Chapter 35
DEBT, EQUITY AND OPTIONS THEORY

Light too bright to see by

The theories of corporate finance examined so far may have given the impression that the only difference between debt and equity is the required rate of return. However, **there is a big difference between the 10% return required by creditors and that required by shareholders.**

Shareholders simply hope to achieve this rate, which forms an average of rates that can be either positive or negative. The actual return can range from 0% to 100%, with the entire gamut of variations in between!

Creditors are assured of receiving the required rate, but never more. They can only hope to earn the 10% return but, with a few exceptions, this hope is almost always fulfilled. So here we have the first distinction between creditors and shareholders: the probability distribution of their remuneration is completely different.

This said, although the creditor's risk is very low, it is not nil. Capitalism is built on the concept of corporation, which legally **restricts shareholders' liability with respect to creditors**. When a company defaults, shareholders hold a "trump card" that allows them to hand the company, or rather, its liabilities, over to the lenders.

The main financial innovation of the 19th century is the corporation.

In the rest of this chapter, *we will concentrate on the valuation of companies in which shareholders responsibility is limited to the amount they have invested.* This applies to the vast majority of all companies in modern capitalism, be they corporations, limited liability companies or sole ownerships with limited liability.

This is the fundamental difference between shareholders and creditors: the former can lose their entire investment, but also hope for unlimited gains, while the latter will at best earn the flows programmed at the beginning of the contract.

Keep this in mind as we use options to analyse corporate structure and, more importantly, the relationship between shareholders and creditors.

Section 35.1
ANALYSING THE FIRM IN LIGHT OF OPTIONS THEORY

To keep our presentation simple, we shall take the example of a joint stock company in which enterprise value EV is divided between debt (V_D) and equity (V_E).

We shall also assume that the company has issued only one type of debt – zero coupon bonds – redeemable upon maturity at full face value (principal and interest) for 100.

1/ EQUITY AND DEBT IN TERMS OF OPTIONS

Depending on the enterprise value when the debt matures, two outcomes are possible.

- The enterprise value is higher than the amount of debt to be redeemed (e.g. $EV = 120$). In this case, the shareholders let the company repay the lenders and take the residual value of 20.
- The enterprise value is lower than the amount of debt to be redeemed (e.g. $EV = 70$). The shareholders may then invoke their limited liability clause, forfeiting only their investment, and transfer the company to the lenders who will bear the difference between the enterprise value and their claim.

Now let us analyse this situation in terms of options. From an economic standpoint, shareholders have a call option (known as a European call if it can only be exercised at the end of its life) on the firm's assets. Its features are:

- **Underlying asset** = capital employed.
- **Exercise price** = amount of debt to be reimbursed (100).
- **Volatility** = volatility of the underlying assets, i.e. the capital employed.
- **Maturity** = expiration date.
- **Interest rate** = risk-free rate corresponding to the maturity of the option.

At the expiration date, shareholders exercise their call option and repay the lenders, or they abandon it. The value of the option is no other than the value of equity (V_E).

From the shareholder's point of view, when a company borrows funds, it is selling its "enterprise value" to its creditors, but with an option to buy it back (at the exercise price) when the debt matures. The shares of a levered company thus represent call options on the capital employed.

The lender, on the other hand, who has invested in the firm at no risk, *has sold the shareholders a put option on the capital employed*. We have just seen that in the event of default, the creditors may find themselves the unwilling owners of the company. Rather than recouping the amount they lent, they get only the value of the company back. In other words, they have "bought" the company in exchange for the outstanding amount of debt.

The features of the put option are:

- **Underlying asset** = capital employed.
- **Exercise price** = amount of debt redeemable upon maturity (100).
- **Volatility** = volatility of the underlying asset, i.e. the capital employed.
- **Maturity** = maturity of the debt.
- **Interest rate** = risk-free rate corresponding to the maturity of the option.

The sale of this (European-style) put option results in additional remuneration for the debt-holder which, together with the risk-free rate, constitutes the total return. This is only fair, since the debt-holder runs the risk that the shareholders will exercise their put option, in other words, that the company will not pay back the debt.

The value of this option is equal to the difference between the value of the loan discounted at the risk-free rate and its market value (discounted at a rate that takes into

account the default risk, i.e. the cost of debt k_D). This is the risk premium that arises between any loan and its risk-free equivalent.

All this means is that the debt-holder has lent the company 103 at an interest rate equal to the risk-free rate. The company should have received 103, but the value of the loan is only 100 after discounting the flows at the normal rate of return required in view of the company's risk, rather than the risk-free rate.

