

# Masters in FINANCE

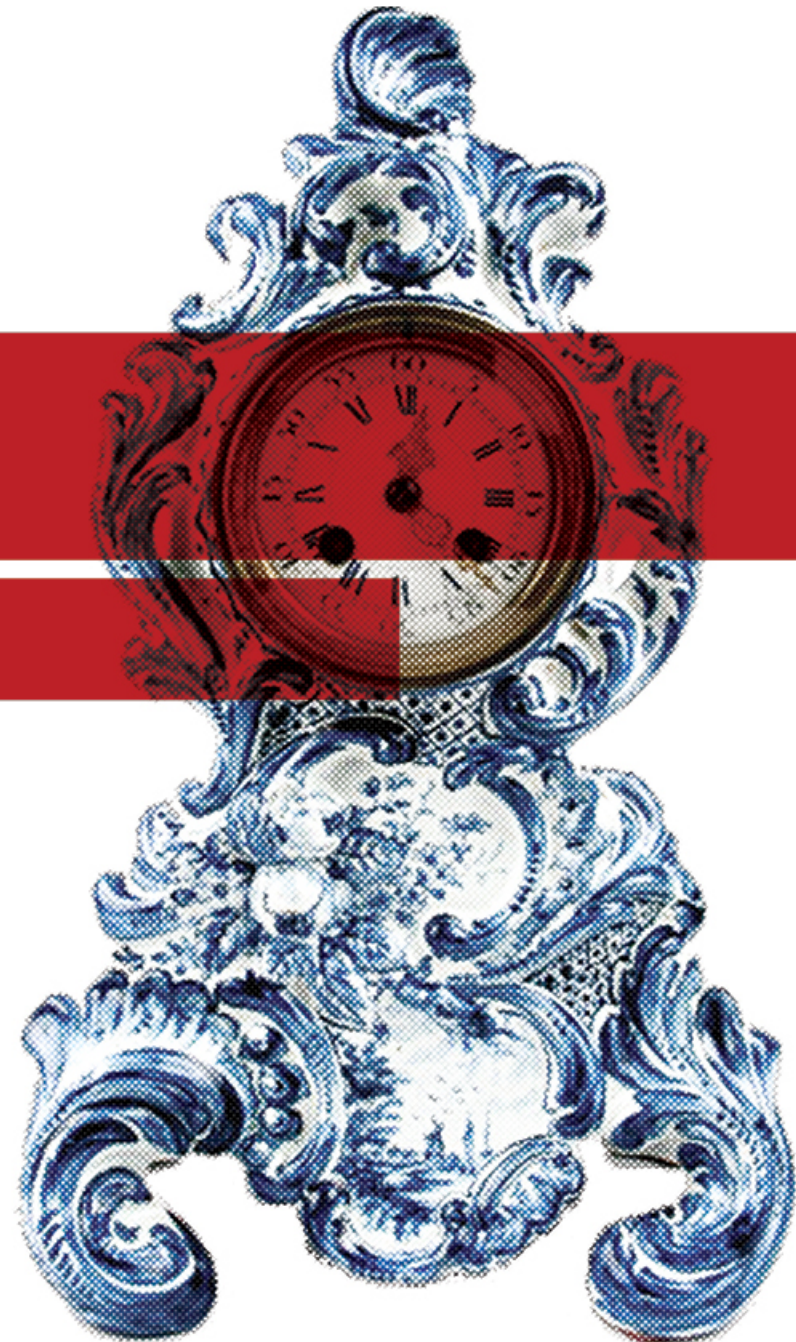
## HYBRID FINANCING Convertible Bonds

Corporate Investment Appraisal

Fall 2017



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## What are Convertible Bonds?

Convertibles are bonds which may be converted into a specific number of shares, the conversion being a decision of their holders.

Many convertible bonds have a “call feature” (i.e., the firm that issued the bonds may buy them back, forcing their conversion).

A convertible bond can be seen as a package of a standard bond and a warrant.



## EXAMPLE

Current Number of Shares: 45 207 580

Current Share Price: 31

Number of Convertible Bonds: 130 500

Nominal Value: 1000 per bond; Annual Coupon 4.5%

Conversion Price: 38.131 (per each new share)

Conversion Ratio: 26.225 (number of shares per convertible bond)

The fraction of equity that the bond-holders will hold in case they convert is:

$$\frac{\text{Conversion Ratio} \times \text{Number of Convertibles}}{\text{Number of Old Shares} + \text{Conversion Ratio} \times \text{Number of Convertibles}} =$$
$$= \frac{26.225 \times 130,500}{45.2\text{million} + 26.225 \times 130,500} = 7.038\%$$



## CONVERSION AT MATURITY

In what circumstances do bondholders convert?

