Paper Overview

- This paper develops a formal finance model of contingent convertible bonds (CCBs) as a possible addition to the capital structure of banks and firms.
- CCBs have the unique potential to avoid bank bailouts of the form that arose during the recent banking and financial market crisis.
- While qualitative discussions of CCBs are available in the literature, this paper develops analytic propositions for structuring CCBs to maximize their benefits for prudential bank regulation.
**Key Model Assumptions**

- Leland-style capital structure model
  - Asset value follows GBM:
    \[ dA_t = \mu A_t dt + \sigma A_t dB_t \]
  - Agents are risk-neutral and risk-free rate is \( r \)
  - Straight debt pays coupon \( c_b \) continually in time
  - Friction 1: \( c_b \) is tax-deductible, tax rate \( \theta \)
  - Friction 2: \( \alpha \) portion of assets is lost at default
- Value-maximization problem of equity holders
  - Endogenous default timing: bankruptcy boundary \( A_b \)

---

**Key Contingent Bond Assumptions**

- CCB is characterized by three parameters: \( c_c, A_c, \lambda \)
- CCB pays coupon \( c_c \) until conversion
  - Tax deductible
- The exogenous CCB conversion trigger is an asset level \( A_C \), or a corresponding equity market value \( W_C \)
  - At conversion, CCB holders receive a market value of equity \( \lambda c_C \).
    - \( c_C \) is the face value of CCB.
    - CCB holders receive a fixed number of shares \( \lambda \frac{c_c}{rW_C} \).
**No Default before CCB Conversion**

- We assume Condition 1 always holds: The straight debt and CCB contract terms are such that the firm does not default before or at CCB conversion.
  - Conversion trigger $A_c, W_c$ is sufficiently high.
- Default timing is determined by the straight debt:
  - Optimal default boundary: $A_b = \beta (1 - \theta) c_b$.

- We allow only a single class of outstanding CCB, all of which convert when $A_C$ is reached. A sequence of CCB conversions might be preferred.

---

**Q1. Will a firm include CCBs in its capital structure if there are no regulatory conditions?**

- A firm will always wish to add at least some CCB to its capital structure, to obtain the tax shield.
- CCB are first added as a CCB for equity swap.
  - Assets A are unaffected by capital changes;
  - Optimal straight debt is unaffected by CCB (as long as Condition 1 holds).
- This is a losing proposition for bank regulation:
  - The default boundary $A_B$ is unchanged.
  - Fiscal deficit is expanded by new CCB tax shield.
  - This may also magnify asset substitution incentive.
Q2. Will firm add CCBs to a *de novo* capital structure, given a CCB for debt constraint?

- Here we impose a regulatory constraint that CCB can be added only as a swap for straight debt.
- A firm will always include at least some CCB as part of a de novo capital structure:
  - The tax shield benefit is reduced (because the CCB convert before the straight debt default);
  - But the reduction in bankruptcy costs dominates.
- This is perfect for prudential banking regulation:
  - Lower tax shield costs, lower bankruptcy costs.
  - There is also generally less risk shifting incentive.

© 2010 Alexei Tchistyi, Slide 7

Q3. Will firm add CCBs to an existing capital structure, given a CCB for debt constraint?

- The existing equity holders will not voluntary enter into swap of CCB for existing straight debt (given straight debt $\geq$ optimal amount).
- While the swap will increase the firm's value (as in Q2), the gain now accrues only to the existing straight debt holders.
  - This is a debt-overhang problem.
  - The problem would be reduced, even eliminated, if short-term debt could be swapped as it matured.
Q4. Can CCBs provide a useful regulatory instrument for banks too big to fail (TBTF)?

- Yes, a CCB for straight debt swap reduces the government subsidy by reducing the expected cost of bondholder bailouts.
  - While the bank’s straight debt is risk-free, the amount it can issue is limited.
  - The key is to reduce the amount of straight debt.
  - Taxpayers benefit from such a swap, but bank equity holders would not voluntarily participate.
  - The conclusion requires Condition 1 as before.
  - A mandatory swap might dominate a bank tax (by directly eliminating the bailout costs).