The company uses the balance of 3, which represents the price of the credit risk, to buy a put option on the capital employed. In short, the company receives 100 while the bank pays 100 for a risky claim since it has sold a put option for capital employed that the company, and therefore the shareholders, will exercise if its value is lower than that of the outstanding date at maturity. By exercising the option, the company, and thus its shareholders, discharges its debt by transferring ownership of the capital employed to the creditors.

Lending to a company is a means of investing in its assets at no risk. The lender sells the shareholders a put option at an exercise price that is equal to the debt to be repaid.

In conclusion, we see that, depending on the situation at the redemption date, one of the following two will apply:

- if $V_D < V$ the value of the call option is higher than 0, the value of the put option is zero and equity is positive,
- if $V_D > V$ the value of the call option is zero, the value of the put option is higher than 0, and the equity is worthless.

2/ AN OPTIONS APPROACH TO FINANCIAL SECURITIES

We have already seen that the additivity rule for equity and debt applies and that there is no connection between enterprise value and the type of financing:

$$\text{Enterprise value} = \text{equity} + \text{debt}$$

Based on the preceding developments, we deduce that:

$$\begin{aligned}\text{Value of equity} &= \text{value of the call option on capital employed}\\ \text{Value of debt} &= \text{present value of debt at the risk-free rate}\\ &\quad - \text{value of the put option}\\ \text{Enterprise value} &= \text{value of the call option}\\ &\quad + \text{present value of debt at the risk-free rate}\\ &\quad - \text{value of the put option}\end{aligned}$$

This brings us back to the fundamental equality between put and call options we examined in Chapter 28:

$$\begin{aligned}&\text{Buying a call option} + \text{selling a put option} =\\ &\qquad \text{Buying the underlying asset} + \text{borrowing at the risk-free rate}\end{aligned}$$

This underscores the relationship between the value of a call on capital employed and the value of a put on the same capital employed:

$$\text{Value of equity} = \text{EV} - \text{present value of debt at the risk-free rate} + \text{value of the put on capital employed}$$

Section 35.2
CONTRIBUTION OF OPTIONS THEORY TO THE VALUATION OF EQUITY

We have demonstrated that the value of a firm's equity is comparable to the value of a call option on its capital employed. The option's exercise price is the amount of debt to be repaid at maturity, the life of the option is that of the debt, and its underlying asset is the firm's capital employed.

This means that, at the valuation date, the value of equity is made up of an intrinsic value and a time value. The intrinsic value of the call option is the difference between the present value of capital employed and the debt to be repaid upon maturity. The time value corresponds to the difference between the total value of equity and the intrinsic value.

The main contribution of options theory to corporate finance is the concept of a time value for equity.

Take, for example, a company where the return on capital employed is lower than that required by investors in view of the related risk. The market value is thus lower than the book value.

If the debt were to mature today, the shareholders would exercise their put option since the capital employed is worth only 70 while the outstanding debt is 80. The company would have to file for bankruptcy. Fortunately, the debt is not redeemable today but only in, say, 2 years time. By then, the enterprise value may have risen to over 80. In that case, equity will have an intrinsic value equal to the difference between the enterprise value at the redemption date and the amount to be redeemed (in our case, 80).

Today, however, the intrinsic value is zero and the present value of equity (8) can only be explained by the time value, which represents the hope that, when the debt matures 2 years hence, enterprise value will have raised enough to exceed the amount of debt to be repaid, giving the equity an intrinsic value.

As seen in the graphs below, a company's financial position can be considered from either the shareholders' or the creditors' standpoint.

By now you must be eager to apply your new-found knowledge of options to corporate finance!

(a) The time value of an option increases with the volatility of the underlying asset

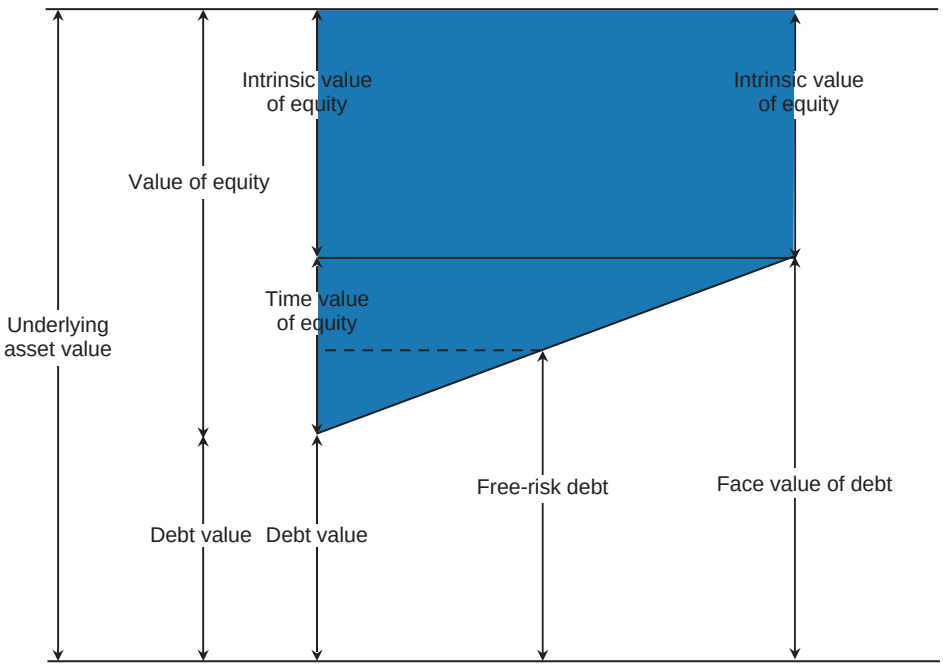
The more economic or industrial risk on a company, the higher the volatility of its capital employed and the higher the time value of its equity. The options method is thus used to

