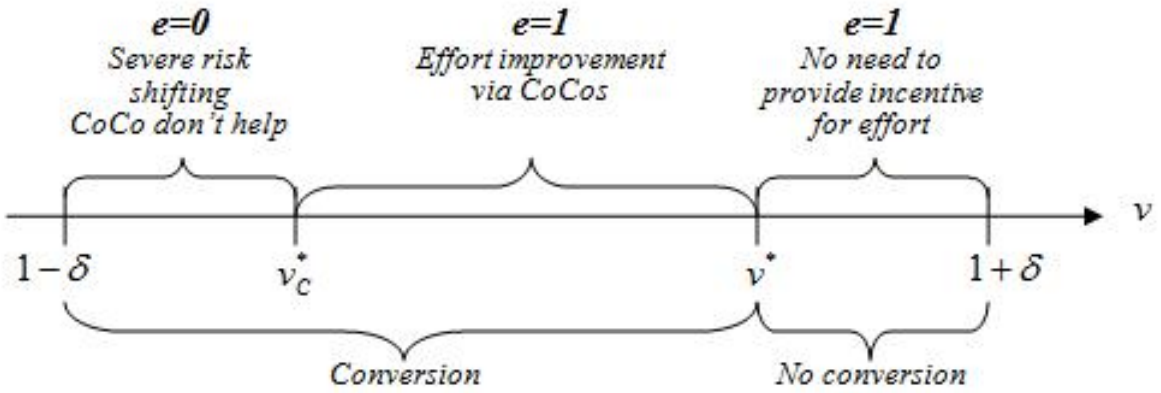


Figure: Risk incentives with restricted trigger price $v_T = v^*$

Model: Equity and CoCo dilution effects

Proposition

For bank with low interim asset values $v \leq v^*$, conversion has two effects: a direct equity dilution effect and a CoCo dilution effect.

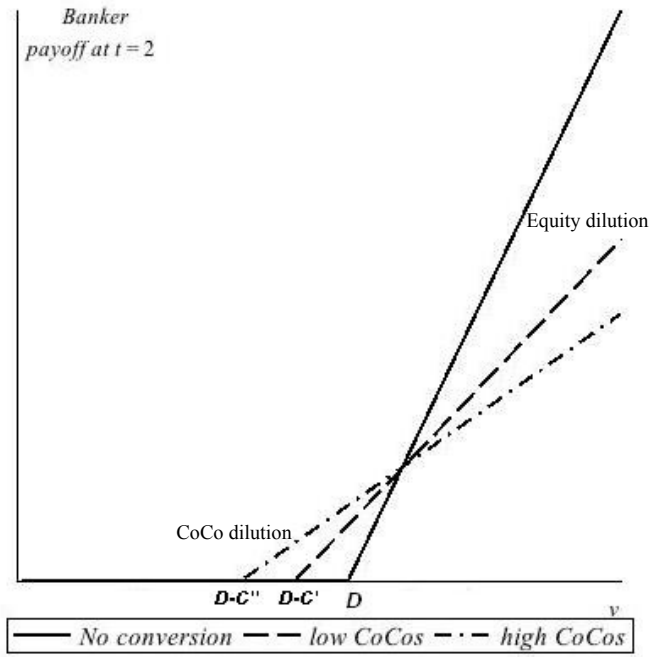


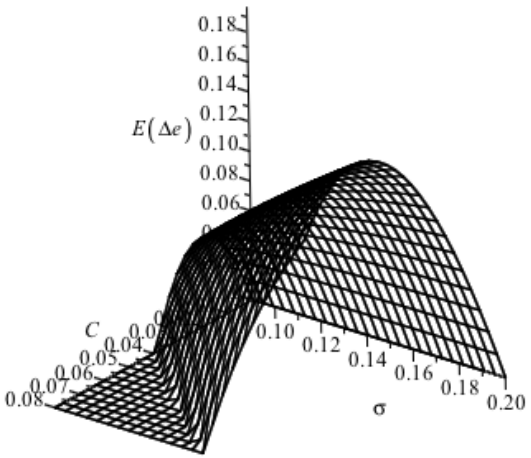
Figure: Equity and CoCo dilution effects