Payoff to bondholders at maturity:

Convert: €  $0.07038 V^*$  = €  $\lambda V^*$

Not Convert: € 130.5 million = €  $F$

$V^*$  represents the value of the firm minus the value of debt at maturity

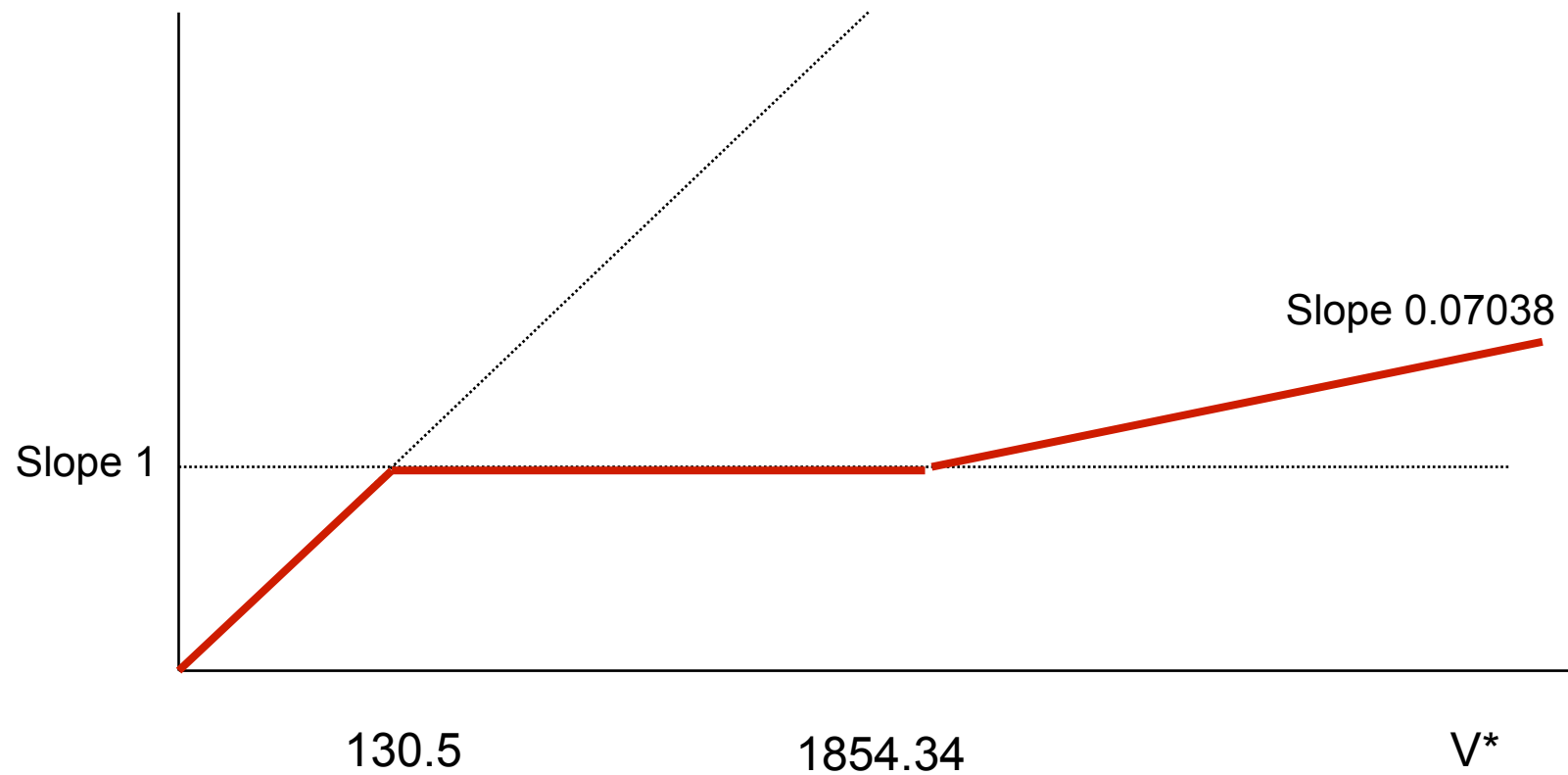
Therefore, the decision to convert is based on:

Convert if:  $0.07038V^* > 130.5$  million ( $\lambda V^* > F$ )

No Conversion if:  $0.07038V^* < 130.5$  million ( $\lambda V^* < F$ )



## PAYOFF AT MATURITY





## VALUE THE COMPONENTS SEPARATELY:

### 1) STRAIGHT BOND

We can compute theoretical values for the components “Straight Bond” and “Warrant” separately.