value large, risky projects financed by debt, such as the Channel tunnel, leisure parks, etc. or those with inherent volatility, such as biotech start-ups.

(b) The time value of an option depends on the position of the exercise price relative to the market value of the underlying asset

When the call option is out-of-the-money (enterprise value lower than outstanding debt), the company's equity has only time value. Shareholders hope for an improvement in the company, whose equity has no intrinsic value.

A DECOMPOSITION OF THE UNDERLYING ASSET VALUE



Decomposition of the value of the underlying asset.

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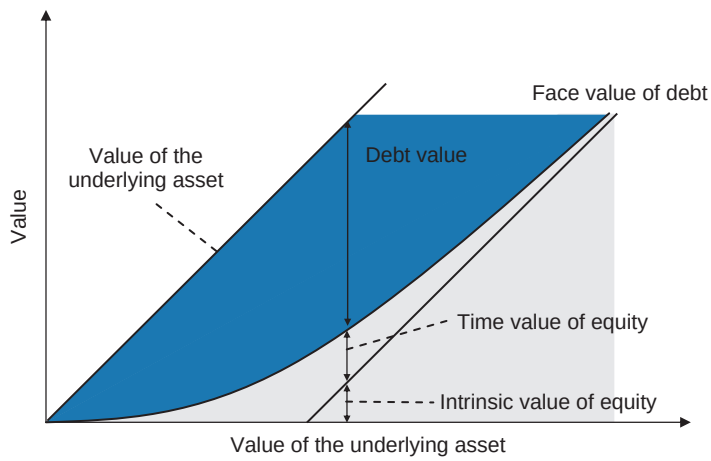

shareholders' position

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debtholders' position

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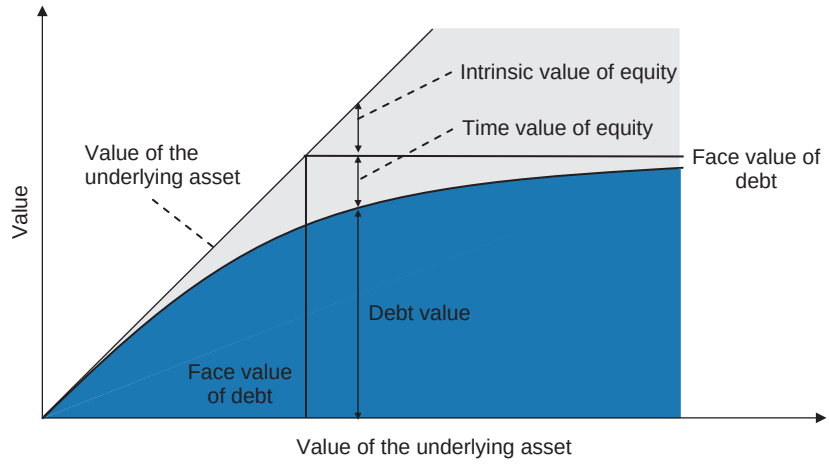


When the call option is at-the-money (enterprise value equal to debt at maturity), the time value of equity is at its highest and anything can happen. Using the options method to value equity is now particularly relevant, since it can quantify shareholders' anticipations.

When the call option is in-the-money (enterprise value higher than outstanding debt at maturity), the intrinsic value of equity quickly outweighs the time value. The risk on the debt held by the lenders decreases and becomes nearly nonexistent when the enterprise value tends towards infinity. This brings us back to the traditional idea that the higher the enterprise value, the less risk creditors have of a default, and the more the cost of debt approaches the risk-free rate.

Using options theory to analyse liabilities is particularly helpful when a company is in financial distress.

