Design of Contingent Capital With Market Trigger for Conversion

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Basic structure of contingent capital (CC)

The capital should be a debt in a good state/bank

- It has a par value.
- It pays interest regularly
- Interest payments are tax deductible.

The capital should be equity in a bad state/bank

- It stops paying interest.
- It converts to *m* shares of common equity.
- The additional equity can be loss absorbing.

Conversion must be either mandatory or optional to the bank

- Bank's option: Bolton & Samama (2010)
- Accounting ratio: Squam Lake (2009)
- Regulator discretion: OSFI (2010), GS (2010), CS(2011)
- Market prices: Flannery (2009), Hart & Zingales (2010)

The objectives of contingent capital

Main objectives

- Overcome the reluctance of raising equity early
- Curtail the incentive for taking excessive risk
- Ensure banks having enough loss-absorbing capital
- Remove the need for public bailout of large banks

CC brings in capital as debt & absorbs losses as equity

- Resistance to raising requirement on equity in good state.
- Raising equity is too difficult or too expensive in bad state.
  - Poor investment opportunities, debt-overhang problem, shares under-valued, signaling problem, …

CC gives the right incentives to managers?

- Punish managers that run their banks into bad state:
  - Punitive conversion

The CC issued in financial industry so far

- 02/25/2009, Treasury's Capital Assistance Program (CAP)
  - Mandatorily Convertible Preferred (MCP)
  - Redemption is optional in 2 years.
  - Conversion is optional in 7 years but mandatory at end.
- 11/05/2009, Lloyds's Enhanced Capital Notes (ECN)
  - Conversion trigger: Basel II core tier 1 / RWA ≤ 5%
- 03/12/2010, Rabobank's Senior Contingent Notes (SCN)
  - Conversion trigger: Basel II equity/RWA ≤ 7%
- 02/14/2011, Credit Suisse's Buffer Capital Notes (BCN)
  - Conversion trigger 1: Basel III equity/RWA ≤ 7%
  - Conversion trigger 2: regulator decision
- ??/??/20??, CC with market trigger (Flannery's CCC)
  - Conversion trigger: market value of equity/RWA ≤ 4%

Why market trigger?

Disadvantages of bank option

- Management may be reluctant to convert, hope for the best or bailout
- This is especially true if conversion is punitive to equity holders.

Disadvantages of accounting triggers

- Accounts are subject to management manipulation (repo 105, Enron)
- Accounting values are backward looking
- Recent crisis: troubled banks had high accounting ratios

Disadvantages of regulator triggers

- Regulator's information & monitoring are limited
- Political pressure: worries about giving false signals: act late
- Potential multiple/no equilibrium: Bond, Goldstein & Prescott (2010)

Advantages of market trigger on equity

- Mandatory conversion (robust to management bias & TBTF mentality)
- Aggregate information of liquid market (less manipulated, not limited)
- Timely information & action (not obsolete, no delay)
- Objective criteria (market view, no politics)

A term sheet of CC w/ market trigger

Issuer: systemically-important financial institutions

Security: preferred equity or debt convertible to common equity

Maturity: [10] years, bullet fixed rate

Trigger: *market value of equity* falls to [4%] of RWA (Basel [III])

Conversion: full principal amount convert to [100%] of par value at [trigger price]

Transferability: no restriction

Regulatory treatment: may not qualify Tier 1 but counts towards the supervisory buffer

Coupon: [?%] (Need to price CC at the par value.)