#### Standard Bond:

Nominal Value = 130.5 million

Coupon = 4.5%

Time to maturity = 5 years

Yield of a “normal” bond, similar in terms of risk = 7%

Value of the Straight Bond component:

$$\frac{5.8725\text{mil}}{1.07} + \frac{5.8725\text{mil}}{1.07^2} + \frac{5.8725}{1.07^3} + \frac{5.8725}{1.07^4} + \frac{5.8725}{1.07^5} + \frac{130.5}{1.07^5} = 117.123 \text{ million}$$

*Common “mistake: Hence, the warrant component seems to be worth (130.5-117.123) = 13.377 million of the price of the convertible bonds...*



VALUE THE COMPONENTS SEPARATELY:

2) WARRANT COMPONENT

$$W = 0.07038 \times Call(V - PV(\text{coupon}), t = 5 \text{ years}, F / \lambda = 1854.34 \text{ million})$$

V is the current value (after issuing the convertible bonds) of the firm's assets (minus its debt);

$$V = 45.2 \text{ million} \times 31 + 130.5 \text{ million} = 1531.93 \text{ million}$$

$$PV(\text{Coupons}) = 24.08 \text{ million}$$

Assuming that the equity volatility is 20% and that the risk-free interest rate is 6.5% per year, the value of the warrant component is:

$$0.07038 C(1507.85 \text{ million}, t=5 \text{ years}, F/\lambda=1854.34, \text{sigma}=20\%) \\ = 23.8 \text{ million}$$



The total value of the Convertible Bonds is:

$$117.1 + 23.8 = 140.9 \text{ million}$$

But the bonds were sold for 130.5 million (This might be usual...  
So it seems in the City..)

Did the bondholders make a good deal?

Note (careful!): The value of the warrant component may appear written as:

~~$$W = 0.07038 \times 45.2 \text{million} \times \text{Call}(S, t = 5 \text{years}, K = 38.131)$$~~

with  $S$  being the current value (after the issuance of the convertibles) of the firm's equity, on a "per share" basis. That is:

$$S = \frac{45.2 \text{million} \times 31 + 13.4 \text{million}}{45.2 \text{million}} = 31.30$$





## OPTIMAL “CALL” STRATEGY

If the managers maximize the wealth of the shareholders, they should try to minimize the value that accrues to the convertible bond-holders (once these are out).

They should “call” them as soon as:

$$\text{Value of the Convertible Bond} = \text{Call Price}$$

Nevertheless, convertible financial assets are generally not called until the premium above the call price is significant.



## WHY ISSUE CONVERTIBLES?

### Pilcher 1955

Delayed equity	82%
Sweeten Debt	9%
Other	9%

### Brigham 1966

Delayed equity	68%
Sweeten Debt	27%
Other	5%

### Hoffmeister 1977

Delayed equity	40%
Sweeten Debt	37%
Other	23%



## “SWEETEN DEBT”: A TECHNICAL DETAIL

Agency Cost of Debt (“Moral Hazard” of debt) (SHIFT VALUE FROM DEBTHOLDERS TO SHAREHOLDERS, BY INCREASING EXPOSURE TO RISK).

Suppose the assets of the firm become more volatile. How does this affect the value of a convertible bond?

Value of the straight bond component goes down;

Value of the Warrant component goes up.

It is conceivable to “design” a convertible bond for which the two effects exactly compensate each other. A convertible bond can be locally independent of risk.



## “DELAYED EQUITY”

### “Lemons” Problem:

Managers have better information than investors. They believe that new shares issued today would be under-valued.

Debt can be a better alternative (less sensitive to the asset value of the firm).

But “normal” debt may increase the “costs of financial distress”.

Under-valued firms are tempted to issue debt; Over-valued firms are tempted to issue equity. Firms “in-between” may issue convertibles.



## PROFILE OF ISSUING FIRMS

Convertible Bonds represented 1/3 of corporate debt (U.S., 1990s).

Companies that issue convertibles tend to have a moderate to low rating

High	High	Higer % of
Volatility	Leverage	intangible assets