The options method is therefore applied to companies that carry heavy debt or are very risky.

(c) The time value of an option increases with its maturity

This is why it is so important for companies in distress to reschedule debt payments, preferably at very long maturities.

The example below illustrates the use of options to value equity.

Take a company that has both debt and equity financing and let us assume its debt is 100, redeemable in 1 year. If, based on its degree of risk, the debt carries 6% interest, the amount to be repaid to creditors 1 year later is 106.

Traditional theory tells us that if the firm's value is 150 at the time of calculation, the value of equity – defined as the difference between enterprise value and the value of debt – will be $150 - 100 = 50$.

What happens if we apply options theory to this value?

We shall assume the risk-free rate is 5%. The discounted value of the debt + interest payment at the risk-free rate is 106/1.05, or 100.95.

The value of debt can be expressed as:

$$\text{Value of debt} = \text{Value of debt at the risk-free rate} - \text{value of a put}$$

i.e. value of the put $= 100.95 - 100 = 0.95$.

We know that the value of equity breaks down into its intrinsic and time value:

	Value of equity	=	50
−	Intrinsic value = 150 − 106	=	44
=	Time value	=	6

You can see that, for this company with limited risk, the time value measuring the actual risk is far lower than the intrinsic value. Similarly, the value of the put, which acts as a risk premium, is very low as well.

Now, let's increase the risk to the capital employed and assume that the cost of equity required by the creditors is 15% rather than 6%, corresponding to a 10% risk premium. The amount to be repaid in 1 year is thus 115.

The value of the debt discounted at the risk-free rate is 115/1.05, or 109.52. The value of the put is thus 109.52 − 100 = 9.52.

Note that the risk premium for this company is much higher than in the preceding example, reflecting the increasing probability that the company will default on its debt.

The value of equity, which is still 50, breaks down into intrinsic value of 35 (150 − 115) and a time value of 15 (50 − 35). Since there is more risk than in our previous example, the time value accounts for a higher portion of the equity value.

Section 35.3
USING OPTIONS THEORY TO ANALYSE A COMPANY'S FINANCIAL DECISIONS

Options theory helps us understand how major corporate financial decisions (choice of capital structure, dividend payout, investment decisions, etc.) affect shareholders and creditors differently, and how they can result in a transfer of value between the two.

Example Take the example of a holding company, Holding SA, which owns 100 ordinary shares of Daughter SA, listed at €2230. We shall assume that the liabilities of Holding SA comprise 100 shares and 300 bonds. Each of the latter is a zero-coupon bond with a redemption value of €1000 in 3 years time. The creditors do not expect any coupon payments or changes in the capital structure before the debt redemption date.

The table below lists the closing prices for a call option on a Daughter SA share at various exercise prices:

Exercise price (€)	Value of a 3-year call option on Daughter SA (€)
2,600	130
2,800	80
3,000	45
3,200	32

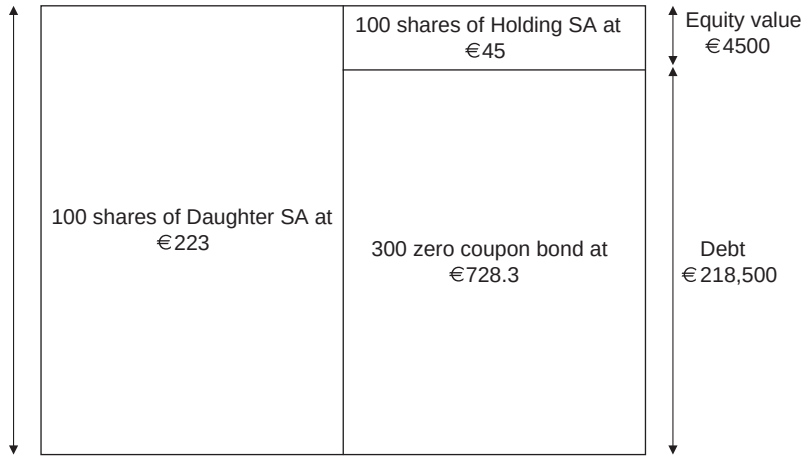
The enterprise value of Holding SA is equal to the number of Daughter SA shares multiplied by their closing price, i.e. €223,000.

Consider each of the 100 shares booked under liabilities at Holding SA as being an option on its capital employed (the shares of Daughter SA), i.e. €223,000, with an exercise price that is equal to the amount of Holding SA debt outstanding, giving 300 bonds × €1000 = €300,000.

Each Holding SA share can thus be considered to be a call option with an exercise price of: €300,000/100 shares = €3,000, and a maturity of 3 years.

According to the table above, Holding SA's equity value is thus €45 × 100 shares = €4500.