Relation to the Literature of Pricing CC

Albul, Dwight & Tchistyi (2010)

- Assume that firm value is exogenous
- Assume that bond and CC are perpetual
- Set trigger on firm value

Pennacchi (2010)

- Assume that firm value is exogenous
- Assume that senior bond value is exogenous
- Set trigger on (equity + CC) / firm = 1 - bond / firm

McDonald (2010)

- Assume that a broad stock index is exogenous
- Assume that firm's equity value is exogenous
- Set triggers on both equity value and broad index

Example: a simple firm with CC

- Risky asset
  - can have value A (e.g., $\$106$, $\$104$, or $\$80$)
- Senior bond
  - par value: $B = \$90$ about to mature now
- Contingent capital
  - par value: $C = \$10$ about to mature now
  - conversion trigger: $K = \$5$
  - conversion ratio: $m = ?$
- One share of common equity ($n = 1$)
  - If not converted: $S = (A - B - C)/n$
  - If converted: $S = (A - B)/(n + m)$

If conversion ratio is too high or too low

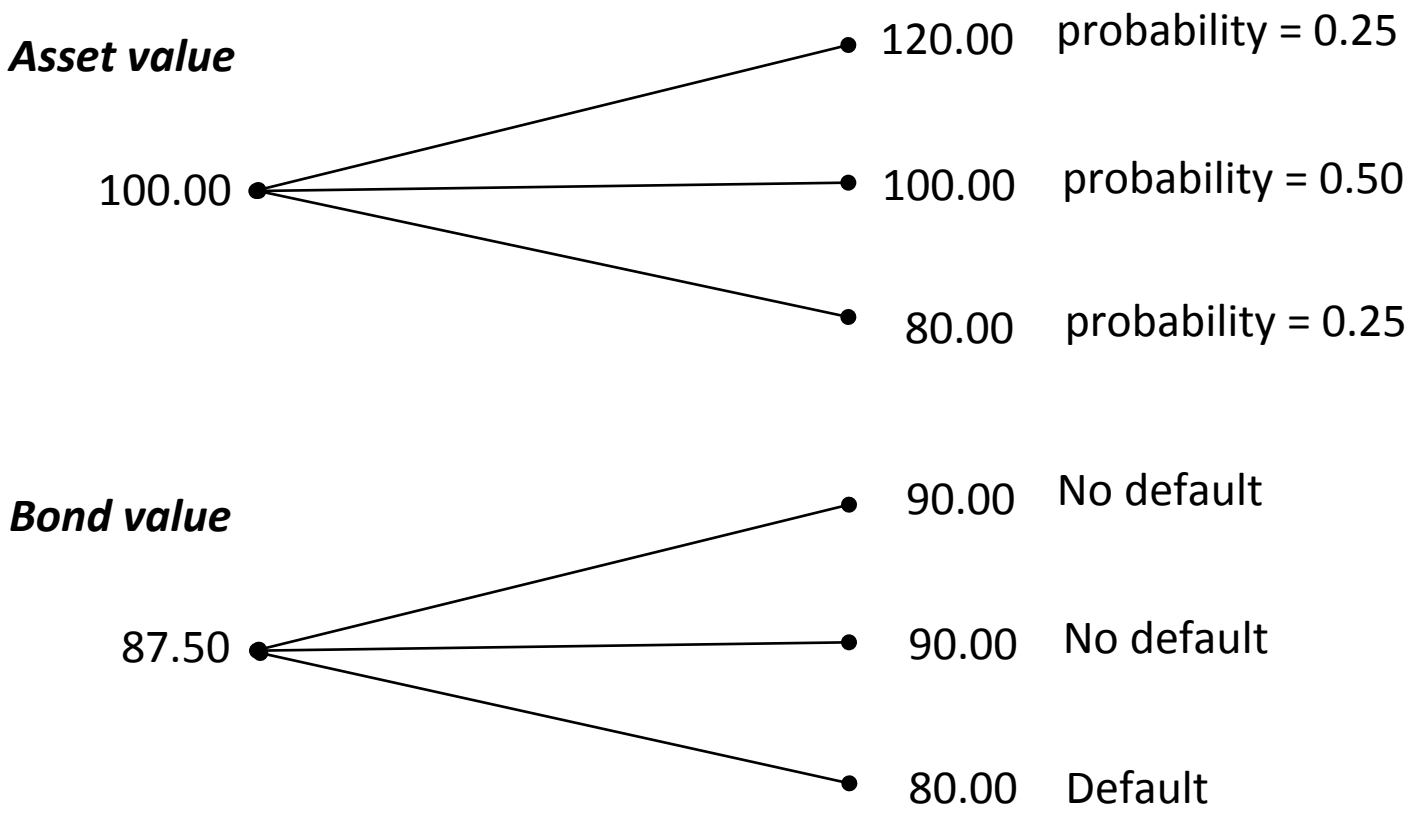
- If m = 3, when the asset value turns out to be \$106
  - If all believe CC will not convert,
    - $S = (106 - 90 - 10)/1 = 6 > K, \;\; C = \text{Par Value} = 10$
  - If all believe CC will convert,
    - $S = (106 - 90)/(1 + 3) = 4 < K, \;\; C = 3 \times 4 = 12$
  - Two rational pairs of stock price and CC value.
- If m = 1, when the asset value turns out to be \$104
  - If all believe CC will not convert,
    - $S = (104 - 90 - 10)/1 = 4 < K, \;\; C = 10$
  - If all believe CC will convert,
    - $S = (104 - 90)/(1 + 1) = 7 > K, \;\; C = 1 \times 7 = 7$
  - No stock price and CC value are rational