Q5. May CCBs create an incentive for market manipulation?

- CCB may potentially create an incentive for either the CCB holders or bank equity holders to manipulate the bank's stock price to a lower value to force a CCB for equity conversion.
  - CCB holders have incentive to manipulate the equity price only if the ratio of equity conversion value to CCB face value ($\lambda$) is sufficiently high to make the conversion profitable for themselves.
  - Bank equity holders have incentive to manipulate the equity price only if $\lambda$ is sufficiently low to make the forced conversion profitable for themselves.
Q6. May contract restrictions maximize the regulatory benefits of CCB?

- Yes, the CCB regulatory benefits generally depend on the contract and issuance terms.
- Perhaps most importantly, the regulatory benefits vanish if banks simply substitute CCBs for equity.
  - It is thus essential to require CCB issuance to substitute for straight debt (and not for equity).
- Also, the higher the threshold for the conversion trigger, the greater the regulatory benefits.
- The conversion ratio may also determine the incentives for stock price manipulation.

Table 1: Effects of CCB issuance on the capital structure of the firm

<table>
<thead>
<tr>
<th>Firm</th>
<th>Constraint</th>
<th>Firm Value</th>
<th>Equity Balance</th>
<th>Capital Risk</th>
<th>Asset Substitution</th>
<th>Tax Savings</th>
<th>Other Effects</th>
<th>Firm Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unleveraged</td>
<td>Sufficiently small amount of CCB</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>n/e</td>
<td>Issue CCB on top of optimal amount of SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leverage with SD</td>
<td>Sufficiently small amount of CCB</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>n/e</td>
<td>Issue CCB on top of existing amount of SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unleveraged</td>
<td>Total amount of debt is fixed</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>n/e</td>
<td>Replace some SD with CCB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leverage</td>
<td>Total amount of debt is fixed</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>n/e</td>
<td>Do not issue CCB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thin (Leveraged/Unleveraged)</td>
<td>Total amount of debt is fixed</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>↑ ↑ ↑ ↑</td>
<td>n/e</td>
<td>Reduced government subsidy</td>
<td>Do not issue CCB</td>
<td></td>
</tr>
</tbody>
</table>

*SD: Straight debt; TBD: Too-big-to-fail; n/e: not considered; ↑: increase; ↓: decrease; ↔: no change; ↔: no effect or insignificant increase/decrease
Table 2: Incentives of CCB holders and equity holders to manipulate the stock price

<table>
<thead>
<tr>
<th>Conversion Ratio</th>
<th>Action</th>
<th>Intuition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; \lambda^* &lt; \lambda$</td>
<td>CCB holders want to drive the stock price down to trigger conversion</td>
<td>If $\lambda$ is high, CCB holders receive a large amount of undervalued equity at conversion.</td>
</tr>
<tr>
<td>$\lambda \leq \lambda^*$</td>
<td>CCB holders do not want to trigger conversion</td>
<td>If $\lambda$ is low, CCB holders are poorly compensated at conversion.</td>
</tr>
<tr>
<td>$\lambda &lt; 1 - \theta$</td>
<td>Equity holders want to drive the stock price down to trigger conversion</td>
<td>If $\lambda$ is low, equity holders can cheaply get rid of the obligation to pay $c_e$.</td>
</tr>
<tr>
<td>$1 - \theta \leq \lambda$</td>
<td>Equity holders do not want to trigger conversion</td>
<td>If $\lambda$ is high, conversion is costly to equity holders.</td>
</tr>
</tbody>
</table>

Conclusions and Further Research

- While CCB are highly valuable for prudential bank regulation, efficient implementation will require more detailed modeling:
  - Model should allow CCB to convert in a sequence of triggers and/or the banks to commit to issue new CCBs as existing bonds convert.
  - Finite maturity bonds would reduce the debt overhang costs of CCB for straight debt swaps.
  - Including asset price jumps would likely improve the model's pricing accuracy.
  - Finally, a full capital budgeting solution would allow the bank to buy or sell assets directly.