MARKET VALUE BALANCE SHEET OF HOLDING SA



The value of debt is equal to the difference between the enterprise value (€223,000) and that of equity (€4500), i.e. €218,500.

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One bond is therefore worth €728.3 (€218,500/300), corresponding to an implied yield of 11.1% (in fact: $728.3 = 1000/(1 + 0.111)^3$).

We will now discuss a few major financing or investment decisions in a context of **equilibrium** – that is, where the debt, shares and assets held are bought or sold at their fair value, **without the market having anticipated the decision**.

1/ INCREASING DEBT

Suppose the shareholders of Holding SA decide to issue 20 additional bonds and use the proceeds to reduce the company's equity by distributing an exceptional dividend. The overall exercise price corresponding to the redemption value of the debt at maturity is:

$$320 \text{ bonds} \times €1000 = €320{,}000, \text{ or } €3200 \text{ per share.}$$

A look at the listed prices of the options shows us that at an exercise price of €3200, Holding SA's equity is valued as €32 × 100 shares = €3200, indicating that the value of its debt at the same date is: €219,800 (223,000 − 3200).

The new bondholders will thus pay €13,737 (20 bonds × €219,800/320 bonds), which will go to reduce the equity of Holding SA.

The shareholders consequently have €13,737 in cash and €3200 in shares, i.e. a total of €16,937 compared with the previous €4500. They have gained €12,437 to the detriment of the former creditors, who have seen the value of their claim fall from €218,500 to 300 bonds × €219,800/320 bonds, or €206,063.

Their loss ($218,500 - 206,063 = €12,437$) exactly mirrors the shareholders' gain.

The implicit yield to maturity has risen to 13.3%, reflecting the fact that the borrowing has become riskier since it now finances a larger share of the same amount of capital employed.

Increasing the risk to creditors has enhanced the value of the shares, thereby reducing that of the bonds. The existing creditors have lost out because they were not able to anticipate the change in corporate structure and have been harmed by the dividend distribution.

Common (accounting) sense seems to indicate that distributing €13,737 in cash to shareholders should translate into an equivalent decrease in the value of their Holding SA shares. According to this reasoning, after the buyback the Holding SA shares should have been revalued at −€9237 (€4500 − €13,737), but that cannot be!

Options theory solves this apparent paradox. It shows that when new debt is issued to reduce equity, the time value of the shares decreases less than the amount received by shareholders and remains positive. True, the likelihood that the value of Daughter SA shares will be higher than that of the redeemable debt upon maturity has lessened (since debt has increased), but it is still not nil, giving a time value that, while lower, is still positive.

Of course, this example is exaggerated. Such a decision would have catastrophic consequences for shareholders who would be taken to court by the creditors and lose all credibility in the eyes of the market. But it effectively illustrates the contribution of options theory to equity valuations.

Increasing debt increases the value of shareholders' investment to the detriment of the claims held by existing creditors. Thus value is transferred from creditors to shareholders.

Conversely, when debt is reduced by a capital increase, the overall value of shares does not increase by the value of the shares issued. The old debt, which has become less risky, has in fact "confiscated" some of the value to the benefit of creditors and the detriment of shareholders.

2/ THE INVESTMENT DECISION

Now let us return to our initial scenario and assume that Holding SA manages to exchange the 100 shares of Daughter SA for 100 shares of a company with a higher risk profile called Risk SA, for €223,000 (100 × €2230).

Each share of Holding SA is equal to a call option on a Risk SA share with an exercise price of €3000 (300 × 1000/100).

Suppose the value of a call option on a Risk SA share is €140 with an exercise price of €3000 and an exercise date in 3 years' time.

The Holding SA shares are consequently worth €14,000.

Exchanging a low-risk asset (Daughter SA) for a highly volatile asset (Risk SA) has redistributed value to the benefit of shareholders, whose gain is €9500 ($14,000 - 4500$).

Their gain is offset by an equivalent loss to creditors, since the value of the debt has fallen from 218,500 to $223,000 - 14,000 = €209,000$, i.e. a €9500 decline.

The higher risk led to an increase in the implicit yield to maturity of the bonds from 11.1% to 12.8%.

As in our previous examples, the transfer of value was only possible because creditors underestimated the power shareholders have over the company's investment decisions.

3/ RENEGOTIATING THE TERMS OF DEBT

What if we now return to our initial situation and imagine that the company is able to reschedule its debt? This happens when creditors prefer to let a company in financial distress attempt a turnaround rather than precipitate its demise.

So let's assume the debt is due in 4, rather than the initial 3 years. A look at our options price list for Daughter SA shares with a 4-year maturity shows us that they carry a higher premium.