If conversion ratio is just right: *m* = 2

- In case asset value = $104
  - No conversion: $S = (104 - 90 - 10)/1 = 4 \quad < K$
  - Conversion: $S = (104 - 90)/(1 + 2) = 4.66 \; < K$
  - CC is expected to convert; stock price is 4.66.
- In case asset value = $106
  - No conversion: $S = (106 - 90 - 10)/1 = 6 \quad > K$
  - Conversion: $S = (106 - 90)/(1 + 2) = 5.33 \; > K$
  - CC is expected not to convert; stock price is 6.
- Observations:
  - No ambiguity about conversion
  - Market settles to unique equilibrium
  - $m = 2 \;=\; C/K = 10/5 = 2$

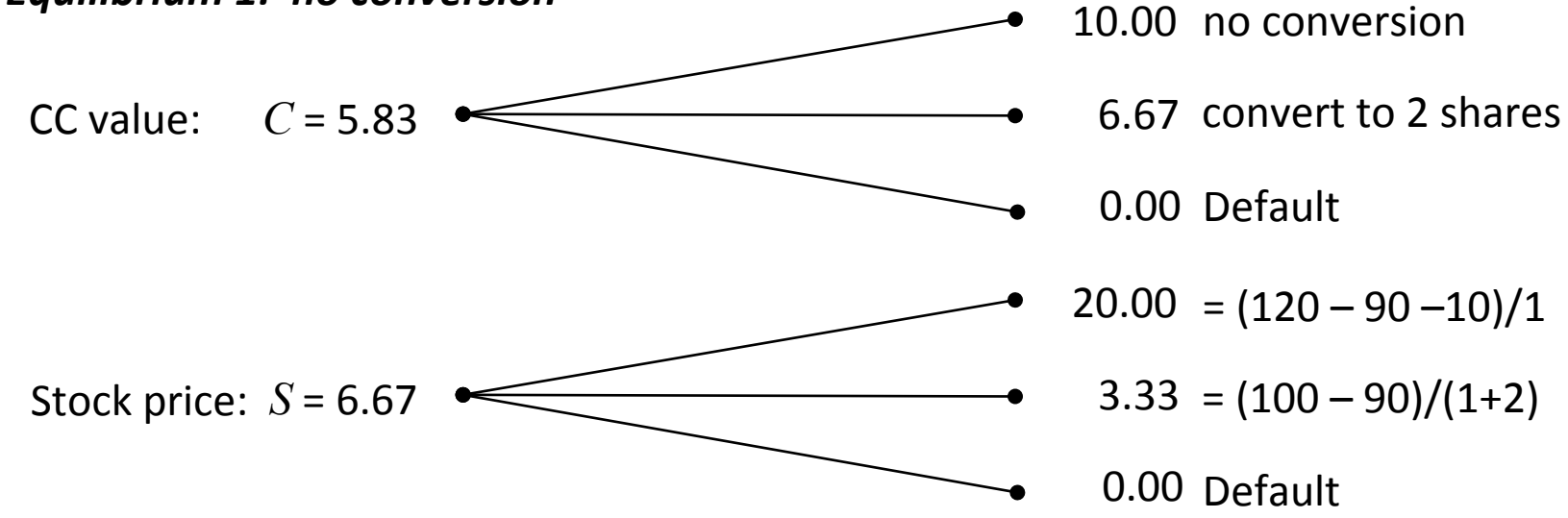
Pricing before maturity

- $m = 2$ guarantees unique equilibrium at maturity,
- but it does not guarantee this before maturity.

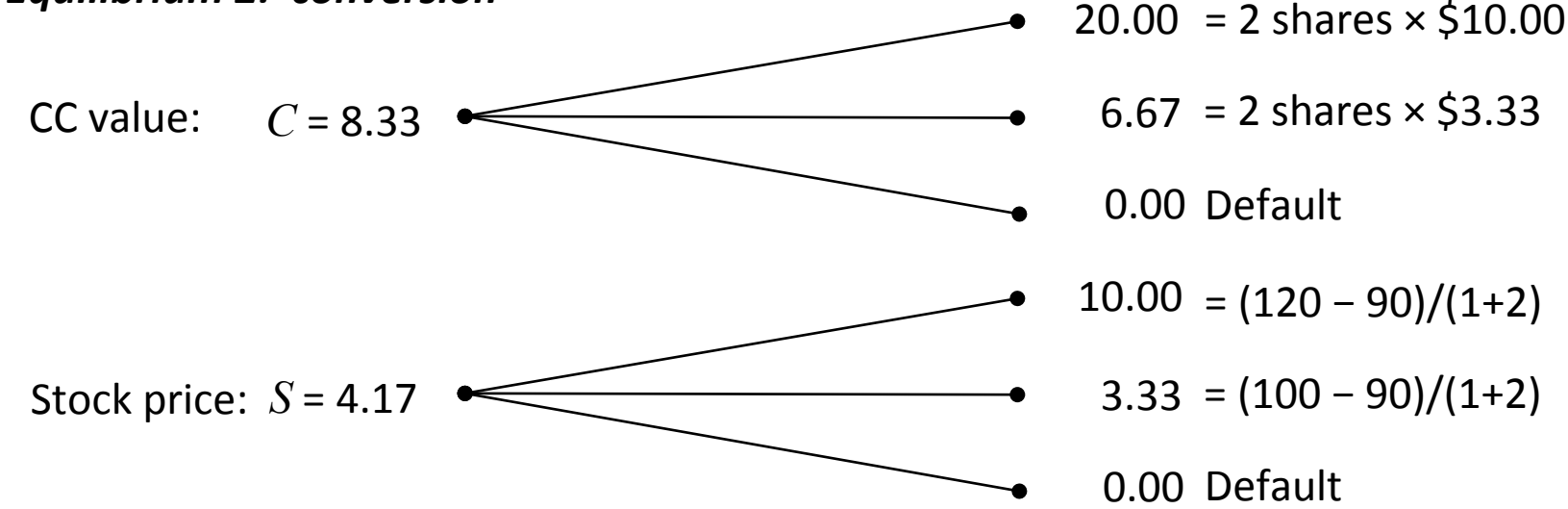


Multiple equilibria before maturity

Equilibrium 1: no conversion



Equilibrium 2: conversion



An example in dynamic continuous time model

$$dA_t = (r - \lambda\, E[Y-1])\, A_t\, dt + \sigma\, A_t\, dz_t + (Y-1)\, A_t\, dq$$

$$z_t = \text{Brownian},\ \ q_t = \text{Poisson}(\lambda),\ \ \ln(Y) \sim N(\mu_y,\, \sigma_y^{\,2})$$