Model: Optimal amount of CoCos

Proposition

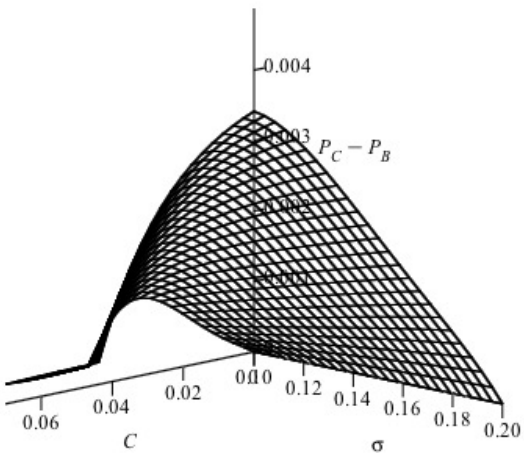
Risk control improves with the amount of CoCos up to a threshold C^*, and then declines. Thus, there exists an optimal amount of CoCos.

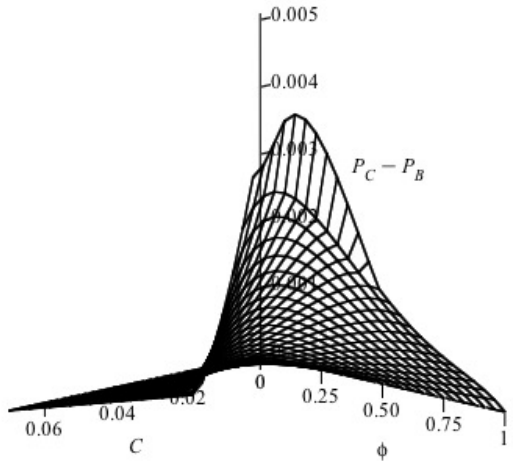
$$\Delta'_C(v + C^*)(C^* + v_T - D) - \Delta(v + C^*) + z = 0 \qquad (1)$$



Are CoCos cheaper than conventional bonds?

- There are two main effects:
  - CoCo holders face less protection when converted than traditional debt holders.
  - CoCos induce safer asset choices.
- The price of CoCos may be higher than for a traditional bond, when asset risk and trigger precision are high and the amount of CoCos is chosen optimally.





CoCo versus Equity

Proposition

The effect of CoCos on risk is weaker than equity, unless the trigger is perfectly informative ($\varphi = 1$).

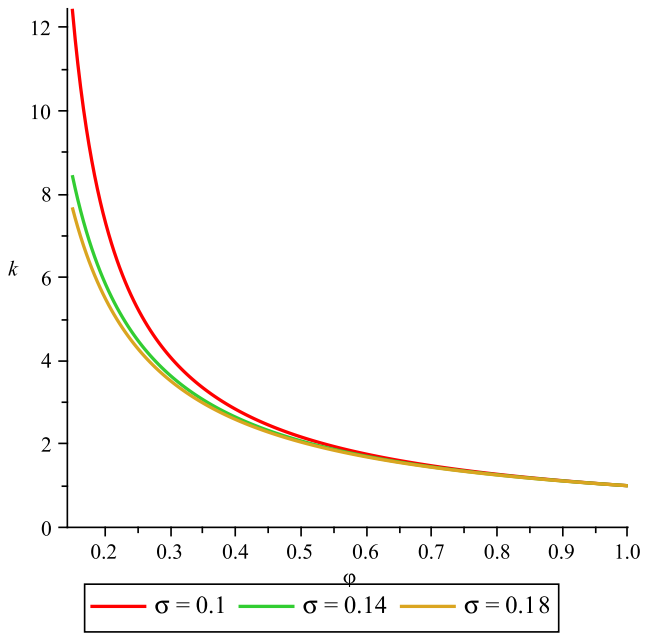


Figure: Substitution ratio between CoCos and equity for trigger price v^*

Market versus Regulatory Trigger

- We now restate the model to compare market and book equity triggers.
- Bankers prefer to underreport leverage, so regulatory intervention is needed to force reporting high book leverage.
- Market prices and regulatory assessments are equally noisy indicators of asset values.
- A market price triggers automatic conversion while an accounting trigger depends on regulatory choice.

Market versus Regulatory Trigger

- Assumptions:
  - at $t = 1$ banker chooses risk as before
  - at $t = 1$, the regulator observes a noisy signal of the interim asset value $\tilde{a} = v + \tilde{r}$ ($\tilde{r}$ has zero mean and st dev σ_r)
  - at $t = 1$, the market price is a noisy measure of true asset value $\tilde{p} = v + \tilde{m}$ ($\tilde{m}$ has zero mean and st dev σ_m)
  - conversion at $t = 1$ causes a cost to the regulator k (loss of reputation)
  - in case of bank failure at $t = 2$ (when $V_2 < D - C$), a larger social cost K is incurred.