Exercise price (€)	Value of put on Daughter SA shares in 3 years (€)
2600	140
2800	89
3000	53
3200	40

This, of course, comes as no surprise to our attentive readers who remember learning in Chapter 28 that the value of an option increases with the length of its life.

The value of equity is thus €53 × 100 shares = €5300. A bond is therefore worth €725.7 (€217,700/300). Without having abandoned any flows, creditors' generosity will have cost them €800.

To sum up:

- Leveraging a company either to distribute dividends, reduce capital or to invest tends to increase the risk to creditors, transferring value from them to shareholders. The value of the shares diminishes less than the dividend payout and increases when the debt is used for investment purposes.
- Similarly, replacing non-risky with risky assets does not change enterprise value, but it does transfer value from creditors to shareholders.
- Lastly, rescheduling debt transfers value from creditors to shareholders, even if the interest rate remains the same.

This is called the expropriation effect, where some of the value of the claims is confiscated without any exchange of flows.

Section 35.4
RESOLVING CONFLICTS BETWEEN SHAREHOLDERS AND CREDITORS

Creditors have a number of means at their disposal to protect themselves and overcome the asymmetry from which they suffer. They can be grouped under two main headings:

- hybrid financial securities;
- restrictive covenants.

1/ HYBRID FINANCIAL SECURITIES

Hybrid financial securities combining features of both debt and equity – such as convertible bonds, bonds with equity warrants, participating loan stock, etc. – would not be necessary in a perfect market. By issuing such hybrid securities, shareholders are in effect giving creditors a call option on equity which neutralises the call option on equity creditors have granted shareholders.

In fact, should shareholders make investment or financing decisions that are detrimental to creditors, the latter can exercise their warrants or convert their bonds into shares, thus becoming shareholders themselves and, if all goes well, recouping in equity what they have lost in debt!

Jensen and Meckling (1976) have demonstrated that the issue of convertible bonds reduces the risk of the firm's assets being replaced by more risky assets that increase volatility and thus the value of the shares. The same reasoning is applied when "free" warrants are granted to creditors who agree to waive some of their claims during a corporate restructuring plan (see Chapter 29).

2/ RESTRICTIVE COVENANTS

We shall discuss the four main types of covenants, but our list is far from comprehensive. They can concern:

- corporate investment and production policies;
- dividend payments;
- net debt and subsequent debt issues;
- early redemption provisions.

(a) Corporate investment and production policies

The purpose of such covenants is chiefly to protect debtholders against the possibility that the firm will substitute more risky assets for the existing ones. Any investment in other companies, mergers, absorption or asset disposals are either restricted or subject to approval by the debtholders.

In some cases, the securities of certain subsidiaries or the equipment the issue served to finance are given as collateral. This restricts the possibility of asset substitution.

The company may also be obliged to invest in certain projects, to continue holding certain assets, maintain its working capital or raise it above a certain threshold.

(b) Dividend payments

These covenants are designed to avoid the massive dividend distributions financed by increases in debt or asset disposals we discussed previously.

For example, they can link dividend distribution to a minimum level of equity during the life of the debt. Similarly, they frequently restrict or rule out the distribution of reserves or share buybacks.

These clauses have the added advantage of imposing a minimum level of investment on shareholders in order to utilise the cash that cannot be distributed, thus reducing the risk of underinvestment.

(c) Net debt and subsequent debt issues

Any unforeseen, subsequent issue of equal or higher-ranking debt reduces value for existing debtholders. And yet it would not be in the interests of either the current bondholders or the shareholders to rule out any further debt issues. To protect themselves against a reduction in the value of their claims, debtholders can impose limits on the amount of net debt and the nature of the new debt issued based on certain ratios:

$$\frac{\text{Net financial debt}}{\text{Equity}}, \quad \frac{\text{Operating income}}{\text{Interest expenses}}, \quad \frac{\text{Net financial debt}}{\text{EBITDA}}, \quad \frac{\text{Receivables}}{\text{Payables}}, \quad \textit{etc} \ldots$$

When these ratios exceed the predefined threshold, the debt immediately falls due.

It can also become payable when the ratios exceed these thresholds because of deteriorating corporate results rather than new borrowings.

In practice, these are chiefly *rendez-vous* clauses that force the company to arrange a restructuring plan with its creditors to contain the risk to the latter, which increases with the financial distress of the company.

(d) Early redemption clauses for all or part of the debt

In a context of information asymmetry, early redemption clauses are a means of dealing with the problem of overinvestment and asset substitution. Analysing equity as an option on the firm's value shows that paying a coupon or an annuity before the final repayment offers some protection to creditors and thus reduces share value.