Current value of asset	A_0	100
Volatility of asset	σ	4%
Arrival rate of jumps	λ	4
Mean of log-jump size	μ_y	-2%
Volatility of jump size	σ_y	5%
Riskless interest rate	r	3%

Par value of bond	B	85
Coupon rate of bond	b	4%
Maturity of bond	T	5 year
Bankruptcy cost	ω	10%

Par value of CC	C	6
Coupon rate of CC	c	0%
Maturity of CC	T	5 year
Trigger on equity value	K	1

Firm value	F_0	94.73
Bond value	B_0	85.48
Stock price	S_0	[4.91 , 7.17]
CC value	C_0	[2.08 , 4.34]

A range of equilibrium prices

The problems of no unique equilibrium

Why is unique equilibrium desired?

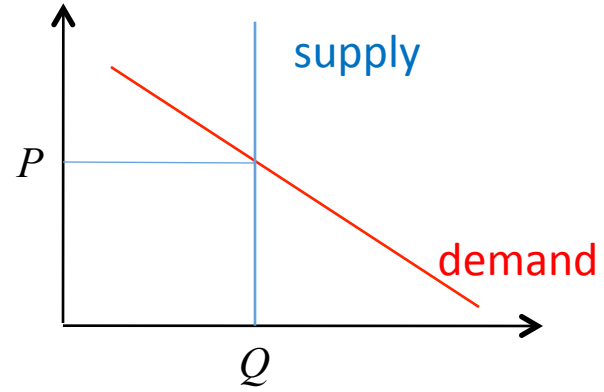
- difficult to manipulate prices
- efficient allocation of capital

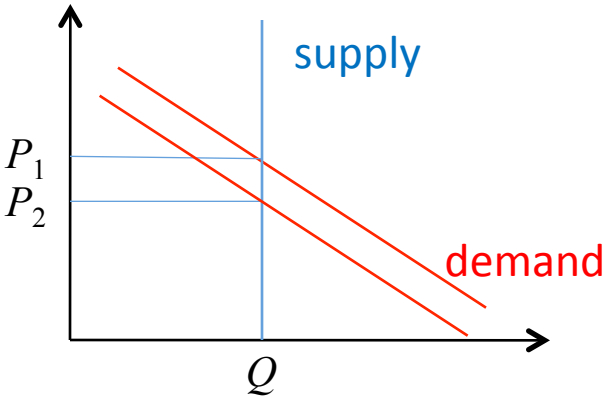
With multiple equilibriums

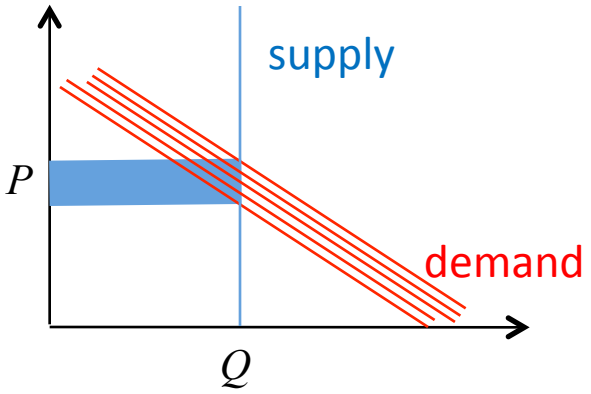
- no market force on price
  - manipulation & excessive volatility
- reward powerful players
  - Inefficient allocation of capital

Without a unique equilibrium

- Davis, Prescott, Korenok (2011)
- excessive uncertainty and volatility
- inefficient allocation of capital







The condition for unique equilibrium

Theorem. Suppose that bankruptcy is costly and asset value follows a jump diffusion process

$$dA_t = (r - \lambda\, E[Y-1])\, A_t\, dt + \sigma\, A_t\, dz_t + (Y-1)\, A_t\, dq_t$$

$$z_t = \text{Brownian},\ \ q_t = \text{Poisson}(\lambda),\ \ Y = \text{log-normal}.$$

For any given trigger K_t and conversion ratio m_t, a necessary and sufficient condition for the existence of a unique dynamic rational expectations equilibrium of CC value and stock price, (C_t, S_t), is $m_\tau = C_\tau / K_\tau$ for all possible conversion time τ.