Market versus Regulatory Trigger

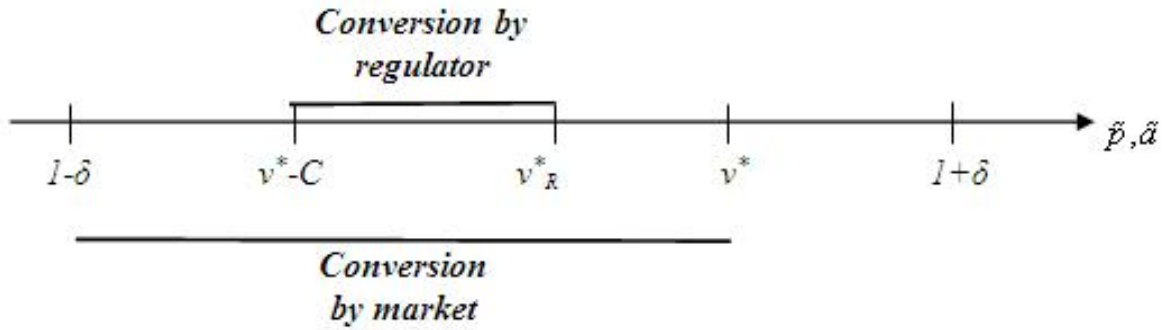


Figure: Conversion under market and regulatory triggers

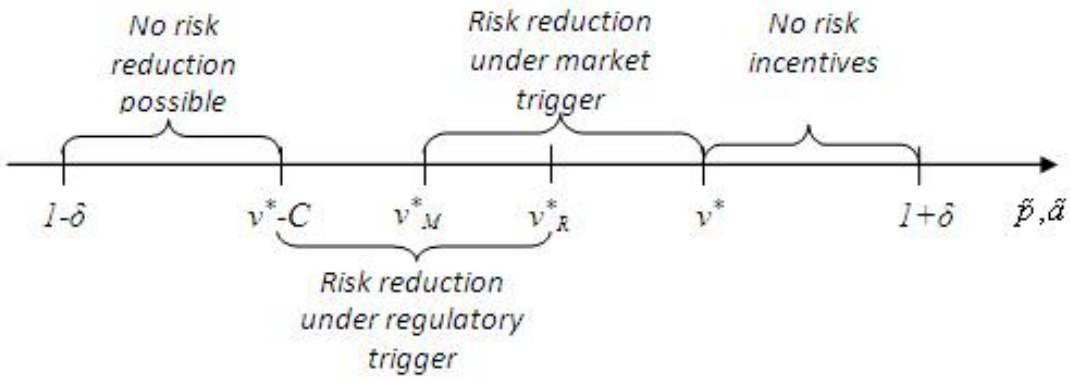


Figure: Risk incentives under market and regulatory triggers

Market versus Regulatory Trigger

Proposition

A market trigger produces more frequent conversion, including some states when it is not necessary (type 1 error).
Conversely, a regulatory trigger will not be activated for banks with leverage just below v^* (type 2 error), and will lead to more risk taking for banks around this range.
The net effect of a market trigger may be more risk reduction (and more equity in general) but some unnecessary conversion.

Literature on regulatory vs market trigger

- Note: all existing theoretical work assumes exogenous risk
- Flannery (2009): proposes a market trigger price.
- Squam Lake Report (2009): Conversion should be triggered when regulator decides that there is financial crisis.
- McDonald (2011): Dual trigger - both a market price and a financial index. This ensures recapitalization in crisis times, else allows bank default with bail in.
- Hart and Zingales (2010): The trigger should be based on CDS prices, upon which the regulator can dictate conversion.

Conclusion

- Properly designed CoCos can induce risk reduction.
- There exists an optimal CoCo amount that minimizes risk. The trade-off is between equity dilution and CoCos dilution effect.
- The banker never willingly chooses CoCos over deposits.
- When asset risk and trigger precision are high, CoCos may be safer and thus cheaper than traditional bonds.
- A higher amount of contingent capital is required to provide the same effort incentives as equity.
- A dual trigger may be optimal, to filter out market manipulation while challenging forbearance.