In short, covenants are affirmative or negative pledges that entail the immediate repayment of the debt when not respected

The main contribution of options theory to corporate finance is the concept of the time value of equity. The options approach is predicated on the physical separation of shareholders and debtholders, which has become standard practice.

You will have realised that this is very different from the simple accounting leverage effect that seemed to show that shareholders create wealth by investing at a higher rate than the cost of debt. The shareholder/debtholder relationship takes on an entirely different meaning where value is concerned. When risks change, the interests of the two parties may diverge radically without any exchange of flows between them or change in the overall value of the firm.

We hope to have impressed on you the importance of reasoning in terms of value and assessing all decisions not just on the basis of profits, but also risk. The use of options may

now seem blindingly obvious to you, and we hope you always keep in mind the notion of risk transfers.

Please don't be discouraged by the difficulty of applying these formulas to real life. They are very efficient qualitative tools that will enable you to tackle the financial reengineering of a group with more imagination and creativity.

SUMMARY

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It seems like stating the obvious when we say that the status of the creditor differs radically from that of the shareholder. The shareholder stands to gain a potentially unlimited amount and his risk is limited to his investment, while the creditor, who can also lose his investment, can only expect a fixed return.

This asymmetry brings options to mind. This chapter showed that there is more than one similarity.

The shareholders' equity of a levered company can be seen as a call option granted by creditors to shareholders on the company's operating assets. The strike price is the value of the debt and the maturity is the date on which the debt is payable. When the debt falls due, if the value of the operating assets is higher than the amount of the debt to be repaid, the shareholders exercise their call option on the operating assets, and pay the creditors the amount of the debt outstanding. If however the value of the operating assets is lower than the amount of the debt to be repaid, the shareholders decline to pay off the debt, and the creditors appropriate the operating assets.

Similarly, we can show that lending to a company is a means of investing in its assets at no risk. The lender sells the shareholders a put option at a strike price that is equal to the debt to be repaid.

Using this options-based approach we can break down the value of equity into intrinsic value and time value. Intrinsic value is the difference between the present value of capital employed and the debt to be repaid upon maturity. Time value is the hope that when the debt matures, enterprise value will have risen to exceed the amount of the debt to be repaid.

This leads to a better understanding of the impact of certain decisions on the financial situation of creditors and shareholders:

- a dividend payout financed by the sale of assets will increase creditors' risk, reduce the value of the debt owed to them, and at the same time increase the value of shareholders' equity
- investing in high-risk projects (but for which the net value at the required rate of return is nil) does not result in an immediate change in enterprise value, but increases creditors' risk, reduces the value of debt and increases the value of shareholders' equity by the same amount
- by financing its own investments (or carrying out a capital increase), the company increases enterprise value by this amount (if the return on the investment is equal to the required rate of return). Part of this additional value will go to the creditors, whose risk is reduced, to the detriment of shareholders, as the overall value of their shares will not rise by the amount of the funds invested or the capital increase.

All financial decisions must be examined from an overall point of view, but also in terms of the creation or destruction of value for the various stakeholders. A given financial decision could be neutral in terms of overall value, but could enhance the value of some financial securities at the expense of others.

QUESTIONS

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1/ When making a comparison with options, what does shareholders' equity correspond to?

2/ When making a comparison with options, what does a credit risk correspond to?

3/ For what type of company can we apply the options theory for the valuation of shareholders' equity?

4/ According to this theory, can the value of a company's equity be nil?

5/ Why is the application of this theory more advantageous for companies in difficulty?

6/ Is this view of the company opposed to the theory of markets in equilibrium?

7/ Give an example of a decision where creditors are "expropriated" by shareholders, without the debt agreement being renegotiated. Explain.

8/ Is the effect of expropriation a result of market inefficiency?

9/ A company is in trouble as a result of low profits and excessive debts.

(a) Do you think that the creditors and the shareholders have the same concerns? More specifically, in the event of the following:
- massive new investments carrying a very high risk but that will possibly lead to high returns which will enable the company to get back on its feet with a low level of profits;
- an increase in debt;
- an increase in shareholders' equity.

(b) Would your answer be different if the company were profitable and carrying very little debt?

(c) What financial product do these examples of creditor–shareholder relationships bring to mind?

10/ What is a covenant? Provide a theoretical example of the usefulness of covenants.

11/ Does a covenant represent a prevention against issuing new debt or does it ensure that shareholders/management will enter into discussions with creditors?

12/ Can you give an example of a group where shareholders' equity is made up of pure time value?

13/ What is the role of debt in the management/shareholder relationship?

EXERCISES

1/ The investment firm Verfinance owns 5000 shares in Uninet, a group involved in the maintenance products sector, worth 10 million. This is what Verfinance's simplified balance sheet looks like:

The debt is a 5-year zero coupon bond (issued today). Its redemption value is 6 million.