- Conversion ratio is tied to trigger price and CC value.

- Cannot punish managers at conversion:

$$m_\tau S_\tau \le m_\tau K_\tau = C_\tau$$

Assume banks can always issue new shares

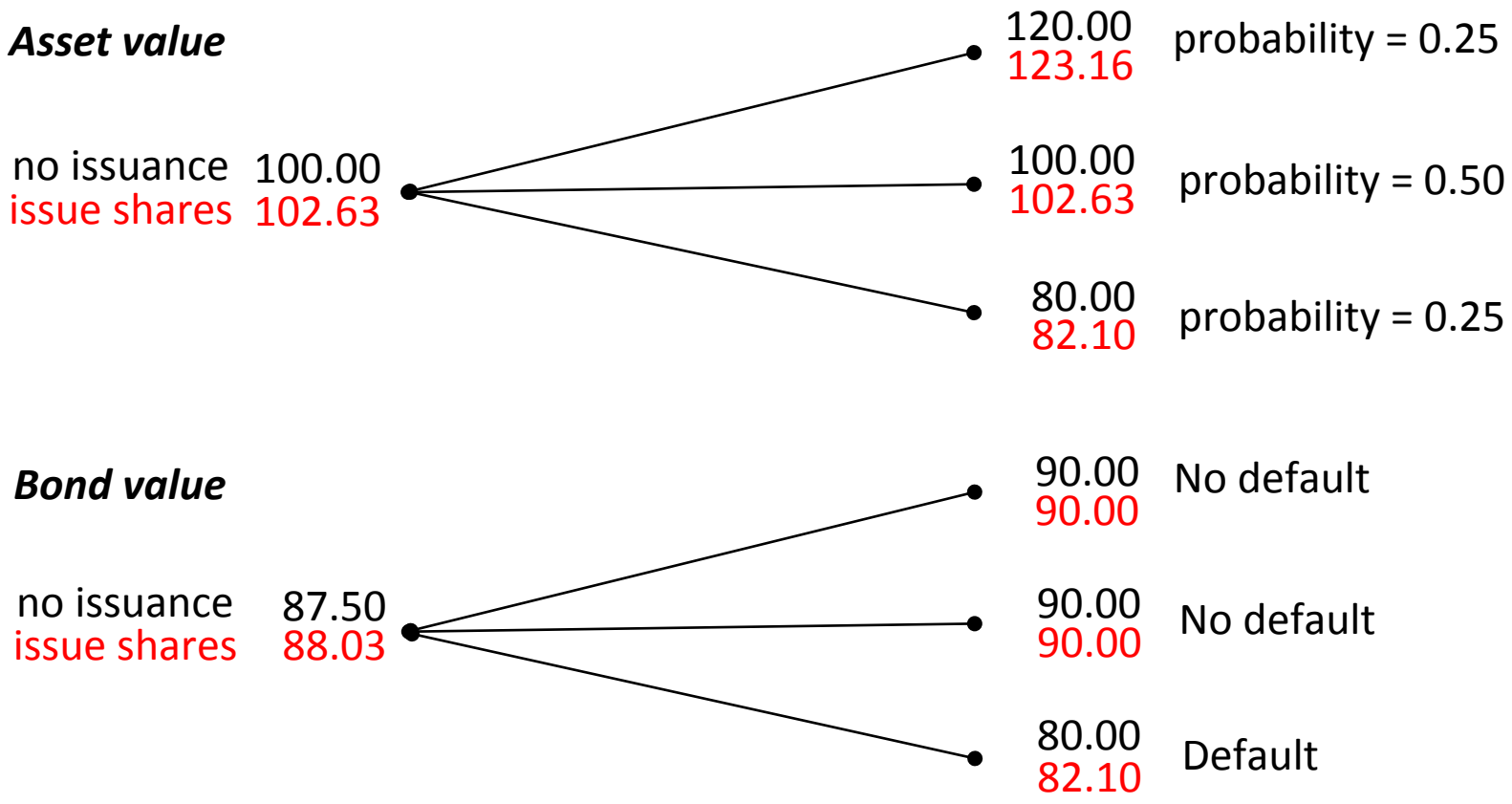
- Calomiris & Herring (2011) :
  - Set conversion ratio to be punitive
  - Banks always issue new shares to avoid hitting trigger
    - CC "almost" never converts to equity
  - There is always a unique equilibrium
- Suppose $m = 3$ and $A = \$106$
  - If all believe CC will not convert,
    - Stock price: $S = (106 - 90 - 10)/1 = 6$
    - CC price: $C = \text{Par Value} = 10$
  - If issuing 1 share at \$6 to avoid conversion,
    - Equity ratio: $(1+1)\times S/(A+S) = 2\times 6/(106+6) \approx 11\%$
    - Stock price: $S = (106 + 6 - 90 - 10)/(1 + 1) = 6$
  - Unique equilibrium in stock price and CC value.