The following table relating to the Uninet share appears in the financial press in the section on European call options:

Strike price	5-year option	7-year option
1200	1010	1085
1600	731	832
2000	510	627
2400	348	468

(a) Does the above table seem consistent to you?
(b) Can you value the shareholders' equity and the debt of Verfinance with the data you have?
(c) What could you do to increase the value of the company's shareholders' equity? Make several suggestions. Which would seem to be the most realistic to you? Why? Would you be creating value? Why? All in all, have you created value or transferred value?

2/ Companies *A* and *B* each have to pay 100 to their creditors in 1 year. The risk-free rate is 5% per year. Below are the key figures for companies *A* and *B*, before and after a capital increase of 50 that they are planning for the purpose of financing new investments:

	A		B	
	Before	After	Before	After
Enterprise value	100	150	100	150
Volatility of capital employed	10%	10%	40%	40%
Equity value	7	?	18	?
Value of debt	93	95.1	82	92.1
Implicit interest rate on debt	7.5%	5.2%	22%	8.6%

What is the equity value of *A* and *B* after the capital increase? Show that it is not in the interests of the shareholders of *A* or *B* to carry out a capital increase to finance investments. Does the capital increase create value? Show that, nevertheless, shareholders' wealth is increased. Do you think that the creditors would agree to finance new investments? Why? How do you explain this paradox?

3/ Take the figures for Holding plc (p. 727) and assume that the shareholders in the company decide to pay out a cash dividend of €13,380 totally financed by the sale of 63 shares in Daughter plc (€13,380/€2230).

(a) What is the new value of Holding plc's equity, according to the options theory?
(b) What is the value of Holding plc's debt, according to the options theory? What is the yield to maturity?
(c) What is the result of the operation?

ANSWERS

Questions

1/ *To a call option on the operating assets, the strike price of which is the amount of debt to be repaid.*
2/ *To the risk-free assets minus a put option, the strike price of which is the amount of debt to be repaid.*
3/ *Companies in difficulty and high-risk companies.*
4/ *No, because there is always some hope, no matter how little, that the enterprise value will rise before the debt must be repaid, to above the amount to be repaid.*
5/ *Because the time value of their equity is higher.*
6/ *No, it is not incompatible.*
7/ *Investing at a fair price, but in a much more risky venture.*
8/ *No, only the lack of anticipation.*
9/ *(a) No, better for the shareholder, better for the shareholder, better for the shareholder.*
(b) Fundamentally no, but the problem is considerably reduced.
(c) Options.
10/ *A restriction that the creditors place on shareholders so that they cannot increase their risk.*
11/ *Covenants force management/shareholders to approach creditors to renegotiate loan agreements if they wish to exceed the limits set in these covenants.*
12/ *Philip Holzmann, Lucent, Mobilcom.*
13/ *Control.*

Exercises

1/ *(a) The table is consistent.*
(b) The shares can be compared to options on the assets (i.e. the Uninet shares). Strike price = 6m/5000 = 1200, maturity = same as debt = 5 years. Value of these options = 1010. Value of Verfinance's shareholders' equity = 1010 × 5000 = 5.05m. Value of debt = 4.95m.
(c) Capital reduction. "Exchange" Uninet shares for much more volatile shares. There would also be a transfer of value from creditors to shareholders, but no creation of net value.
2/ *54.9; 57.9. The capital increase of 50 will only increase the value of shareholders' equity by 47.9 for A and 39.9 for B. The capital increase creates value for the creditors (2.1 for A and 10.1 for B), but destroys the same amount of shareholder value. Accordingly, this is not a simple transfer of value. No, because unlike the capital increase, an increase in debt level will reduce the value of the debt.*

3/(a) *Shareholders have a call option on 94 Daughter plc shares (100 − 6) with a strike price of 300,000 (300 bonds × 1000). This option is equal to 94% of an option of an asset made up of 100 Daughter plc shares (94/94%) and the strike price is equal to 319,149 (300,000/94%). The new value of shareholders' equity is thus: 94% × 32.55 × 100 shares = 3060. The value of the option − 32.22 – is calculated by linear interpolation on the basis of the table provided.*

(b) *The value of the debt will then be 94 × 2230 − 3060 = 206,560, a decrease of 11,940. The yield to maturity on the debt rises to 13.2%, which means an increase in the risk on Holding plc' s debts.*

(c) *The shareholders will have 3060 worth of Holding plc shares and 13,380 in cash (dividends paid), a total of 16,440 compared with 4500 initially. Their gain of 11,940 (16,440 − 4500) is made at the expense of the creditors, who lose: 218,500 − 206,560 = 11,940.*

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