Our analysis with stock issuance

- No ratio ensures conversion being punitive:
  - If $m \times S > C$, conversion is punitive.
  - There is no positive m to satisfy $m > C/S$ for all S.
- Always a positive chance for CC to convert:
  - If issuance price > converted price, issuance is optimal.
  - Prob{issuance price ≤ converted price} > p > 0
- No guarantee for uniqueness of equilibrium:
  - Calomiris & Herring (2011) only analyze an example,
    - where the firm is not leveraged after issuance.
  - They ignore the increase of bond value after issuance
    - in a firm that remains highly leveraged.
  - Multiple equilibrium may still occur in
    - dynamic stochastic rational expectations models.

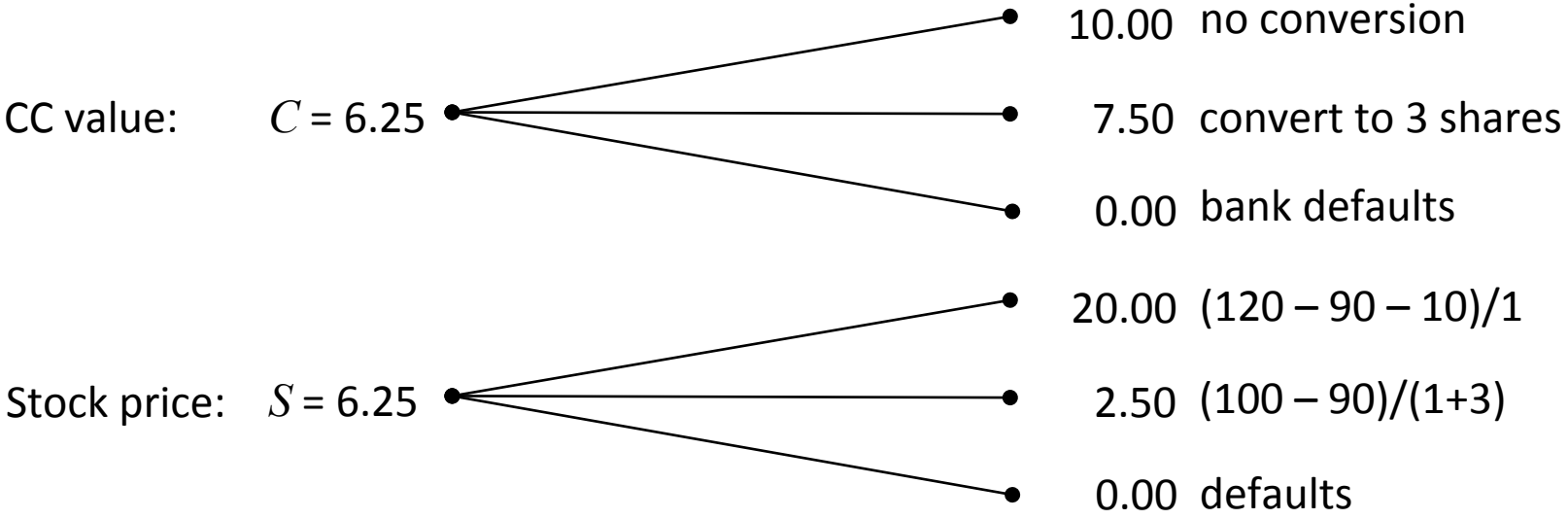
Asset & bond value before & after issuance

- Enlarge shares by 50% at $5.26 per share, for example.
- Asset magnified with constant return to scale.
- Reduction in leverage raises senior bond value by $0.47.

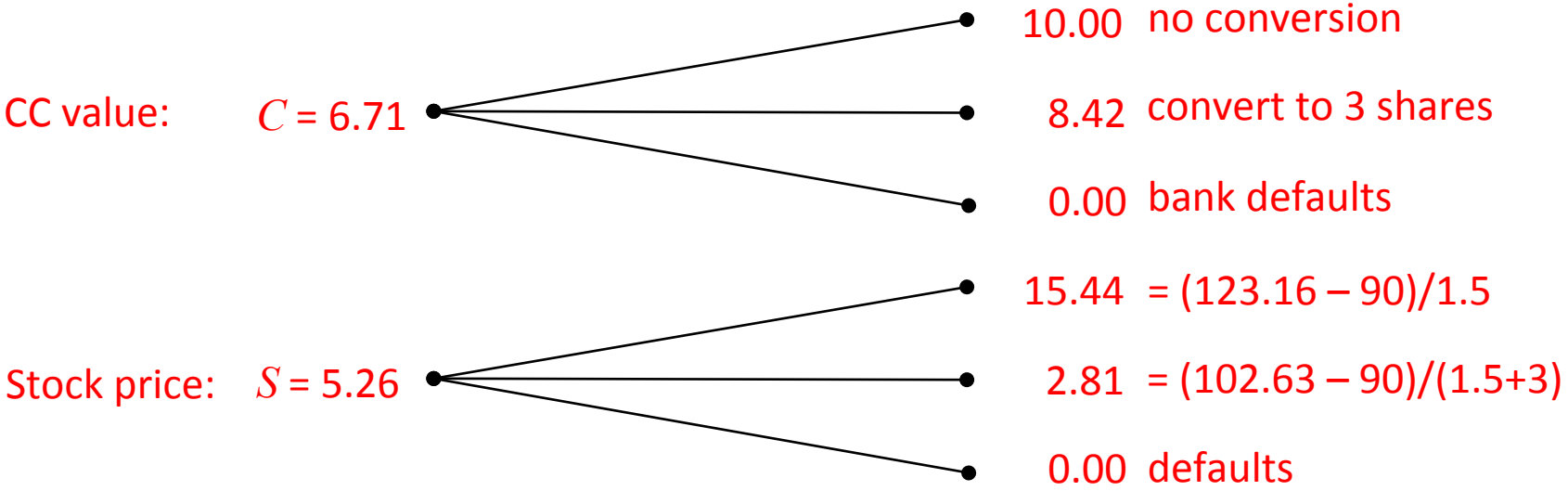


Multiple equilibria with stock issuance

Equilibrium 1: no conversion or issuance



Equilibrium 2: issue a share to avoid conversion



Conclusion about CC with market trigger

In general, CC with market trigger leads to

- multiple/no equilibrium in CC and equity prices.

This is still true in more complicated settings.

- Equity issuance does not guarantee unique equilibrium.
    - Bond can have multiple equilibrium values.
- Multiple equilibrium can exist with financial distress costs.
    - Firm can have multiple equilibrium values.

Concerns that are important for regulators:

- CC with a unique equilibrium
    - Cannot be punitive to managers at conversion;
- CC without a unique equilibrium
    - adds uncertainty to the capital markets
    - and causes inefficient capital allocation.